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Three essays on FDI and uneven development
Três ensaios sobre IDE e desenvolvimento desigual

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São Paulo
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Dissertação apresentada ao Departamento de Economia da Faculdade de Economia, Administração e Contabilidade da Universidade de São Paulo como requisito parcial para a obtenção do título de Mestre em Ciências.

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In a right triangle, the square of the hypotenuse is equal to the sum of the squares of the other two sides; but it is appropriate to add the question: is it really a right triangle?

S. Jevons

Resumo

Esta dissertação tem como principal objetivo uma melhor compreensão de mecanismos subjacentes aos efeitos observados a partir da entrada de fluxos de Investimento Direto Estrangeiro (IDE) em economias em desenvolvimento. Com foco central nas questões referentes às trajetórias de desenvolvimento relativo de longo prazo entre regiões estruturalmente distintas - o Norte, desenvolvido, e o Sul, menos desenvolvido - exploramos também as relações entre a distribuição funcional da renda e os fluxos comerciais e de capitais, buscando compreender possíveis mecanismos de superação de trajétorias desiguais de desenvolvimento entre países ricos e pobres. O primeiro ensaio desta tese incorpora a análise de Thirlwall em um modelo Norte-Sul que leva em consideração alguns aspectos frequentemente ignorados do crescimento em economias abertas - a importância dos fluxos de capitais a longo prazo, as mudanças nos termos de troca e a interdependência entre comércio e pagamentos entre as regiões. Considerando cinco canais intrinsecamente conectados através dos quais as entradas de IDE podem afetar a estrutura produtiva da região Sul, descobrimos que os efeitos desses fluxos de capitais podem reduzir a distância entre as regiões, aliviando a restrição externa e, a depender da magnitude de alguns efeitos, podem, no limite, indicar uma reversão do padrão de desenvolvimento desigual. No segundo ensaio, apresentamos um exercício empírico que fornece evidências robustas de que variações da parcela dos salarios na renda têm um impacto negativo no volume de importações de países em desenvolvimento. Ao indicar a importância da distribuição funcional da renda para a determinação das importações, destacamos não apenas a omissão de uma variável relevante em grande parte da literatura empírica que estima esse fluxo comercial, mas também a omissão de um canal relevante nas discussões sobre desvalorizações da taxa de câmbio real e seus impactos, restrição externa e crescimento econômico. Também examinamos duas questões empíricas relacionadas ao primeiro ensaio desta dissertação. Por fim, o terceiro ensaio apresenta um estudo de caso para a economia brasileira e os principais resultados apontam para uma relação positiva entre os fluxos de IDE e a atividade econômica brasileira no curto prazo, bem como uma relação positiva entre os tais fluxos de capital, produtividade agregada e o crescimento econômico no longo prazo. Apesar desses efeitos positivos, uma advertência importante aparece em nossa análise: quando levamos em conta os efeitos desses fluxos de capital na distribuição de renda, encontramos evidências de uma certa troca entre promover o crescimento econômico relacionado aos fluxos de IDE e aumentar a desigualdade de renda. Além disso, sugerimos que a conexão entre o IDE e a balança comercial indica uma piora da restrição externa a longo prazo.

Palavras-chaves: Investimento direto estrangeiro; Desenvolvimento desigual; Relações Norte-Sul; Crescimento restrito pelo Balanço de Pagamentos; Distribuição funcional da renda.

Abstract

This thesis aims to a better understanding of the mechanisms underlying the effects observed from the inflow of Foreign Direct Investment (FDI) into developing economies. With a central focus on issues related to the long-run relative development trajectories between structurally distinct regions - the developed North and the less developed South - we also explore the relationships between the functional distribution of income and the commercial and capital flows, seeking to understand possible mechanisms to overcome unequal development trajectories between rich and poor countries. The first essay of this thesis incorporates Thirlwall's analysis into a North-South model that takes into consideration some often ignored aspects of growth in open economies - namely, the importance of capital flows in the long run, terms of trade changes and trade and payments interdependence among regions. Considering five intrinsically connected channels through which FDI inflows can affect the productive structure of Southern region, we find that the effects of these capital flows might reduce the distance between regions by alleviating the external constraint and, depending on the magnitude of some effects, might even indicate a reversion of the uneven development pattern. In the second essay, we present an empirical exercise that provides robust empirical evidence that variations of the wage share have a negative impact on the volume of imports of developing countries. When indicating the importance of the functional distribution of income for the determination of imports, we point out not only the omission of a relevant variable in much of the empirical literature that estimates this trade flows, but also the omission of a relevant channel in the discussions of real exchange rate undervaluation and its impacts, external constraint and economic growth. Besides, we examine two empirical questions related to the first essay of this thesis. Finally, the third essay presents a case study for the Brazilian economy and our main results point to a positive relationship between FDI flows and Brazilian economic activity in the short term, as well as a positive relationship between FDI flows, aggregate productivity and GDP growth rate in the long run. Despite these positive effects, an important caveat appears in our analysis: when consider the effects of such capital flows on income distribution, we find evidence of a certain trade-off between promoting economic growth related to FDI flows and increases in income inequality. Furthermore, we suggest that the connection between FDI and trade balance indicates a tightening of the external constraint in the long run.

Key-words: Foreign direct investment; Uneven development; North-South relations; Balance-of-Payments constrained growth; Functional distribution of income.

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List of abbreviations and acronyms

BCB	Central Bank of Brazil
BOP	Balance-of-Payments
ECLAC	Economic Commission for Latin America and the Caribbean
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
GFCF	Gross Fixed Capital Formation
IAD	Intensity-Adjusted Demand
IBC-BR	Economic Activity Index
IBGE	Brazilian Institute of Geography and Statistics
ILO	International Labour Organization
IMF	International Monetary Fund
IPCA	Broad National Consumer Price Index
IPEA	Institute for Applied Economic Research
IRF	Impulse Response Function
OECD	Organisation for Economic Co-operation and Development
TFP	Total Factor Produtivity
ULC	Unit Labor Cost
UNCTAD	United Nations Conference on Trade and Development
VAR	Vector Autoregression
VEC	Vector Error Correction
WB	World Bank

Introduction

The gap in per capita income levels between rich and poor countries of the world is enormous. As is well-known, a large empirical literature suggests that this disparity has been increasing over time.

In view of this, the question that arises is whether this gap will close or widen over time. The answer, however, depends on a large number of factors, some internal to the country's economic dynamics and others related to the interaction between rich and poor countries, or in a stylized way, North and South. Deepening our analysis in the latter, the study of the consequences of the interaction between North and South has drawn attention to a large number of mechanisms through which these relations tend to produce convergence, on one hand, or uneven development, on the other. In brief, Dutt (2003) argues that these mechanisms might be divided into those that rely on the effects of changes in demand composition, as well as in technology on North-South terms of trade and growth (PREBISCH, 1949; SINGER, 1950; DUTT, 1990; DUTT, 1996), and those focused on the role of international capital flows (DUTT, 1997).

Focusing our analysis on the latter, one of the most important aspects of the recent process of expansion of economic relations between countries, whether developed or developing, has been the substantial expansion of capital flows, both financial and physical. In particular, Foreign Direct Investment (FDI) has played a prominent role as the main component of capital flows to developing countries. Alongside these increases in FDI inflows, the literature on the impacts of FDI on economic development has grown significantly (especially in the mid-1990s and 2000s), although it still offers theoretical and empirical results not always conclusive (DUTTARAY; DUTT; MUKHOPADHYAY, 2008; IAMSIRAROJ; ULUBAŞOĞLU, 2015).

Moreover, the last few decades have also been marked by significant changes in income distribution, both on personal and functional levels. On one hand, top incomes have raised to levels unseen since the *Belle Époque*, especially in the US (PIKETTY; SAEZ, 2003; PIKETTY, 2014; ALVAREDO et al., 2017). On the other hand, wage shares have been falling substantially since the 1980s across most OECD countries but also across developing countries, although with certain heterogeneity. Although changes in the personal distribution of income have had more prominence, as argued by Atkinson, Piketty and Saez (2011) and Stockhammer (2017), there is an increasing interest in the determinants of functional income distribution and the macroeconomic implications of this recent trend.

In the face of such evidence, a question that arises is whether, in some way, these

issues are related. That is, what role do these growing flows of direct investment play, in terms of the possibilities for economic development of such heterogeneous regions or groups of countries? In the end, can these capital flows represent a relative growth trajectory that would indicate a convergence between regions in the long run? Besides, can the recent trends of income distribution (raising inequality) also be linked in some way to the expansion of trade and financial relations between countries?

This thesis seeks to contribute to a broad literature on economic theory by attempting to address some of the questions posed above. In general, we seek to contribute to a better understanding of the relationships between FDI and economic development of structurally distinct regions. In particular, we look at the possible implications of such capital flows to relative development trajectories between the North and the South, with a focus on the possibilities of overcoming a relevant obstacle to long-run economic growth: the balance-of-payments constraint. Within this general perspective, we also seek to consider the possible relationships that not only FDI but also trade flows between regions can present with the distribution of income, especially the functional distribution.

As the title itself anticipates, we will seek to cover such issues and contribute to the literature through three essays that, *a priori*, are independent and self-contained. Nevertheless, it is important to highlight that, throughout the development of the text, some common relations between the essays will be properly explored, having as the main focus, the relations between FDI and uneven development between regions. Due to the structure of this work, this present introduction is intended to be quite general and, it is worth saying, each essay will feature a very detailed introduction in which we motivate our work and also present an analytical review of the literature related to the issues addressed. However, it is worth presenting a brief outline of the work that follows, indicating the general objectives of each essay that composes this dissertation as well as anticipating some of their results.

First, in Essay 1, we develop a theoretical-formal model of North-South trade, including capital flows from the North to the South and taking into consideration some channels through which these FDI inflows can affect the Southern long-run growth rate and its productive structure. The model shows how Thirlwall's analysis can be incorporated into North-South models to explain uneven development broadly. In a more specific way, we considered five channels through which capital flows could affect Southern growth rates: capital accumulation, balance-of-payments components, technological change, market structure, and income distribution. Furthermore, the consideration of the effects of FDI inflows on the ratio of income elasticities of trade has indicated a possible change in the long-run development pattern: if the effects of foreign presence in the Southern economy are strong enough on the income elasticities ratio, in the long-run we have that the South grows faster than the North and, thus, there is a quite different divergence in the global

economy. Nevertheless, these positive effects of FDI inflows on the Southern economy posed a potential problem: the possible instability of the economy in the long run.

Second, Essay 2 presents an empirical contribution that dialogues, in particular, with a wide literature of growth regimes in open economies, balance-of-payments constrained growth and the role of RER misalignment in economic growth. First, we present a simple accounting structure that shows that a general specification (vastly used in open macroeconomics literature) of the import function can present a composition effect of income besides the usual quantity effect - highlighting the importance of functional income distribution. Through the estimation of this import function, we find robust empirical evidence that variations on the wage share have a negative, statistically significant impact on the volume of imports of underdeveloped countries (which is also true for the entire sample). When indicating the importance of the functional distribution of income for the determination of imports, this effort has pointed out not only the omission of a relevant variable in much of the empirical literature that estimates this trade flows, but also the omission of a relevant channel in the discussions of real exchange rate undervaluation and its impacts, external constraint and economic growth. We also present evidence that supports the argument that the income elasticity of import demand is higher in poor (less developed) countries compared to richer economies, which strengthens the result of uneven development between regions in the long run. Moreover, we find evidence that FDI flows do not impact the imports of underdeveloped countries and that FDI flows also do not impact the income elasticity of imports of underdeveloped countries.

Lastly, Essay 3 presents a case study for the Brazilian economy, using time series econometrics methods in order to aim for a better understanding of the relationship between FDI and economic growth in Brazil. The main results from this essay point to a positive relationship between FDI flows and Brazilian economic activity in the short term, as well as a positive relationship between FDI flows, aggregate productivity and the real product growth rate in the long run. Despite these positive effects, an important caveat appears in our analysis: when we take into account the effects of such capital flows on income distribution, in both functional and personal context, we find evidence of a certain trade-off between promoting economic growth related to FDI flows (especially through increases in the growth rate of aggregate productivity) and increases in income inequality. These effects on income distribution seem to be related to the net effects of FDI flows on the Brazilian trade balance which, especially indicating a negative relationship between these variables in the long run - a connection that represents a tightening of the external constraint and, therefore, might indicate limited possibilities of economic growth associated with balance-of-payments equilibrium.

1 FDI in a North-South model: mechanisms and effects on uneven development

1.1 Introduction

The gap in per capita income levels between the rich and poor countries of the world is enormous. As is well-known, a large empirical literature suggests that this disparity has been increasing over time. Jones (2016), using data from The Penn World Table for a sample of 100 countries, finds that between 1960 and the late-1990s there was a widening of the world income distribution (in the last decades this pattern seems to have stabilized). For instance, the standard deviation of the log of per capita income levels of countries in the sample increased steadily from 1 in 1960 to approximately 1.5 in 2000, whilst the ratio of GDP per person between the 5th richest and 5th poorest countries in the sample went from 0.5 in 1960 to 1.12 in 2000.[1] In general, whilst the very poorest countries seem to be falling further behind, the rich countries seem to be converging (within the group).[2]

Although the evidence is clear, some analysts such as Lucas (2000) argue that these unequalizing trends are likely to be reversed in the very long-run. Following Quah (1993), Jones (1997) used a method of transitional matrices to calculate the long-run distribution of world incomes, finding evidence of convergence. However, in a more recent exercise, Jones (2016) finds evidence of a greater concentration of countries in the bottom bin, with less than 5 percent of the U.S. income level, as well as a smaller top bin in relation to the earlier simulation.

In view of this, the question that arises is whether this gap will close or widen over time. The answer, however, depends on a large number of factors, some internal to the country's economic dynamics and others related to the interaction between rich and poor countries, or in a stylized way, North and South. Deepening our analysis in the latter, the study of the consequences of the interaction between the North and South has drawn attention to a large number of mechanisms through which these relations tend to produce convergence, on one hand, or uneven development, on the other. Dutt (2003) presented a summary of these mechanisms, including those that rely on the effects of changes in demand composition and in technology on North-South terms of trade and growth (PREBISCH, 1949; SINGER, 1950; DUTT, 1990; DUTT, 1996); and on the role of international capital flows (DUTT, 1997). Following in the latter, it is noteworthy that

[1] A similar analysis is developed by Sala-i-Martin (1996), who finds that the dispersion of the GDP per capita (measured by the standard deviation) increased from 0.89 in 1960 to 1.12 in 1990.

[2] An example of this phenomenon is the catch-up process within OECD economies. See Barro (2012) for a discussion of convergence in smaller samples of countries.

the last decades have been marked by a strong expansion of economic relations between rich and poor countries and one of the most important aspects of this process was the expansion of capital flows, both speculative and physical.

In particular, Foreign Direct Investment (FDI) has played a prominent role as the main component of capital flows to developing countries. While in the mid-1990s FDI flows to developing economies were around US$ 150 billion (per year), by 2017 these flows reached US$ 671 billion (almost 43 percent of the world's total amount), of which US$ 151 billion were directed to Latin American and Caribbean countries (UNCTAD, 1999; UNCTAD, 2018). Alongside these increases in FDI inflows, the literature on the impacts of FDI on economic development has grown significantly (especially in the mid-1990s and 2000s), although it still offers theoretical and empirical results not always conclusive (DUTTARAY; DUTT; MUKHOPADHYAY, 2008). Although the questions of interest and the methods utilized could modify the results, it is possible to synthesize these results as follows: research at the firm-level since 1990 usually shows that spillover effects are non-significant or even negative, whilst the results on aggregate-level point to a positive effect of FDI inflows on economic growth of developing countries under certain circumstances (HERZER, 2012).

In order to analyze systematically the effects of FDI inflows in the so-called "global South", a first effort to be done is an analytical review of a theoretical and empirical literature on the channels through which FDI can affect the economic growth of developing countries. A first point to be addressed in this analysis concerns the way in which FDI flows enters an economy, either through mergers and acquisitions (M&A) of domestic capital (called brownfield investment) or by structuring new production plants in the recipient country (greenfield investment). It seems intuitive to point to the preference of governments to receive this second type of FDI flows, as it would increase gross fixed capital formation and possibly encompass the transfer of new technologies, production methods and management, whist the brownfield investment theoretically would not be associated with so many positive effects. An important contribution in this sense is that of Calderón, Loayza and Servén (2002) and Calderón, Loayza and Servén (2004), pointing to the importance of the type of FDI in its effect on productivity and economic growth. Related to this, the existence of certain institutional barriers to the entry of foreign capital in the form of mergers and acquisitions seems to direct the analysis of the effects of FDI inflows to the greenfield case (BITTENCOURT; MATTOS; BORINI, 2017).

However, leaving aside the aspects that would determine the FDI inflows to countries and what type of investment was chosen, the analysis developed here looks at an aggregate situation and seeks to understand its effects on variables related to the economic development of the recipient countries. Having made this reservation, we can proceed to the specification of the main channels found in the literature to identify the effects of this

capital flow on developing economies. In a simplified way, the main channels identified are: i) capital accumulation; ii) balance-of-payments components; iii) technological change; iv) market structure and v) sectoral composition of output and employment (income distribution)(HERZER, 2012; DUTTARAY; DUTT; MUKHOPADHYAY, 2008; HERZER; HÜHNE; NUNNENKAMP, 2014). It is worth saying that the mechanisms underlying each one of these channels are strongly interconnected, a characteristic that needs to be considered in the subsequent theoretical-formal modeling.

As we are going to consider those five channels in the next sections, let us deepen the analysis on those. First, in the capital accumulation channel, the mechanisms concern the role of FDI inflows in increasing savings and aggregate investment in the host country, with a major effect on low domestic savings economies with a lack of governmental action to promote domestic investment (the general case of the South). Theoretically, these investments would also be less volatile (in comparison with other capital flows), which would serve to stabilize higher long-term savings and investment rates. The insight behind this effect, as De Mello (1997) and Nair-Reichert and Weinhold (2001) point out, derives directly from "neoclassical" growth models, as this increase in investment volume and/or its efficiency would bring effects both on income level and on long-run growth rates. On the other hand, foreign capital inflows can have long-term negative effects on developing countries' savings and investment, either because profit remittances are consistently higher than new FDI inflows (so it may decrease aggregate savings)[3] or because a crowding-out effect of domestic investment may occur with the entry of multinational firms, especially if there is direct competition with domestic firms in the recipient country for skilled labor and if foreign firms finance themselves in the host country (leading to a possible rise in interest rates due to increased credit demand).

Second, in the balance-of-payments components channel, the first and simplest analysis concerns the improvement in balance-of-payments results via the financial account in the period of inflow (as FDI is an important component). The increase in capital inflows could then be related to sustaining larger current account deficits and, therefore, to greater foreign savings. Apart from this short-term effect, a possibility pointed out in the literature is a decrease in imports coming from domestic production of final and intermediate goods by foreign companies in the country and an increase in exports[4] due to the expansion of trade relations with the countries of origin of capital flows (market opening argument). As pointed out by Duttaray, Dutt and Mukhopadhyay (2008), these results could then increase the long-run equilibrium growth rate determined by the external constraint (or the balance-of-payments constraint). In addition to the balance-of-payments issue, contact

[3] In the discussion regarding the possibilities (or impossibilities) of sustained long-run economic growth with external savings, see Bresser-Pereira and Nakano (2003) and Bresser-Pereira and Gala (2007).

[4] It is worth noting that the Brazilian case seems to be quite different, as Sarti and Laplane (2002) indicate and will be examined later on this thesis.

with foreign markets can generate positive externalities from exporting sectors to the rest of the economy, since, theoretically, access to such markets would be related to better trade practices and to managerial and technological innovations. On the other hand, foreign exchange outflows through profit remittances may as briefly argued in the previous channel, represent a structural deficit on the income balance, which could be related to an aggregate negative effect on current account and, therefore, indicate the need for greater external financing, representing a certain "vicious cycle" within the external constraint that would be associated with greater vulnerability of developing economies. Another possible effect of the entry of foreign firms is that of increased imports of capital and intermediate goods (if the domestic market is not competitive or does not exist in these sectors) which, coupled with a delay in significantly improving exports (due to the existence of institutional constraints) may actually lead to a negative aggregate balance-of-payments result and thus intensify the external constraint of developing economies (JENKINS, 2013). It is important to highlight that the mechanisms through which this channel works, in the long run, might be directly related to the impacts of FDI on income elasticities of trade, an extremely relevant issue that will be addressed later in this essay. The net aggregate result on the balance-of-payments may, then, depend on the impacts of FDI inflows on the recipient country's productive structure (structural competitiveness), especially if it significantly alters the composition of imports and exports.[5]

Third, the technological change channel is directly related to the possibility of technological transfers from developed to developing countries, either directly or indirectly. Directly, capital flows from a developed country, typically a technology developer and with high R&D investment, would tend to increase the average productivity of the sector in which it operates in the South. In this same context, but indirectly, the literature points to several possibilities of spillover effects, cases of positive externalities derived from the establishment of foreign firms in the receiving country. The main spillover mechanisms would be: workers' learning process (training of labor and dissemination (accumulation) of "human capital" in the South); a "push" given to domestic firms to improve production and management in the face of direct competition from multinationals or to meet their demands within the so-called backward linkages (JAVORCIK, 2004). It is important to point out that a key issue for the relationship of this channel with a positive effect on growth is largely based on endogenous growth models, especially concerning technology diffusion and human capital enhancement as engines of economic development (BLOMSTRÖM; KOKKO, 1998; BORENSZTEIN; DE GREGORIO; LEE, 1998; LIU, 2008; WOO, 2009; SENGUPTA; PURI, 2018). On the other hand, as negative effects analyzed in this channel, it is pointed out a possible transfer of obsolete technology to the

[5] This discussion is largely based on Thirlwall (1979) and the vast subsequent literature on balance-of-payments constrained growth. For surveys on this literature see, for instance, Thirlwall (2012) and Setterfield (2012).

South (keeping the technological difference between developed and developing economies); transfer of technologies that would be relatively inefficient in the recipient country (such as labor-saving technologies in economies with extensive labor supply, that is "industrial reserve army")[6]; a structural deficit in the absorption of new technologies, as the observed transfer is that of technological development results and innovations from outside, with no long-run counterpart in technology development internally in the South, representing the maintenance of a lower technological level compared to the North (BERTELLA; LIMA, 2005; DUTTARAY; DUTT; MUKHOPADHYAY, 2008). Furthermore, another possible negative effect in this channel is related to environmental questions and its impacts on productivity. For instance, if foreign firms perform their polluting activities abroad, namely in recipient countries with more lenient regulation, the higher pollution levels associated with their production may negatively impact labor productivity[7] and, therefore, represent an aggregate negative technological transfer to the recipient country (BEN-DAVID; KLEIMEIER; VIEHS, 2018).

Furthermore, in the market structure channel, the arguments basically refer to the effects of FDI flows on the level of competition between firms. In a pioneering work, Caves (1974) presented the idea that FDI influence the recipient country's economy not only through technology transfers and their underlying spillovers but could also increase the intensity of competition in the host country.[8] Nevertheless, the empirical evidence of the pro-competitive effect of FDI is quite limited.[9] Bertella and Lima (2005) point out that the entry of foreign firms may be related to increased competition and efficiency gains in the sectors in which they are established, but they may also represent a worsening in the level of market concentration, through the expulsion of national firms in the market due to cost competition, expressed in the mark-up of transnational firms. It is important to point out that these effects may also have reverse causality, that is, the inflow of foreign capital could have been directed to sectors where there was already a strong initial market concentration (once the entry barrier was overcome, the rates of return would be higher). However, the existence of considerable costs associated with a change of management, especially for foreign firms, may lead to temporarily lower margins. For instance, there might be large cultural differences, language difficulties, or an inadequate knowledge of consumer preferences that could represent a short-run drop in those firms' mark-ups (HARRIS; ROBINSON, 2002). Sembenelli and Siotis (2008) find, using Spanish firm-level data, that FDI has heterogeneous impacts on firms' mark-ups. For non-R&D sectors, the

[6] These two questions were largely discussed in "dependentist" interpretations. See, in special, Cardoso and Faletto (1970) and Furtado (1975a).

[7] In this point see, for instance, Zivin and Neidell (2012) for interesting evidence of the impact of ozone concentration on labor productivity.

[8] This idea is further developed in Caves (1996) and in Dunning and Lundan (2008).

[9] In this point, Sembenelli and Siotis (2008), for instance, argue that these evidences are practically non-existent, with the exception of Bloom, Schankerman and Reenen (2013) who show that R&D activity can generate an increase in product market rivalry.

results indicate that increased multinational presence dampens margins in the short-run, although this effect vanishes over time. In R&D intensive sectors, the authors find that FDI inflows are associated with greater mark-ups. Moreover, Aitken and Harrison (1999) argue that although domestic firms may be positively affected by an "agglomeration effect" and its positive spillovers (e.g. knowledge spillover, input sharing and labor pooling), they may lose market share to the more productive foreign firms, suffering than from a negative competition effect. Consequently, these foreign firms will gain market share and market power. Barrios, Görg and Strobl (2005) and, more recently, Lu, Tao and Zhu (2017), for instance, argue that the impact of FDI on the development of local firms will depend on the relative strength of these effects, that is, if competition effects are stronger or weaker than the positive spillovers coming from the agglomeration effect.[10] In one way or another, the aggregate effect related to this channel is ambiguous, as well as the related empirical evidence.

Lastly, in the distribution channel, the arguments generally point to the higher wages paid by foreign firms in developing countries (given that their productivity tends to be higher). The aggregate positive effect on income distribution can be derived from a theoretical analysis based on a basic framework of international economics, the Heckscher-Ohlin model, with incoming FDI flows resembling a trade liberalization in which the production factor relatively abundant is favored, that is, low-skilled labor remuneration (which is the case for the Southern region) tends to improve, thus improving the overall income distribution.[11] As argued by Herzer, Hühne and Nunnenkamp (2014), theoretical predictions become more complex and, of course, ambiguous when a certain sequence of qualification intensities are considered. Although FDI flows from developed economies to developing economies are part of the process of fragmentation of production and thus would benefit from the comparative advantages of each country, the entry of foreign firms into emerging countries may diminish wages and prospects of low-skilled workers, although it pays well a small privileged share of highly skilled workers, representing an inequalizing process regarding wages (FEENSTRA; HANSON, 1997). These "islands" of high-wage workers and managers can, according to Duttaray, Dutt and Mukhopadhyay (2008), generate a certain consumption pattern that, by altering the productive structure in the country (seeking to meet such demand), alters employment composition and the pattern of income distribution in the long-run.[12] In addition, the theoretical arguments

[10] Barrios, Görg and Strobl (2005) present a model in which the number of domestic firms follows a U-shaped curve, where the competition effect first dominates but is gradually outweighed by the aggregation effects, thus indicating that positive spillover effects of FDI inflows are expected only in the long run. Thus, the effects of FDI inflows in firms' mark-ups are likely to be time-varying and may depend on the economy's "degree of internationalization".

[11] More correctly, such a distributive relationship can be seen by the Stolper-Samuelson theorem. See Stolper and Samuelson (1941).

[12] In this point, see the discussion of circular causation chain and development patterns in Furtado (1966), Furtado (1975b) and Pinto (1976).

suggest that the relationship between FDI inflows and inequality is not linear and may change over time, given workers' learning and skills improvement in the transition to new technologies. In the short run, skill premium would increase as the slow learning process resulted in high demand for skills *vis-a-vis* a scarce supply of such skills. In the long run, however, the learning process would narrow this wage differential and eventually increase the economy's average wages (which has an impact on the income distribution) by pointing to the absorption of labor from less-skilled sectors.[13] Anyway, even though the aggregate effect of this channel might be ambiguous, an essential issue to be highlighted to understand if this channel has a positive or negative impact on economic growth is that of the relationship between functional income distribution and growth given the specificities of developing economies.

Moreover, it is worth presenting a last mechanism identified in theory. Although only in passing, Duttaray, Dutt and Mukhopadhyay (2008) point to a possible adverse effect of FDI flows on economic growth by characterizing a loss of government autonomy in developing countries in face of an increase in the decision-making power of multinational firms. This disparity can, in a certain way, reduce the margin of those governments regarding the implementation of economic policies, having a possible aggregate negative effect on economic growth in developing economies. Finally, it is worth mentioning, again, that the channels described here tend to operate in a typically interconnected manner. An illustrative example of this interconnection would be: a technological change (increase in productivity) may have the effect of decreasing market concentration which, in turn, by decreasing the firms' mark-up factor, might represent a transfer of income to workers, that is, a higher wage share.

After a brief analytical review of the theoretical arguments present in the literature, let us now look at the empirical evidence regarding the effects of FDI inflows on economic development.[14] In order to better structure this brief review of the empirical results found in the literature, different from the previous paragraphs, we will follow the presentation without dividing the arguments in the channels examined earlier. This is due both to the wide range of mechanisms addressed empirically in recent decades, which can be more easily presented by the different data and methods used, and to the interconnected way in which these channels tend to operate, which makes it difficult to analyze the causation chains and effects of each channel in the empirical evidence.

[13] The argument of a transitory inequalizing process coming from technology diffusion can be found, for instance, in Aghion and Howitt (1998), where skill premia and the distributive pattern remember Kuznets' inverse U-shaped curve.

[14] As our main focus in this essay is to consider many of the channels previously analyzed in a theoretical-formal model, the review of the empirical literature is done here in a brief way. However, in the third essay of this thesis, which presents an empirical exercise seeking to capture the relationship between FDI and economic development for the Brazilian economy, we present a detailed analytical review of this empirical literature. See, in special, Section 3.1.

In studies with cross-section data, the general suggestion is that the aggregate effect of FDI flows is positive on economic growth. Notwithstanding, this result seems to be conditional on certain factors that represent the "absorption capacity" of the recipient countries (HERZER et al., 2008).[15] On the other hand, in studies with panel data and time series econometrics, the general evidence is less clear. Carkovic and Levine (2005) did not find significant coefficients in the relationship between FDI and economic growth, even with representative control variables of the "absorption conditions" found in the previous literature. Using cointegration techniques, Basu, Chakraborty and Reagle (2003) found evidence of double causality between FDI and economic growth for relatively open economies. In the case of more closed economies, the dominant long-term causality appears to be that of economic growth to FDI flows. Herzer (2012), in turn, finds a negative and significant effect of FDI on economic growth for a large sample of developing countries, also not finding significant effects after using control variables that are representative of the countries' "absorption conditions". Moreover, using a meta-regression analysis (MRA), Iamsiraroj and Ulubaşoğlu (2015) conducted a review of 108 empirical studies using data from around the globe and reporting 880 regression estimates of the effects of FDI on growth, and indicate that the distribution of these estimates are such that 40% of those works find a statistically insignificant effect, 43% find a positive (and significant) effect and 17% find a negative and significant effect.

Looking at the empirical work at the firm and sector level, with greater interest now in the relations of capital transfer and spillover effects, most results for developing countries cast some doubt on the occurrence of productivity increases (HADDAD; HARRISON, 1993; AITKEN; HARRISON, 1999; DJANKOV; HOEKMAN, 2000; KONINGS, 2001). Javorcik (2004) argues that these results would be related to the design of these exercises, quite focused on spillovers within the same sector of activity, pointing to a greater importance of vertical spillovers, as in the case of backward linkages. The results found by the author go along with other similar works for developing countries, with a positive spillover effect at the inter-sector level, but without significant results at the intra-sector level (BLALOCK, 2001; SCHOORS; TOL, 2001).

By way of conclusion, an interesting point and relatively not quite addressed by the empirical literature concerns the income distribution channel. Choi (2006) finds greater income inequality in economies where the FDI/GDP ratio is higher. Basu and Guariglia (2007) point to the trade-off between promoting growth related to FDI inflows and increasing inequality. Herzer, Hühne and Nunnenkamp (2014), in turn, point to the

[15] Some of the factors that are identified as necessary for FDI flows to be beneficial for the recipient country are: a certain minimum level of per capita income (a "development threshold"), the degree of trade openness of the country, the level of existing human capital, and, the development of the local financial markets (BLOMSTROM; LIPSEY; ZEJAN, 1994; BALASUBRAMANYAM; SALISU; SAPSFORD, 1996; BALASUBRAMANYAM; SALISU; SAPSFORD, 1999; BORENSZTEIN; DE GREGORIO; LEE, 1998; ALFARO et al., 2004).

evidence of significant coefficients for the relationship between FDI and income inequality, with no evidence of reverse causality.

Finally, this introduction sought to present a brief analytical review of the theoretical and empirical literature on the effects of FDI inflows on economic development in emerging countries to explain the main objective of this essay: in face of a wide range of contradictory results, we will seek to contribute for the understanding of channels and mechanisms by which FDI flows can affect (positively or negatively) economic development in developing countries. It is worth mentioning that the ambiguity of the results found in the literature is directly related both to the complexity of the channels and mechanisms described, as well as to the context-dependent nature of their effective operation and, of course, cannot be represented as something necessarily negative.

Having that in mind, the theoretical and formal front of this essay aims to develop a North-South model, initially based on Dutt (2002). Deepening the description, the relations between two structurally different regions give support to the incorporation of hypotheses typically left aside in derivations of models related to Thirlwall (1979) - such as real fluctuations in terms of trade and balance of payments positions, among them, physical capital flows. Nevertheless, the crucial analysis continues to come from the differences between income elasticities of foreign trade, explaining uneven patterns of development in which, in the long run, the North grows faster than the South. This essay will seek to contribute to the theoretical literature by expanding the scope of this model, including physical capital flows in the relations between the North and the South. It is important to say that the model developed in this essay is quite different from that of Dutt (2002), especially since it considers a demand-led closure for both regions. Furthermore, as the model considers the possibility that the Southern economy operates under excess capacity or full capacity utilization, Dutt's results become a particular case of ours: a case in which trade is balanced in the short term and the South operates at full capacity utilization. Lastly, this model also will allow trade imbalances in the short run, a feature that brings a set of new mechanisms and implications for the long-run analysis and, mainly, for the analysis of uneven development patterns. Although the simple inclusion of FDI flows, subject to a credit restriction that is feasible for the South, does not completely alter the main qualitative results derived in Dutt (2002), the introduction and consideration of those channels through which these capital flows could affect the host economy represents a meaningful gain of interpretation and point to different results both in terms of uneven development and in the relationship between these capital flows and the ratio of income elasticities of trade.

In summary, our results regarding the functioning of those five channels are the following. Technological changes caused by FDI flows have somewhat altered the productive structure in the region through changes in the average labor productivity of the Southern

economy. In addition, FDI inflows caused a greater capital accumulation in the South, which lead, in the long run, to an equilibrium with faster growth rate for the South that, despite not representing an overcoming of the uneven development pattern, indicates a new path of development: a less unequal one. Furthermore, the effects of FDI on the market structure of the Southern region represented a possibility of new long-run equilibrium with further variations in the functional income distribution, thus possibly with a long run in which the workers in the South are benefited (that is, the wage share is higher). These effects on the functional distribution are directly related to the ratio between the regions' long-run growth rates and, thus, to the possibility of overcoming uneven development, especially for the case in which the Southern economy operates with excess capacity. Moreover, the consideration of the effects of FDI inflows on the ratio of income elasticities of trade indicated a possible change in the long-run development pattern: if the effects of foreign presence in the Southern economy are strong enough on the income elasticities ratio, in the long-run we have that the South grows faster than the North and, thus, there is a quite distinct divergence in the global economy. Nevertheless, these positive effects of FDI inflows on the Southern economy posed a potential problem: the possible instability of the economy in the long run. Thus, this essay also indicates the existence of an important long-run trade-off - a dichotomy between instability and the possible overcoming of uneven development.

The rest of this essay proceeds as following. Section 1.2 presents the theoretical-formal model structure, as well as its short-run and long-run behavior for the cases in which the Southern economy operates under excess capacity and full capacity utilization, exploring the relations between FDI inflows, terms of trade dynamics and growth rates, with special attention to uneven development patterns. In Section 1.3, an extension of the model is presented, analyzing the impact of FDI inflows in the market structure of developing economies through variations in the mark-up factor. Section 1.4 presents another extension of the model, considering the effects of FDI inflows on the income elasticities ratio and discussing the implications of these effects on the pattern of development between the regions. Lastly, Section 1.5 presents our conclusions and will shed light on some interesting questions that could be analyzed in further work.

1.2 Theoretical-formal structure

Following Dutt (2002), we will develop in this section a model that simultaneously determines Southern and Northern growth rates and the dynamics of the North-South terms of trade. We shall begin with some structuralist assumptions based on Taylor (1981) and Taylor (1983). First, we assume that the North grows with excess capacity with firms determining their price through a mark-up rule. With this specification, the

Northern output is determined by demand, in a structure that Dutt called "Kalecki-Keynes". Nevertheless, in this essay, we will also consider that the South has a "Kalecki-Keynes" structure and grows with possible excess capacity. Under this assumption, two different cases emerge: i) one in which there is excess capacity in the South and the Southern good price is fixed in the short run and ii) a case in which producers will fully utilize their capacity and the Southern good price varies over time. For both regions, we assume a fixed coefficient technology in the production of a single good (within the same region and across regions), using labor and capital as homogenous factors of production. Let us begin now with the price-setting mechanism in both regions, determined by a typical mark-up equation following Kalecki (1971):

$$P_i = (1 + z_i)\frac{W_i}{a_i} \tag{1.1}$$

where $i \in \{N, S\}$, z_i is the exogenous (and constant) mark-up, representing the degree of monopoly in region i's good market, W_i is the fixed money wage in the region i, and a_i is the labor productivity for the good produced in region i. In the South, with full capacity utilization, we have:

$$Y_S = Min[v_S K_S; a_S L_S] \tag{1.2}$$

where Y_S is the output production in the Southern region, v_S is the output-capital ratio (or the capital "productivity"), K_S is the Southern capital stock and L_S is the stock of labor employed in the South.

As we are interested in the effects of capital flows from the North to the South, we should consider the composition of capital stock in the South. Therefore, let us define $K_S = K_{SS} + K_{SN}$, where K_{ij} is the stock of capital in region i that is property of capitalist from region j. Let us assume, for simplicity, that the ratio of potential output to capital associated with both types of capital are the same and equal to unity, that is the same as assuming technological homogeneity between the capital stock in the South detained by Northern capitalists and by Southern capitalists. Similarly, the stock of labor employed in the South can be understood as $L_S = L_{SN} + L_{SS}$, where L_{ij} is the stock of labor employed in the region i by capitalist of region j. Furthermore, we assume that labor productivities in domestic and foreign firms will always be equal. However, the average labor productivity might change with the composition of the capital stock in the Southern region (owing to spillovers from foreign to domestic firms, a point that will be carefully discussed later in this essay), so a_S is not constant.[16]

[16] Some possibilities that could be considered in future research: i) skilled and unskilled labor in the South, a structure that may enlighten some of the ambiguous questions underlying the functioning of income distribution channel (especially wage inequality); ii) FDI increasing average skill formation in the South, a question that also brings in an interesting empirical path to follow.

If we turn our attention to the distribution of output in both regions, we will assume that there are two income groups: workers who receive wage income and capitalists who receive profit income. In both regions, it is easy to see from the mark-up equation (Equation 1.1), that the profit share and the wage share can be determined, respectively, by:

$$\pi_i = \frac{z_i}{1 + z_i} \tag{1.3}$$

$$\sigma_i = 1 - \pi_i = \frac{1}{1 + z_i} \tag{1.4}$$

Northern capitalists save fractions s_{NN} and s_{SN} of their income while workers consume all their income. Both classes at the North spend a fraction α of their consumption expenditure on the Southern good and the rest on the Northern one. The fraction is defined, following Dutt (2002), as:

$$\alpha = \alpha_0 Y_N^{\varepsilon_N - 1} P^{1-\mu_N} \tag{1.5}$$

where $\varepsilon_N > 0$ is the income elasticity of Northern imports, $\mu_N > 0$ is the price elasticity of Northern imports, P are the terms of trade (given by $\frac{P_S E}{P_N}$, where E is the nominal exchange rate) and Y_N is the Northern income or product. We assume that the parameters are such that $0 < \alpha < 1$ for every period of time. This formulation is compatible, as Dutt argues, to a great variety of assumptions of income and price elasticities of demand for both goods.

On the other hand, in the South workers spend their entire income consuming only the Southern good and capitalists save a fraction s_{SS} and consume the rest of their income, expending a fraction β of their consumption in the Northern good and the rest on the Southern. Similarly, we assume that the fraction is defined:

$$\beta = \beta_0 (\pi_{SS} Y_S)^{\varepsilon_S - 1} P^{1-\mu_S} \tag{1.6}$$

where π_{SS} is the profit share of Southern capitalists in the South.

In addition, it is important to consider that the presence of foreign firms in the South, arising from FDI flows, changes part of the behavior of agents in the region. As briefly discussed in the introduction, these capital flows can have both positive and negative effects on the recipient developing economy. In particular, in this essay we will consider that these foreign firms (or, for simplicity, transnational corporations (TNCs)) reinvest

all of their profits but act as an “enclave”, that is, they only trade with each other.[17] Thus, we will consider that capitalists from the North operating in the South will save all their income and consume, as an investment good, the good produced by the TNCs themselves. Also, the workers of these foreign firms will continue to spend all their income on goods produced in the South, but only those goods produced by TNCs. So, in summary, TNCs only sell within the enclave, and not to Southern workers and capitalists outside the enclave. Under these assumptions, it is clear that the rationale for a fraction of the Southern capital stock is quite particular: the capital stock in the South held by capitalists from the North does not face any problem of aggregate demand, that is, all its production is purchased in all periods of time. This indicates that the Southern region has an interesting structural “duality” caused by the presence of FDI.[18]

Furthermore, as we assumed a “Keynes-Kalecki" structure in the North, the firms have an independent investment function (normalized by the stock of capital) given by:

$$\frac{I_N}{K_N} = \gamma_{1N}\left(\frac{Y_N}{K_N}\right) \tag{1.7}$$

where K_N is the capital stock in the North, and γ_{1N} is a positive constant. Note that the Northern investment rate depends on the rate of capacity utilization, measured by $\frac{Y_N}{K_N} = u_N$ (that is, assuming that the capital-potential output ratio equals unity[19], because higher u_N implies higher profits and more buoyant markets.[20]

Similarly, we assume that a fraction of the Southern capital stock also has an independent investment function given by:

$$\frac{I_{SS}}{K_{SS}} = \gamma_{1S}u_{SS} + \gamma_2 P \tag{1.8}$$

[17] The consideration of this enclave in the Southern region sheds light on some possible extensions of this model, especially focusing on the demand composition in both regions. Depending on different consumption decisions by the classes in each of the regions and, mainly, on who consumes the goods produced by foreign firms in the South, we can examine certain patterns of trade surpluses and deficits within the Southern economy (among the foreign and the domestic sectors). With this extension, the step to consider the so-called “South-South" relations seems clearer and direct.

[18] The assumptions made in this paragraph indicate that the enclave operates under full capacity utilization, that is $u_{SN} = 1$, in all periods. Nevertheless, we could relax this assumption by assuming, instead, that Northern capitalists operating in the South have a saving propensity lower than unity and they spend, in consumption and investment, all their income placing a demand for the production of the enclave. Under these circumstances, the enclave would actually not operate at full capacity but rather at a desired level of capacity utilization that is always achieved. Notwithstanding, it is important to indicate that, in both cases, the enclave operates under a similar supply-driven rationale and their capacity utilization is not an adjusting variable.

[19] We also make this assumption for the Southern region, in a way that $\frac{Y_{SS}}{K_{SS}} = u_{SS}$.

[20] Note that we could use an investment function that considers the dual effects of capacity utilization on investment rate, adding a term related to the profit rate directly. Nevertheless, as the profit share is constant in some parts of the model, we chose this simplified form.

where γ_{1S} and γ_2 are positive constants.[21] First, let us briefly discuss the introduction of the terms of trade effect on the investment function. As the Southern capitalists import Northern goods to use as investment, it is possible (and reasonable) that the terms of trade impact their investment decision. Note that, under the assumptions made so far, this term is equivalent to the introduction of the real exchange rate in the investment function.[22] In our case, we assume that improvements in the terms of trade positively affect investment in the South. Furthermore, is it important to highlight that those Southern capitalists only consider their own rate of capacity utilization in order to decide their investment, as the other fraction of the capital stock has another rationale (and, as it might be clear, we always have that $u_{SN} = 1$).

In the North, only the Northern good can be used as an investment good. However, in the South, both goods can be used as investment goods, and for simplicity, we assume that the same fraction β of total investment (of Southern capitalists in the South) is spent on the Northern good and the rest on the Southern good. Also for simplicity, we assume that capital stocks in neither region depreciate.

Before we move forward to the behavior of the model in the short run, let us turn our attention, once more, to the capital flows from the North to the South. The total investment of Northern capitalists in the South, normalized by the stock of capital in the South which is detained by foreign capitalists, can be determined as[23]:

$$\frac{I_{SN}}{K_{SN}} = \delta \pi_{SN}(Y_S/K_{SN}) \tag{1.9}$$

where $\delta > 0$ is a constant related to the profits received by Northern capitalists in the South. Within this specification, we have three general cases: i) $0 < \delta < 1$, in which the total investment of Northern capitalists in the South is less than the total profits detained by those capitalists in the region, so there are profit remittances to the North; ii) $\delta = 1$, where all those profits are reinvested in the South and there aren't any "new" capital inflows (FDI is only composed by reinvestment); and iii) $\delta > 1$, where the aggregate investment of Northern capitalists in the South is not only composed by the reinvestment of all their profits but there are also new investment flows to the South (proportional to reinvestment). In all cases, the constant δ might depend on the differential of profit rates between the Northern and Southern regions and on the growth rates of the regions. It is important to say that each capitalist (Northern or Southern) can detain only one type of capital stock in the South, that is K_{SN} and K_{SS} are composed only by foreign and

[21] The autonomous terms in both independent investment functions were omitted in order to simplify some of the analysis presented in the next sections. Nevertheless, the qualitative results are similar.

[22] For discussions regarding the effects of the real exchange rate on investment see, for instance, Nucci and Pozzolo (2001), Blecker (2007), Bahmani-Oskooee and Hajilee (2010) and Baltar, Hiratuka and Lima (2016).

[23] It is clear that Equation 1.9 has a quite simplified form. Further work will need to take into consideration any relative profitability measure between the North and the South.

domestic firms respectively. For simplicity in a first approach, we assume that all Northern capitalists profits in the South are reinvested, so they do not consume either of the goods (as consumption goods) and $\delta = 1$.[24]

The assumptions made so far imply that the value of Northern imports from the South, that is, in this model, of Southern exports, is determined as:

$$P_S X_S = \alpha \left\{ \frac{[1 + (1 - s_{NN}) z_N]}{(1 + z_N)} \right\} P_N Y_N \tag{1.10}$$

which can be simplified to:

$$X_S = \Theta_S P^{-\mu_N} Y_N^{\varepsilon_N} \tag{1.11}$$

where $\Theta_S = \alpha_0 \left\{ \frac{[1+(1-s_{NN})z_N]}{(1+z_N)} \right\}$ and $P = \frac{P_S}{P_N}$ (considering that $E = 1$). It is worth noting that Equation 1.11 is very similar to export (and import) functions generally used in balance-of-payments constraint growth models (but not restricted to these models), following Thirlwall's tradition. Northern exports, which is the same as the value of Southern imports from the North, is given by:

$$P_N X_N = \beta \pi_{SS} P_S Y_S \tag{1.12}$$

once more, we can write Equation 1.12 as:

$$X_N = \Theta_N (1/P)^{-\mu_S} Y_S^{\varepsilon_S} \tag{1.13}$$

where $\Theta_N = \beta_0 \pi_{SS}^{\varepsilon_S}$.[25]

After describing the general structure of the North-South model, we now advance to analyze it. It is important to remember that, in the South, we are considering the possibility of full utilization of productive capacity (that is $u_{SS} \leq 1$).[26] With this in mind, we divide the exposure into two time horizons: short run and long run. In the short run, the stocks of capital in the two regions, K_{ij}, are given, as well as labor productivity, the distribution of income and FDI inflows (which means that capital stock composition in the Southern region is given) and the markets for both goods clear through changes in Northern and Southern outputs (if $u_{SS} < 1$) or through changes in Northern output

[24] So, it is important to note that the case analyzed here consider FDI flows as basically reinvestment of profits. A first advance to be made is to generalize the model considering $\delta > 1$ (or $\delta < 1$), thus the case herein developed would become a particular one.

[25] An interesting point to note is that both export functions depend on the functional distribution of income. This relation will be the focus of our analysis in the second essay of this thesis.

[26] Note that, with the assumptions made regarding the functioning of the enclave, the crucial distinction in the short run is between the case where capacity utilization adjusts outside the enclave and the where capacity utilization does not adjust even outside the enclave (due to the occurrence of enough aggregate effective demand).

and the Southern relative price (if $u_{SS} = 1$). In the long run, we shall consider that the conditions for short-run equilibrium always hold, and that capital stocks change due to investment in both regions.

1.2.1 Short-run behavior

In the short run, we assume that a positive excess of demand for the Northern good results in an increase in the rate of capacity utilization, u_N. The excess demand for the Northern good is given by:

$$ED_N = C_{NN} + I_{NN} + X_N - Y_N \tag{1.14}$$

where C_{ij} represents the consumption demand for good i in region j and I_{ij} represent the investment demand for good i in region j. We shall remember that Northern income can be used for consuming the Northern good, for imports and for savings, so we have: $Y_N = C_{NN} + S_N + M_N$, where M_i are the imports of region i in units of good i. Since, in this model, the value (in local currency) of imports from the South is equal to the exports of the Northern region, that is $M_N = PX_S$, Equation 1.14 can be rewritten as:

$$ED_N = I_{NN} - S_N + X_N - PX_S \tag{1.15}$$

On the other hand, the excess demand for the Southern good can be described as:

$$ED_S = C_{SS} + I_{SS} + X_S - Y_S \tag{1.16}$$

where I_{ij} represent the investment demand for good i in region j. Once again, we shall remember that Southern income can be spent on buying domestic goods or imports (that is, the income that wasn't saved) and, furthermore, we assumed that Northern capitalists' profits are totally reinvested in the South (which, in our case, represents FDI inflows), in a way that all their savings generated in the South become investment in the same region. That said, then we have $Y_S = C_{SS} + S_S + M_S$. As we stated before, the value of imports from the South is equal to the exports of the Northern region so that $M_S = X_N/P$. Now we can rewrite Equation 1.16 as:

$$ED_S = I_{SS} - S_S + X_S - (1/P)X_N \tag{1.17}$$

Before analyzing the different short-run equilibria for each one of the two possible cases, let us simplify the conditions for the existence of such equilibria. In both cases, it is

necessary for the short-run equilibrium that $ED_i = 0$. That said, from Equations 1.15 and 1.17 and using the definitions expressed in Equations 1.11 and 1.13, we can define:

$$I_{NN} = S_{NN} - S_S^e \tag{1.18}$$

$$I_{SS} = S_{SS} + S_S^e \tag{1.19}$$

where $S_S^e = \Theta_N(1/P)^{1-\mu_S} Y_S^{\varepsilon_S} - \Theta_S P^{-\mu_N} Y_N^{\varepsilon_N}$. In other words, S_S^e represents the Southern region external savings, that is, its current account (in this case, the trade balance) deficit. It is important to present some comparative statics regarding this function before advancing to the analysis of each case. We can see, in a synthetic way, such derivatives (noting that $Y_S = u_{SS}K_{SS} + u_{SN}K_{SN}$, $Y_N = u_N K_N$):

$$\frac{\partial S_S^e}{\partial \varepsilon_S} > 0$$
$$\frac{\partial S_S^e}{\partial \varepsilon_N} < 0$$
$$\frac{\partial S_S^e}{\partial u_{SS}} > 0$$
$$\frac{\partial S_S^e}{\partial u_N} < 0$$
$$\frac{\partial S_S^e}{\partial \pi_N} \gtrless 0$$
$$\frac{\partial S_S^e}{\partial \pi_{SS}} \gtrless 0$$
$$\frac{\partial S_S^e}{\partial P} \gtrless 0$$

The economic substance of such partial derivatives is straightforward. First, regarding the income elasticities of import demand, as increases in ε_S have a positive impact on Southern imports and, on the other hand, increases in ε_N have a positive impact on the exports of the South, the effects on the Southern region external savings are clear. Second, as both rates of capacity utilization are positively related to the income of the regions, it is direct to see that increases in u_{SS} will positively impact Southern imports (and, thus, the external savings) and increases in u_N will positively impact Southern exports (with a negative effect of the external savings).[27] Third, regarding the functional income distribution in both regions, increases in the profit share in the North are associated with possible decreases in the Northern import demand as a result of the import demand composition (as the Northern workers have a higher propensity to consume any goods).

[27] Note that the indirect effects of u_{SS} variations on u_N (and, Y_N) and of u_N variations on u_{SS} (and, Y_S) operate in the same direction as $\frac{\partial Y_S}{\partial u_{SS}}$ and $\frac{\partial Y_N}{\partial u_N}$, respectively.

However, the net effect of such distributional variations on the Southern external savings depends on the effects that those profit share variations have directly on the Northern income and, indirectly, on the income of the South, so the sign of the partial derivative is ambiguous. Moreover, the effects of distributional variations in the South on the region's external savings are also not clear: although the import demand composition indicates that increases in the profit share will raise Southern imports, the Southern economy demand regime might be wage-led or profit-led, depending on the case analyzed, and, the indirect effects on the Northern region income also need to be considered. Lastly, the effects of terms of trade variations on the Southern external savings depend on a combination of parameters. In a simplified manner, if the Marshall-Lerner condition is valid, that is, if $\mu_S + \mu_N > 1$, variations of the terms of trade will positively impact the Southern external savings.

1.2.1.1 The excess capacity situation

In the South, considering first the case in which $u_{SS} < 1$, we assume that a positive excess of demand for the Southern goods results in an increase in the rate of capacity utilization, u_{SS} (and prices does not adjust in this short-run case). That is:[28]

$$\dot{u}_{SS} = \frac{d(u_{SS})}{dt} = f_1(ED_S) \tag{1.20}$$

where $f_1(0) = 0$ and $f_1'(.) > 0$.

Short-run equilibrium, in which u_{SS} and u_N do not change, given the stock of capital in both regions and the FDI flows, requires $ED_i = 0$. Imposing this condition into Equations 1.18 and 1.19, we can solve for the short-run equilibrium values of the variables that we are interested: the Southern and the Northern rates of capacity utilization. We can simplify the equations:

$$u_N = \frac{S_S^e(P, u_N, u_{SS})}{s_N \pi_N - \gamma_{1N}} \tag{1.21}$$

$$u_{SS} = \frac{\gamma_2 P - S_S^e(P, u_N, u_{SS})}{s_{SS} \pi_{SS} - \gamma_{1S}} \tag{1.22}$$

Thus, both u_N^* and u_{SS}^*, that is, the short-run equilibrium values for the rate of capacity utilization in both regions, are defined implicitly by Equations 1.21 and 1.22. Since the functional form of the Southern external savings is quite complex, it is difficult to present a simple solution for the system.[29]

[28] Note that we consider only u_{SS} due to the rationale under which the enclave operates in the South.

[29] Nevertheless, a specific solution is presented in Appendix A, considering a certain combination of parameters values.

In order to present a tractable and, mainly, logically plausible analytical solution, we will follow a simplified path. Looking to obtain economically meaningful equilibrium values for u_N and u_S, we assume that the combination of parameters that implicitly define both u_N^* and u_{SS}^* guarantee that both values are smaller than one (both greater than zero), that is, we observe excess capacity in both regions.

Under these assumptions, it is necessary to analyze if this short-run equilibrium is stable. For that, we need that both $\frac{\partial(ED_S)}{\partial u_{SS}} < 0$ and $\frac{\partial(ED_N)}{\partial u_N} < 0$ around the short-run equilibrium (i.e in the neighborhood). In a general way, we can compute the derivatives:

$$\frac{\partial(ED_N)}{\partial u_N} = \gamma_{1N} - s_N\pi_N - \varepsilon_N\Theta_S P^{-\mu_N}(u_N K_N)^{(\varepsilon_N-1)}K_N + \varepsilon_S\Theta_N P^{(\mu_S-1)}(u_{SS}K_{SS} + K_{SN})^{(\varepsilon_S-1)}K_{SS}\frac{\partial u_{SS}}{\partial u_N} \quad (1.23)$$

$$\frac{\partial(ED_S)}{\partial u_{SS}} = \gamma_{1S} - s_{SS}\pi_{SS} - \varepsilon_S\Theta_N P^{(\mu_S-1)}(u_{SS}K_{SS} + K_{SN})^{(\varepsilon_S-1)}K_{SS} + \varepsilon_N\Theta_S P^{-\mu_N}(u_N K_N)^{(\varepsilon_N-1)}K_N\frac{\partial u_N}{\partial u_{SS}} \quad (1.24)$$

As we are analyzing the neighborhood of the short-run equilibrium implicitly defined by Equations 1.21 and 1.22, this means that both $\frac{\partial u_{SS}}{\partial u_N}$ and $\frac{\partial u_N}{\partial u_{SS}}$ can be disregarded (as the equilibrium values of those variables do not depend on each other). With this formal simplification, from Equations 1.23 and 1.24, it is clear that this short-run equilibrium will be stable whenever the negative terms have a greater magnitude in relation to the accelerator effect coefficient (γ_{1i}). Moreover, it is direct to see that even if $\gamma_{1i} > s_i\pi_i$, the stability condition can be observed if $\frac{\partial S_{Se}}{\partial u_i}$ has a relatively high magnitude. That is, even if the typical Keynesian stability condition (regarding domestic savings) is not verified, if variations in the rates of capacity utilization of both regions affect the Southern external savings enough[30], the short-run equilibrium will be stable. Thus, the necessary conditions for stability of this short-run equilibrium are less stringent than those made by Dutt (2002).[31] Lastly, it is noteworthy that this stability condition can be understood as a variation of the Keynesian stability condition, one that considers that demand leakages (savings and imports) are more sensitive to capacity utilization than demand injections (investment and exports).

[30] It is direct to see that, in this case, "enough" can be understood as any combination of parameters that guarantees $\frac{\partial S_{Se}}{\partial u_i} > \gamma_{1i} - s_i\pi_i$.

[31] In the model developed by Dutt (2002), the short-run equilibrium is stable if two conditions are valid: i) the Keynesian stability condition for the North (savings are more responsive than investment to capacity utilization) and ii) the Marshall-Lerner condition.

1.2.1.2 The fully utilized capacity situation

In the short run, considering the case in which $u_{SS} = 1$, a positive excess demand for the Southern good will result in an increase in the relative price of this good, that is, a raise in P. In order to characterize this short-run equilibrium, we will solve the system formed by Equations 1.18 and 1.19. Nevertheless, in this case the short-run adjustment can be expressed by:

$$\dot{P}_S = \frac{d(P_S)}{dt} = f_2(ED_S) \tag{1.25}$$

where $f_2(0) = 0$ and $f_2'(.) > 0$.

Short-run equilibrium, in which u_N and P do not change, given the stock of capital in both regions and the FDI flows, requires $ED_i = 0$. In a general manner, we can solve for the short-run equilibrium values of the variables that we are interested: the terms of trade and the Northern rate of capacity utilization. By the macroeconomic equalization of investment and savings (both normalized by K_{Sj}), we have:

$$u_N = \frac{S_S^e(P, u_N, u_{SS})}{s_N \pi_N - \gamma_{1N}} \tag{1.26}$$

$$P = \frac{s_{SS}\pi_{SS} + S_S^e(P, u_N, u_{SS}) - \gamma_{1S}}{\gamma_2} \tag{1.27}$$

Thus, both u_N^* and P^*, that is, the short-run equilibrium values for the rate of capacity utilization in the North and the terms of trade, are defined implicitly by Equations 1.26 and 1.27. Once again, we cannot present a simple solution for both variables since the external savings has a complex functional form.[32]

Nevertheless, it is possible to continue in a general approach in order to analyze the stability of this short-run equilibrium. Note that, looking to obtain an economically meaningful equilibrium value of u_N, we will make the same assumptions as those of the last section, that is the combination of parameters that implicitly define u_N^* is such that it guarantee that the rate of capacity utilization will be positive but less than unity. Moreover, let us assume that $\frac{\partial S_S{}^e}{\partial u_N} + s_N \pi_N > \gamma_{1N}$, that is, the extended Keynesian stability condition is verified. Under those assumptions, it is clear to see that $\frac{\partial (ED_N)}{\partial u_N} < 0$. Nevertheless, the local stability of this short-run equilibrium still requires that $\frac{\partial (ED_S)}{\partial P} \leq 0$ around the short-run equilibrium (i.e in the neighborhood). In a general approach, from Equation 1.19, we have:

$$\frac{\partial ED_S}{\partial P} = \gamma_2 - (\mu_S - 1)P^{(\mu_S - 2)}\Theta_N Y_S^{\varepsilon_S} - \mu_N \Theta_S P^{-(\mu_N + 1)}(Y_N)^{\varepsilon_N} \tag{1.28}$$

[32] Again, a specific solution is presented in Appendix A, considering a certain combination of parameters values.

Note that the first term in Equation 1.28 is positive and the last term is negative. Nevertheless, the sign of the second term depends on the sign of $(\mu_S - 1)$. Furthermore, it is clear to see that if μ_S is near to unity, the second term (even if positive) will be small and probably smaller than the third term. That said, $\frac{\partial S_S^e}{\partial P} > 0$ is more likely to hold. It is worth noting that this condition is quite related to the one presented in Dutt (2002), where the Marshall-Lerner condition was assumed to be valid in order to have a short-run locally stable equilibrium. Even so, the sign of Equation 1.28 is still ambiguous. However, it is reasonable to assume that the external savings will be more reactive to variations in the terms of trade than the investment of Southern capitalists, that is $\frac{\partial S_S^e}{\partial P} > \gamma_2$. Therefore, variations in the terms of trade will negatively impact the Southern excess demand, thus this short-run equilibrium is stable.

Therefore, we presented in the last subsections the general structure of the model as well as the characterization of the short-run equilibria for both possible cases. An interesting point that emerged from the stability analysis of both short-run equilibria is that the stability conditions regarding those equilibria are related to those of Dutt (2002). In the case in which the Southern region operates under excess capacity, the condition seems to be less restrictive than Dutt's, although it is almost the same for the case in which the South operates under full capacity utilization. That said, we now turn our attention to the long-run behavior of the model.

1.2.2 Long-run dynamics

In the long run, capital stocks grow according to the rates of capital accumulation, which in our model includes FDI flows, in the two regions. These growth rates are given by: $g_i = I_i/K_i$.

Similarly to the path followed in the short-run analysis, we will again divide our exposure for the analysis of the long-run behavior of the model in two cases: i) the case in which there is excess capacity also in the long run and ii) the case in which we have full capacity utilization also in the long run.

1.2.2.1 The excess capacity case

In this case where $u_{SS} < 1$, we can compute the growth rate of capital stock in both regions, respectively, from the short-run equilibrium values of u_N^* and u_{SS}^* defined implicitly by Equation 1.21 and 1.22. For the Northern region, from Equation 1.7 we have:

$$g_N = \gamma_{1N} u_N^* \tag{1.29}$$

On the other hand, for the Southern region we need to compute both the growth rate of capital stock detained by Northern capitalists and that detained by Southern

capitalists. From Equations 1.8 and 1.9:

$$g_{SS} = \gamma_{1S} u^*_{SS} + \gamma_2 P \tag{1.30}$$

$$g_{SN} = \pi_{SN} \frac{Y_S}{K_{SN}} = \pi_{SN} \frac{(u^*_{SS} K_{SS} + K_{SN})}{K_{SN}} = \frac{\pi_{SN} u^*_{SS}}{k} + \pi_{SN} \tag{1.31}$$

where $k = \frac{K_{SN}}{K_{SS}}$ is a measure of the Southern capital stock composition. Thus, if we remember that $K_S = K_{SN} + K_{SS}$, g_S would then be the weighted average of g_{SN} and g_{SS}. For simplicity, let us assume that both capital stocks have similar weights in the calculation of the Southern growth rate. Therefore, if we add up Equations 1.30 and 1.31:

$$g_S = g_{SS} + g_{SN} = \left(\frac{\gamma_{1S} k + \pi_{SN}}{k} \right) u^*_{SS} + \gamma_2 P + \pi_{SN} \tag{1.32}$$

Furthermore, our major interest at this point is to consider how FDI inflows from the Northern region to the South can affect the productive structure of the recipient region in the long run. It is important to say that we use the capital stock composition in the South, k, as the major variable associated with those capital flows. In the long run, we need that $\hat{k} = 0$ which, by definition, is equal to $\hat{K}_{SN} - \hat{K}_{SS} = 0$. Thus, from Equations 1.30 and 1.31, we can represent this relation as:

$$\hat{k} = \left(\frac{\pi_{SN}}{k} - \gamma_{1S} \right) u^*_{SS} + \pi_{SN} - \gamma_2 P \tag{1.33}$$

In a first approach, it is clear from Equation 1.32 that FDI inflows have a direct (positive) impact on the Southern growth rate. Going further, this point means that the capital accumulation channel is acting in an aggregate positive way: since we consider only good mechanisms (that is, we assumed that there are no profit remittances nor crowding out effects) through which FDI inflows could affect Southern savings, those capital flows boost capital accumulation in the South. Moreover, the existence of the enclave guarantees a source of aggregate demand for a region that, by construction, faces problems of effective demand. Furthermore, let us initially focus our attention on two other channels that were analyzed in the first section: technological change and income distribution.

Therefore, let us continue our long-run analysis by looking at technological change. We will consider one mechanism underlying the functioning of this channel: changes in labor productivity, given by the coefficient associated with L_S in Equation 1.2. We assume that the growth rate of labor productivity in the South will be positively affected by the composition of capital stock between foreign and domestic firms in the Southern region. It is worth noting that this positive effect on productivity can emerge directly or indirectly, as we discussed in the first section of this essay. Whilst the entry of foreign firms could increase

labor productivity directly through the use of new technologies, on the other hand, it can trigger positive spillover effects, especially those related to intersectoral backward linkages (see Javorcik (2004) empirical findings) but also secondary effects related to domestic firms "imitating" the productive models and management of foreign firms (HANOUSEK; KOČENDA; MAUREL, 2011). Therefore, we will summarize these mechanisms as:

$$\lambda = \hat{a}_S = f_3(k) \tag{1.34}$$

with $\lambda \lessgtr 0$, $f_3'(k) \geq 0$, $f_3''(k) \leq 0$. The effects captured in Equation 1.34 may represent considerable changes in Southern productive structure, as it alters the growth rate of average labor productivity. For instance, these improvements on productivity may have an impact on Southern price competitiveness that, in turn, could indicate an alternative structural competitiveness pattern for recipient countries - say with greater value added to the Southern product - a pattern that resembles the Northern one. It is worth noting that, once more, this effect may be strongly related to variations on the income elasticities of trade.[33]

Similarly, for the income distribution channel, we assume that the average nominal wage in the South will be related to the capital stock composition. Empirical evidence suggests that foreign firms tend to pay higher wages than domestic counterparts (see Görg, Strobl and Walsh (2007), Huang and Zhang (2017) and Setzler and Tintelnot (2019)) and that foreign wage premium unambiguously benefits workers in foreign firms, particularly high-skilled labor (see Anwar and Sun (2012) and Setzler and Tintelnot (2019)). As discussed earlier in this essay, it is not clear however if the workers in domestic firms will be better off with the presence of FDI firms. On this point, Nguyen, Sun and Beg (2019) found that besides paying much higher wages than domestic counterparts, an increase in the presence of FDI firms in Vietnam also put downward pressure on domestic firms' wages, i.e. cause negative wage spillovers. The authors argue that if domestic firms are positively affected by FDI via productivity spillovers (which tends to increase the marginal product of labor), it lowers the cut-off capability and, subsequently, firms that previously could not survive will now enter the industry, lowering the firms' expected average wages. Thus, if the indirect effect (cut-off capability) is greater than the direct effect (productivity spillover), an aggregate negative wage spillover will be observed. On the other hand, Setzler and Tintelnot (2019) find positive and sizable local indirect effects on domestic firms' wages for the US. With that in mind, we assume a positive relation between k and the growth rate of the average (nominal) wage in the South. In a general way, we have:

$$\hat{W}_S = f_4(k) \tag{1.35}$$

[33] This point will be addressed later on this essay, specifically in Section 4.

where $\hat{W}_S \lesseqgtr 0$, $f_4'(k) \geq 0$ and $f_4''(k) \leq 0$.

Furthermore, we shall turn our attention to the missing part of our long-run analysis: the dynamics of the terms of trade. From Equation 1.1, and remembering that the Northern good price is fixed, we have:

$$P = \frac{(1+z_S)W_S}{a_S P_N} \tag{1.36}$$

If we take the logarithm of Equation 1.36 and differentiate with relation to time, we obtain:

$$\hat{P} = \hat{P}_S = \hat{W}_S - \lambda \tag{1.37}$$

Therefore, is it clear that $\hat{P}$ is a function of the Southern capital stock composition. Furthermore, it is also direct to see that the "net" effect of both channels introduced in Equations 1.34 and 1.35 will be crucial do determine the long-run behavior of the terms of trade. Bearing that in mind, the long-run equilibrium can be obtained by solving the dynamic system formed by Equations 1.33 and 1.37. In order to analyze the existence and stability of such a long-run equilibrium, let us consider the Jacobian matrix formed by:

$$J = \begin{bmatrix} \frac{\partial \hat{k}}{\partial k} & \frac{\partial \hat{k}}{\partial P} \\ \frac{\partial \hat{P}}{\partial k} & \frac{\partial \hat{P}}{\partial P} \end{bmatrix} \tag{1.38}$$

Moreover, let us make a simple assumption regarding the dynamic of the terms of trade. Consider that both relations expressed in Equations 1.34 and 1.35 are linear, in a way that we have:

$$\hat{P} = \delta_0 + \delta_1 k \tag{1.39}$$

where δ_0 and δ_1 are constants (positive or negative).[34] The sign of δ_1 depends on the magnitude of the effects of FDI inflows in labor productivity and nominal wages (that is, if $f_3'(k) \gtrless f_4'(k)$).

With that in mind, we can advance to the analysis of the existence and the stability of a long-run equilibrium in this case considering the dynamic system formed by $(\hat{k}, \hat{P})$. Thus, in this case, we have the terms of the Jacobian matrix (defined in Equation 1.38) given by:

$$J_{11} = -\frac{\pi_{SN} u_{SS}^*}{k^2} + \frac{\pi_{SN}}{k}\frac{\partial u_{SS}^*}{\partial k} - \gamma_{1S}\frac{\partial u_{SS}^*}{\partial k} \tag{1.40}$$

$$J_{12} = \frac{\pi_{SN}}{k}\frac{\partial u_{SS}^*}{\partial P} - \gamma_{1S}\frac{\partial u_{SS}^*}{\partial P} - \gamma_2 \tag{1.41}$$

[34] Nevertheless, we need the constants to have opposite signs.

$$J_{21} = \delta_1 \tag{1.42}$$

$$J_{22} = 0 \tag{1.43}$$

Analyzing the sign of each term, first, we have an ambiguous impact of variations on capital stock composition on the proportionate rate of change of the same variable. It is clear that the sign of this term depends on the sign of $\frac{\partial u^*_{SS}}{\partial k}$. That said, we should examine how variations in the Southern capital stock composition affect the Southern rate of capacity utilization (of the Southern capitalists' stock). From the short-run analysis, we know that Southern external savings is a function of both capital stocks in the South. Furthermore, we also know that this external savings are differently impacted by variations in K_{SS} and K_{SN}, since we are analyzing the case where $u_{SS} < 1$ (so variations in the capital stock of Northern capitalist in the South has a greater impact). As variations in k can be understood as relative variations in K_{SN} (compared to K_{SS}), changes in the Southern capital stock composition have a positive impact on the external savings and, thus, will represent a negative impact in u_{SS}. With that in mind, we can see from Equation 1.40 that the first and second terms are negative. Although, as the last term is positive, the sign is ambiguous. Nevertheless, we assume that the first two terms have a greater magnitude than the last one, in a way that $J_{11} < 0$. In summary, we assume that variations in the Southern capital stock composition have a stronger (negative) impact on the growth rate of Northern capitalist capital stock in the South than on the growth rate of Southern capitalist capital stock.

Second, variations in the terms of trade have an ambiguous effect on the proportionate rate of change of the Southern capital stock composition. It is clear that the sign of this term depends on the sign of $\frac{\partial u^*_{SS}}{\partial P}$. From the short-run analysis, we know that Southern external savings is a function of the terms of trade. Furthermore, we assumed earlier that variations in the terms of trade positively impact the external savings. With that in mind, let us further assume that variations in the terms of trade will have a negative net impact on u_{SS}. That is, we are assuming that the positive effects that variations in the terms of trade have in the Southern rate of capacity utilization through the Southern capitalists' investment function (see Equation 1.8) are smaller than the negative effects that those variations have through the external savings. If we turn our attention to Equation 1.41, we can see that, under the assumptions made, the first and third terms are negative. Although, as the second term is positive, the sign is ambiguous.

Furthermore, variations on the capital stock composition have an ambiguous effect on $\hat{P}$, depending on the magnitude of the dynamic effects of FDI inflows on nominal wages and labor productivity. On the other hand, variations in the terms of trade do not affect

its proportionate rate of change. Clearly, the trace of matrix J is negative. Nevertheless, the determinant of the Jacobian matrix has an ambiguous sign: if nominal wages growth rate have a stronger positive reaction to variations in capital stock composition than the growth rate of labor productivity does, that is the term $J_{21} > 0$, the determinant will have a positive sign if and only if the growth rate of Southern capital stock composition is negatively related to variations in the terms of trade, which implies that the system presents stability and converges to the long-run equilibrium. Another possible stable long-run equilibrium appears when J_{12} is negative and J_{21} is positive, that is, the effect of FDI inflows is stronger in labor productivity than nominal wages and the proportional growth rate of Southern capital composition is positively affected by variations on the terms of trade. On the other hand, if the signs of J_{12} and J_{21} are equal, the determinant will be negative and the system presents a saddle-path equilibrium (although could be stable in the equilibrium neighborhood if, by coincidence, the initial condition is located at some point in its stable arms).

That said, it is clear to see that the consideration of FDI and its potential effects on the Southern economy has brought the possibility of a long-run characterized by instability (compared to a simple demand-led version of the model developed by Dutt (2002)). This is the first evidence that, even if the effects of those channels through which FDI inflows affect the South economy are clearly positive, the presence of such capital flows may be associated with the instability of the recipient economy. Thus, we see the emergence of a certain trade-off between instability and possibilities to overcome uneven development. Notwithstanding, in order to present the most interesting cases, let us focus our attention in both stable long-run equilibria. First, let us examine the first case, where the effect of FDI inflows on labor productivity growth is smaller than on nominal wages. To support that, it could be argued that the increased presence of foreign firms have a strong effect on the growth rate of nominal wages as all the workers of those firms are affected (and increasingly affected as k grows), while the effects of changes in Southern capital stock composition on labor productivity growth rate are milder since spillover effects tend to be less embracing. Furthermore, as k is negatively related to g_S, it could be argued that its positive effects on the labor productivity growth rate will be reduced if we consider a Kaldor-Verdoorn effect (or even a "learning by doing" type of mechanism). Figure 1 presents a simplified sketch of the long-run equilibrium under these circumstances. Moreover, for this stable case, we also have $J_{12} < 0$, which means that variations in the terms of trade have a negative effect on the Southern capital stock composition growth rate, so we assume that the negative effect of variations in P on g_{SN} (first term of Equation 1.41) and the positive effect on g_{SS} (third term) are greater than the negative effect that those variations have on g_{SS} (second term). In this case, as we have a negative trace for matrix J and a positive determinant, the equilibrium is stable (stable focus). The slope of isoline $\hat{P}$ is parallel to the x-axis, indicating that this line does not depend on the level of terms of trade. As, for

this combination of parameters, we have $\frac{\partial \hat{P}}{\partial k} > 0$, the proportionate rate of change of the terms of trade varies in the same direction as the capital stock composition, what explain the direction of the horizontal vectors. The slope of isoline $\hat{k} = 0$ is given by $-(\frac{J_{12}}{J_{11}})$, so it is negative. As $\frac{\partial \hat{k}}{\partial k} < 0$, the growth rate of capital stock composition varies in the opposite direction to the composition itself, thus the direction of the vertical vectors are explained.

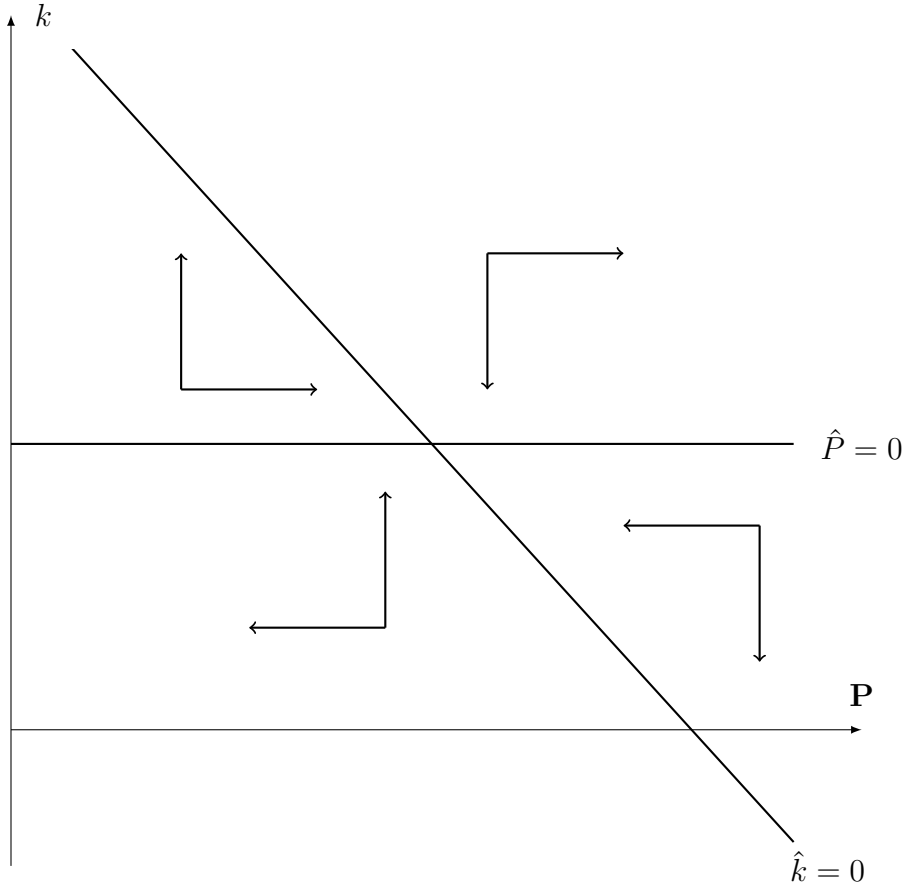

Figure 1 – Stable long-run equilibrium - $J_{12} < 0$, $J_{21} > 0$

Second, let us analyze the equilibrium path in the other case, that is, when the effect of FDI inflows on labor productivity growth is greater than on nominal wages. We also assume, in this case, that $J_{12} > 0$, that is variations in the terms of trade have a positive impact on the growth rate of Southern capital stock composition. Figure 2 presents a simplified sketch of the long-run equilibrium under these circumstances. In this case, as we have a negative trace for matrix J and a positive determinant, the equilibrium is also stable (stable focus). The slope of isoline $\hat{P}$ is, again, parallel to the x-axis, indicating that this line does not depend on the level of terms of trade. As, for this combination of parameters, we have $\frac{\partial \hat{P}}{\partial k} < 0$, the proportionate rate of change of the terms of trade varies in the opposite direction to the capital stock composition, what explain the direction of the horizontal vectors. The slope of isoline $\hat{k} = 0$ is given by $-(\frac{J_{12}}{J_{11}})$, so it is positive. As $\frac{\partial \hat{k}}{\partial k} < 0$, the growth rate of capital stock composition varies in the opposite direction to the composition itself, thus the direction of the vertical vectors are explained.

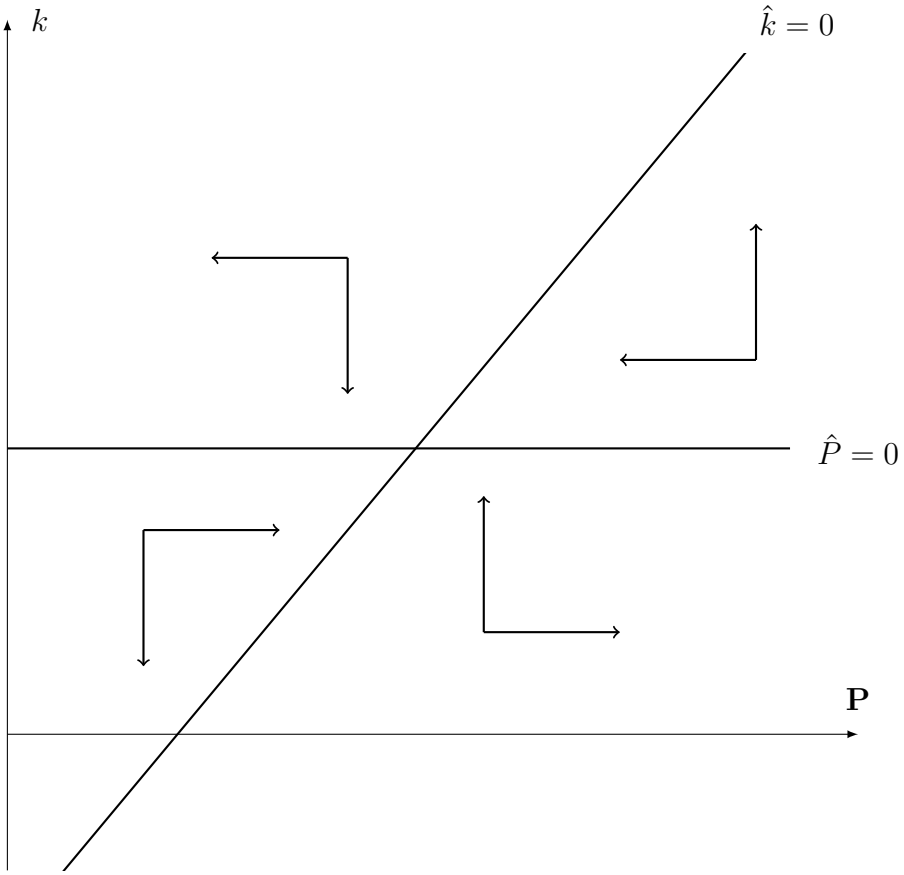

Figure 2 – Stable long-run equilibrium - $J_{12} > 0,\ J_{21} < 0$

That said, it is worth to analyze some of the structural determinants of the relation between these growth rates, that is g_S/g_N. Dutt (2002) presented a stylized relation derived from Thirlwall's Law, considering a division of the world into two regions (North and South, as in this essay), that can be simplified as:

$$\frac{y_S}{y_N} = \frac{\varepsilon_N}{\varepsilon_S} \tag{1.44}$$

where y_i is the rate of growth of output of region i. As we discussed early on this essay, the relation synthesized in Equation 1.44 is derived on the basis of a number of stringent assumptions, such as that the terms of trade are constant and trade is balanced. In order to present a similar ratio of growth rates, one that can help us examine the growth trajectories of both regions, we can determine from Equations 1.29 and 1.32:

$$\frac{g_S}{g_N} = \Omega = \frac{\left(\frac{\gamma_{1S}k + \pi_{SN}}{k}\right) u^*_{SS} + \gamma_2 P + \pi_{SN}}{\gamma_{1N} u^*_N} \tag{1.45}$$

Equation 1.45 shows that the ratio of growth rates in this model is determined by several variables besides the income elasticities of imports (that are present on both u^*_{SS} and u^*_N). First, it is direct to see that variation in the Southern capital stock composition,

k, may negatively affect this ratio, as it slows the accumulation of Northern capitalists in the South. That is, although the FDI inflows might positively impact nominal wages and labor productivity, when the stock of foreign capital becomes relatively large (in comparison to domestic capital stock), the Southern growth rate slows down. Although this effect is observed, we need to consider how variations in k affect both u^*_{SS} and u^*_N in order to compute the net effect of this variation on Ω. If we consider that, all else constant, variations in k will raise the Southern external savings, this means that it will positively impact g_N and negatively impact g_S.

Nevertheless, all else constant, variations in the Northern capitalist profit share in the South have a positive impact on the ratio of growth rates as it positively impacts the Southern growth rate. This effect is directly related to the dual nature of the Southern economy: although a fraction of the capital stock (K_{SS}) operates with excess capacity and might present a wage-led growth regime, the foreign capital stock operates with full capacity utilization and presents a profit-led growth regime. That is:

$$\frac{\partial g_S}{\partial \pi_{SN}} > 0; \quad \frac{\partial \Omega}{\partial \pi_{SN}} > 0$$

Going further in this point, we actually know the effect of variations in the profit share of Southern capitalists in the South: besides directly affecting the rate of capacity utilization (in a negative way) through a slow down on consumption, it boosts the external savings (as Southern imports are positively related to the Southern capitalists' profit share), which negatively affect the rate of capacity utilization and thus have a second negative impact on the Southern growth rate. Therefore, K_{SS} in fact presents a wage-led growth regime (a wage-led "overall" regime). Moreover, as variations in the Southern external savings have a positive impact in u^*_N, it is clear that changes in π_{SS} will have a positive impact in the Northern growth rate. Thus, we have that :

$$\frac{\partial g_S}{\partial \pi_{SS}} < 0; \quad \frac{\partial g_N}{\partial \pi_{SS}} > 0; \quad \frac{\partial \Omega}{\partial \pi_{SS}} < 0$$

Regarding the Northern functional income distribution, variations in the Northern profit share will have a double impact on the ratio of growth rates. Although these variations will negatively affect the consumption in the Northern region, it will also reduce the Northern imports and, thus, will loosen the external constraint (reducing demand leakages), which have a positive impact in u^*_N and, therefore, in g_N. That said, it is not clear if the Northern region have a profit-led or wage-led growth regime: although domestically the growth rate is wage-led, when we take into consideration the trade relations between both regions, the growth regime becomes ambiguous.[35] Nevertheless, these variations will

[35] In this point, there is a large literature of growth regimes in open economies. See Blecker (1989), Blecker (2013).

also impact the Southern growth rate, as it could reduce or increase their net exports and, thus, tighten or loosen their balance-of-payments restriction. Therefore, we have:

$$\frac{\partial g_S}{\partial \pi_N} \gtrless 0; \quad \frac{\partial g_N}{\partial \pi_N} \gtrless 0; \quad \frac{\partial \Omega}{\partial \pi_N} \gtrless 0$$

Furthermore, it is interesting to examine how variations in the propensities to save would affect the growth rates ratio. Increases in the Southern capitalists propensity to save have a negative impact in u^*_{SS} and, therefore, in g_S. Moreover, increases in the Northern capitalists propensity to save have a negative impact in u^*_N and g_N. Nevertheless, both of these variations will negatively impact the other regions' growth rate, as it will tighten their external constraint. The net effect is, then, ambiguous, and depends on which of the impacts have a greater magnitude: the direct impact on the regions' growth rate or the indirect impact on the other region. Thus, we can express:

$$\frac{\partial g_S}{\partial s_{SS}} < 0; \quad \frac{\partial g_N}{\partial s_{SS}} < 0; \quad \frac{\partial \Omega}{\partial s_{SS}} \gtrless 0$$

$$\frac{\partial g_S}{\partial s_N} < 0; \quad \frac{\partial g_N}{\partial s_N} < 0; \quad \frac{\partial \Omega}{\partial s_N} \gtrless 0$$

Lastly, it is important to analyze how variations in import income elasticities and in the terms of trade would affect Ω. Variations in Northern income elasticity of import have a negative impact in the Northern growth rate (as it tightens the external constraint) and a positive impact in the Southern growth rate (as their net exports raises). On the other hand, variations in ε_S have a negative impact on the Southern growth rate and a positive impact in the Northern one. It is clear that the ratio of income elasticities of import does not determine the entire ratio of growth rates, as it does in the simplified relation presented in Equation 1.44, although it remains an important component of Ω in our model.

$$\frac{\partial g_S}{\partial \varepsilon_N} > 0; \quad \frac{\partial g_N}{\partial \varepsilon_N} < 0; \quad \frac{\partial \Omega}{\partial \varepsilon_N} > 0$$

$$\frac{\partial g_S}{\partial \varepsilon_S} < 0; \quad \frac{\partial g_N}{\partial \varepsilon_S} > 0; \quad \frac{\partial \Omega}{\partial \varepsilon_S} < 0$$

Regarding the terms of trade, variations in P will have an ambiguous impact in the Southern growth rate. Although there is a positive impact of these variations have on the investment function (as it cheapen the imports of Northern goods), there is a negative effect coming from the balance-of-payments constraint: a rise in P boosts Southern imports and have a negative impact on Southern exports. Symmetrically, the net effect on the Northern growth rate is also ambiguous. Thus, we have:

$$\frac{\partial g_S}{\partial P} \gtreqless 0; \quad \frac{\partial g_N}{\partial P} \gtreqless 0; \quad \frac{\partial \Omega}{\partial P} \gtreqless 0$$

Finally, before moving to the case with full capacity utilization, it is worth briefly discuss (given the partial effects examined above) under which circumstances we might observe the reversal of the uneven development trajectory in which, in the long run, the North grows faster than the South. First, it is important to note that overcoming this situation can occur in two ways - with the inversion of uneven development (with the South growing faster than the North) or with the equal development (even development) of the regions. To better explain the details of this model, suppose that the ratio of income elasticities of trade is constant and equal to unity.[36] In the model developed by Dutt (2002) (with similar results of a particular case of our model, presented in the next subsection), under this hypothesis we would observe an equal development trajectory between the regions, that is, with the North and South presenting the same rate of economic growth. However, by Equation 1.45, we can see that the equalization of the income elasticity of import demand of both regions does not, by itself, determine the pattern of development between the North and the South. In this case, the demand conditions (aggregate demand components) are the main determinants of the magnitude of the ratio Ω. In particular, it is worth highlighting the role that the functional income distribution plays. For instance, if the profit share outside the enclave, that is, π_{SS} is relatively low, effective demand might be strong enough (as this fraction of the Southern region presents wage-led demand and growth regimes) to guarantee that $g_S > g_N$, that is, there is a distinct uneven development pattern in the long run. Nevertheless, the same result might be achieved if the enclave operating in the Southern region is large and, moreover, the profit share within this enclave is sufficiently high to guarantee that the South grows faster than the North.[37]

1.2.2.2 The fully utilized capacity case

Having presented the excess capacity case, now we turn our attention to the other possibility: the one in which the Southern region operates under full capacity utilization both in the short run and in the long run.

In a general way, from Equations 1.26 and 1.27 we have the short-run equilibrium values for the Northern rate of capacity utilization and the terms of trade being defined implicitly. That said, we can substitute those equilibrium values into Equations 1.7, 1.8

[36] With this supposition we are, in practice, "closing" the income elasticities channel and looking to other factors that impact effective demand in both regions.

[37] Similarly, the relative magnitude of the propensities to save of the Southern and Northern capitalists might also indicate different patterns of development between the regions. However, the relationship between the Northern profit share and the ratio of the regions' growth rates and the terms of trade and this ratio is not clear.

and 1.9:

$$g_N = \gamma_{1N} u_N^* \tag{1.46}$$

$$g_{SS} = \gamma_{1S} + \gamma_2 P^* \tag{1.47}$$

$$g_{SN} = \pi_{SN} \theta_k \tag{1.48}$$

where $\theta_k = (\frac{1+k}{k})$ is a measure of the Southern capital stock composition. Thus, if we add Equation 1.47 to 1.48:

$$g_S = \gamma_{1S} + \gamma_2 P^* + \pi_{SN} \theta k \tag{1.49}$$

Again, in order to analyze the existence and possible stability of the long-run equilibrium we need to examine the dynamic system formed by $(\hat{k}, \hat{P})$. In the long run, we need that $\hat{k} = 0$. We can determine the growth rate of Southern capital stock composition from Equations 1.47 to 1.48:

$$\hat{k} = \pi_{SN} \theta_k - \gamma_{1S} - \gamma_2 P^* \tag{1.50}$$

Furthermore, we shall turn our attention to the missing part of our long-run analysis: the dynamics of the terms of trade. If we consider, again, the relations presented in Equations 1.34 and 1.35, we have the terms of trade dynamics as presented in Equation 1.39, which represents a "cost-push" inflation in the Southern region. Nevertheless, in this case, we considered that the terms of trade varied in the short-run, thus we should determine $\hat{P}$ taking the proportional variation of the equilibrium value implicitly determined by Equation 1.27. Then, we will find a "second" determination for the dynamics of the terms of trade, a "demand-pull" inflation. It is clear that the nature of the Southern inflation is dual when the economy operates under full capacity utilization. Not only we have cost-push components but we also have variations on the terms of trade coming from excess demand in the South. In face of this dual determination we will suppose, for now, that the terms of trade dynamics are entirely determined by excess demand in this case, that is, we will not consider those effects related to FDI inflows (so both Equations 1.34 and 1.35 are equal to zero). Thus, the growth rate of the terms of trade can be determined by the growth rate of both the components of the Southern excess demand: the functional distribution of

income and the external savings (net imports). Therefore, if we use the definition of the Southern excess demand (given by Equation 1.17), we have:

$$\hat{ED}_S = -\hat{\pi}_{SS} - \hat{S}_S^e \tag{1.51}$$

But in this case, we also know that the income distribution is constant in the long-run. Thus, using the definition of the Southern external savings and the fact that, in equilibrium, $\hat{ED}_S = 0$ (and so $\hat{S}_S^e = 0$), we have:

$$\hat{P} = [1/(\mu_N + \mu_S - 1)](\varepsilon_N g_N - \varepsilon_S g_S)] \tag{1.52}$$

which shows that the growth rate of P depends on the gap between $\varepsilon_N g_N$ and $\varepsilon_S g_S$.

Therefore, the long-run equilibrium can be obtained by solving the system formed by Equations 1.50 and 1.52. In order to analyze the existence and stability of such a long-run equilibrium, let us consider the Jacobian matrix formed as the one presented in Equation 1.38. Thus, we have the components of that matrix given by:

$$J_{11} = -\frac{\pi_{SN}}{k^2} - \gamma_2 \frac{\partial P^*}{\partial k} \tag{1.53}$$

$$J_{12} = -\gamma_2 \tag{1.54}$$

$$J_{21} = \frac{\varepsilon_N \frac{\partial g_N}{\partial k} - \varepsilon_S \frac{\partial g_S}{\partial k}}{\mu_S + \mu_N - 1} \tag{1.55}$$

$$J_{22} = \frac{\varepsilon_N \frac{\partial g_N}{\partial P} - \varepsilon_S \frac{\partial g_S}{\partial P}}{\mu_S + \mu_N - 1} \tag{1.56}$$

Analyzing the sign of each term, first, we have an ambiguous impact of variations on capital stock composition on the proportionate rate of change of the same variable. It is clear that the sign of this term depends on the sign of $\frac{\partial P^*}{\partial k}$. That said, we should examine how variations in the Southern capital stock composition affect the terms of trade. From the short-run analysis, we know that Southern external savings is a function of both capital stocks in the South. Moreover, we also know that, in this case where $u_{SS} = 1$, variations in both Southern capital stock will have the same effect on the external savings. Thus, it is necessary to specify what type of variations in k we are analyzing, that is, if it is characterized by raises in K_{SN}, falls in K_{SS}, or any combination of these changes. For simplicity, let us assume that variations in k are caused by raises in K_{SN} in relation to K_{SS} (e.g. K_{SS} raised less than K_{SN}). This way, those variations in the Southern capital stock composition will positively impact the external savings and, therefore, the terms of

trade. Thus, J_{11} is negative. Second, it is direct to see from Equation 1.54 that $J_{12} < 0$, since variations in the terms of trade, affect the growth rate of Southern capital stock composition in a negative way, as it boosts g_{SS}.

Furthermore, variations in capital stock composition have an ambiguous effect on $\hat{P}$. It is direct to see from Equation 1.55 that the sign of the expression depends on the relative magnitude of effects of variations in k on the Northern and Southern growth rates, weighted by their respective income elasticities of import. Fortunately, from Equation 1.49 we know that $\frac{\partial g_S}{\partial k} < 0$, thus the second term of the expression is positive. Furthermore, we assume that variations in k have a stronger impact in the Southern growth rate than in the Northern one (since the effect on g_N is derived from the effect on g_S) and that $\varepsilon_S > \varepsilon_N$[38]. Under those assumptions, it is clear that $J_{21} > 0$. Lastly, let us consider that the effect of variations in the terms of trade on the Southern growth rate is at least as strong as on the Northern growth (we actually would expect that the effect is greater for g_S than for g_N, as we considered not only the effects of the terms of trade on trade imbalances but also in the Southern investment function). Considering that the elasticity differential hypothesis is valid, that is $\varepsilon_S > \varepsilon_N$, this means that $J_{22} < 0$. Thus, under these assumptions, we have that the trace of the Jacobian matrix is negative and its determinant is positive (so we have a stable focus). Figure 3 presents a simplified sketch of the long-run equilibrium under these circumstances. The slope of isoline $\hat{P}$ is negative. As we have $\frac{\partial \hat{P}}{\partial k} > 0$, the proportionate rate of change of the terms of trade varies in the same direction as the capital stock composition, what explain the direction of the horizontal vectors. The slope of isoline $\hat{k} = 0$ is given by $-(\frac{J_{12}}{J_{11}})$, so it is negative. As $\frac{\partial \hat{k}}{\partial k} < 0$, the growth rate of capital stock composition varies in the opposite direction to the composition itself, thus the direction of the vertical vectors are explained.

In order to present the long-run dynamics of the model, in a clear way, Figure 4 summarizes the behavior of growth rates and terms of trade. First, is it important to say that we keep the assumption made in order to $J_{22} < 0$, that is, that external savings variations have a stronger impact on the Southern growth rate than on the Northern one, which explains the relation between the slopes of the curves. Furthermore, note that we present the case in which $\varepsilon_S > 1 > \varepsilon_N$.

In the case herein addressed, the curve g_N will lie above the curve $\varepsilon_N g_N$ and the opposite occur to g_S curves. Given the values of K_{ij}, we know that u_N and P will be determined in the short run, nevertheless the curves $\varepsilon_S g_S$ and $\varepsilon_N g_N$ show how P behaves over time. For any initial short-run equilibrium value of terms of trade, say P', if $P' > P^*$, we have $\varepsilon_S g_S > \varepsilon_N g_N$, so that P falls over time until it reaches the long-run equilibrium value P^*, in which we have from Equation 1.52 that $\hat{P} = 0$. Thus, the "global" economy

[38] This reasonable hypothesis is crucial for the long-run result of uneven development presented in Dutt (2002). Dutt (2003) presented some preliminary evidence that the hypothesis is empirically observed.

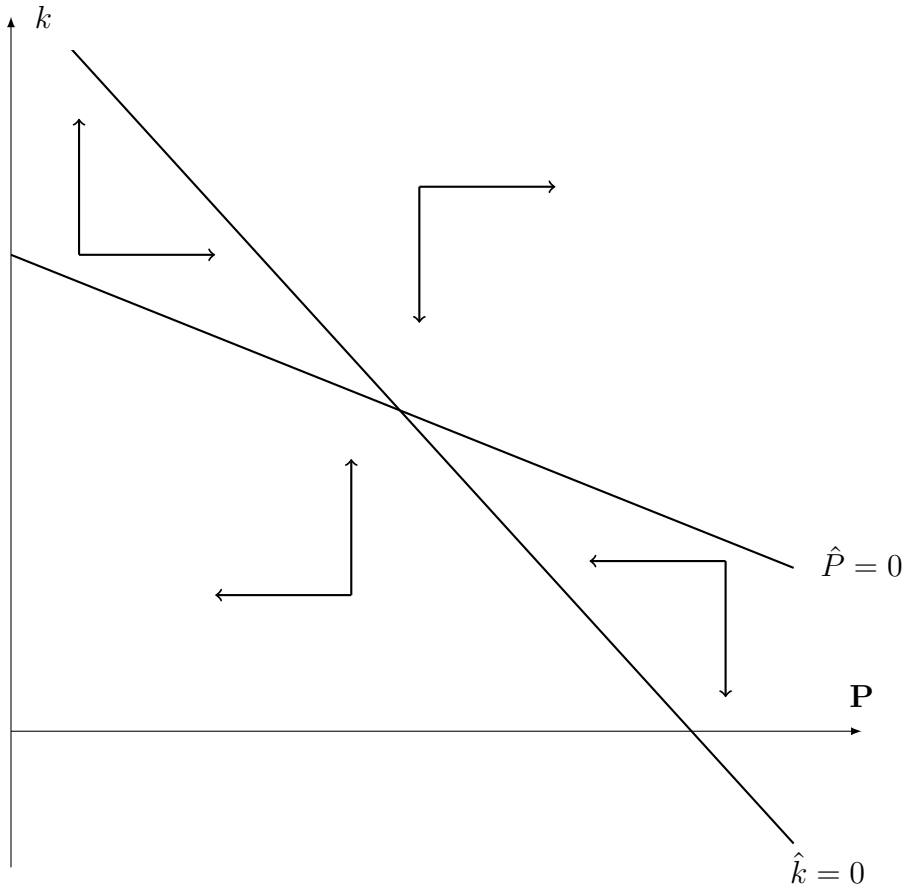

Figure 3 – Stable long-run equilibrium - full capacity utilization

will pass through a declining P, g_S and g_N phase, although the Northern growth rate will decline less than the Southern, until it reaches the point A. On the other hand, if $P^* > P'$ we will have a rise in terms of trade until it reaches P^*, i.e. the global economy will experience a rise in the terms of trade as well as for both growth rates.

Moreover, it is interesting to analyze the case in which $\varepsilon_S > \varepsilon_N > 1$. Figure 5 illustrates the long-run dynamics of growth and terms of trade in this case. Again, the results are similar to those examined in Figure 4. Nevertheless, two main differences are interesting: i) the new long-run equilibrium for P, P^{**}, is appreciated in relation to P^*, and ii) the gap between g_N and g_S is smaller in this case. Thus, higher values for ε_N are associated *ceteris paribus* to shorter distances between the growth rate of the Northern and Southern regions, that is to less severe uneven development trajectories.

The equilibrium analyzed above is a long-run one in the sense that $\hat{k}$ (and k), g_S, g_N and $\hat{P}$ (and P) become stationary. Nevertheless, we have an equilibrium characterized by the persistence of uneven development, that is $g_N > g_S$ in the long run. Note that even if we started from a point in which $g_S > g_N$, the deterioration of the Southern terms of trade will reduce g_S until we have, once more, uneven development.

In this long-run situation a similar relation to that of Equation 1.44 can be derived

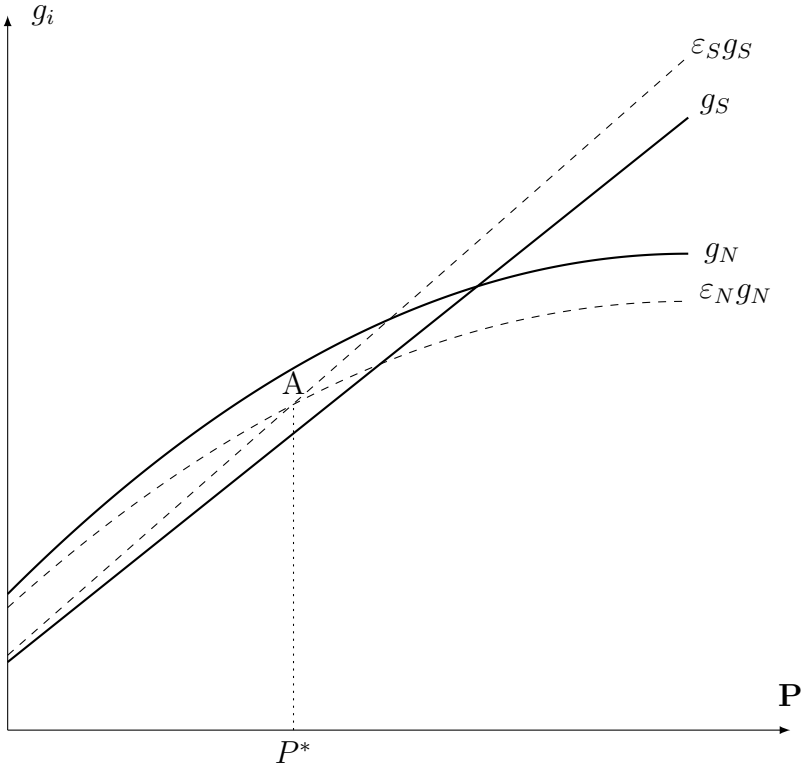

Figure 4 – Long-run dynamics of growth and terms of trade - $\varepsilon_S > 1 > \varepsilon_N$

from Equations 1.46 and 1.49. Thus, we have:

$$\frac{g_S}{g_N} = \Omega = \frac{\gamma_{1S} + \gamma_2 P^* + \pi_{SN}\theta_k}{\gamma_{1N} u_N^*} \tag{1.57}$$

Equation 1.57 shows that the ratio of growth rates in this model is determined by several variables besides the income elasticities of imports (that are present on both P^* and u_N^*. First, it is direct to see that variation in the Southern capital stock composition, k, negatively affect this ratio, as it slows the accumulation of Northern capitalists in the South. Although, again, the net effect of these variations in Ω is not clear since we need to consider the relative magnitude of both impacts of variations in k in g_S and g_N. Nevertheless, all else constant, variations in the Northern capitalist profit share in the South have a positive impact on the ratio of growth rates as it positively impacts the Southern growth rate. This effect is directly related to the dual rationale present in the Southern economy. So, we have:

$$\frac{\partial g_S}{\partial \pi_{SN}} > 0; \quad \frac{\partial \Omega}{\partial \pi_{SN}} > 0$$

Going further in this point, in this case where the Southern region operates under full capacity utilization, we know that domestically (that is, without considering trade between regions), variations in π_{SS} would raise g_{SS} and, thus, g_S. When we take into

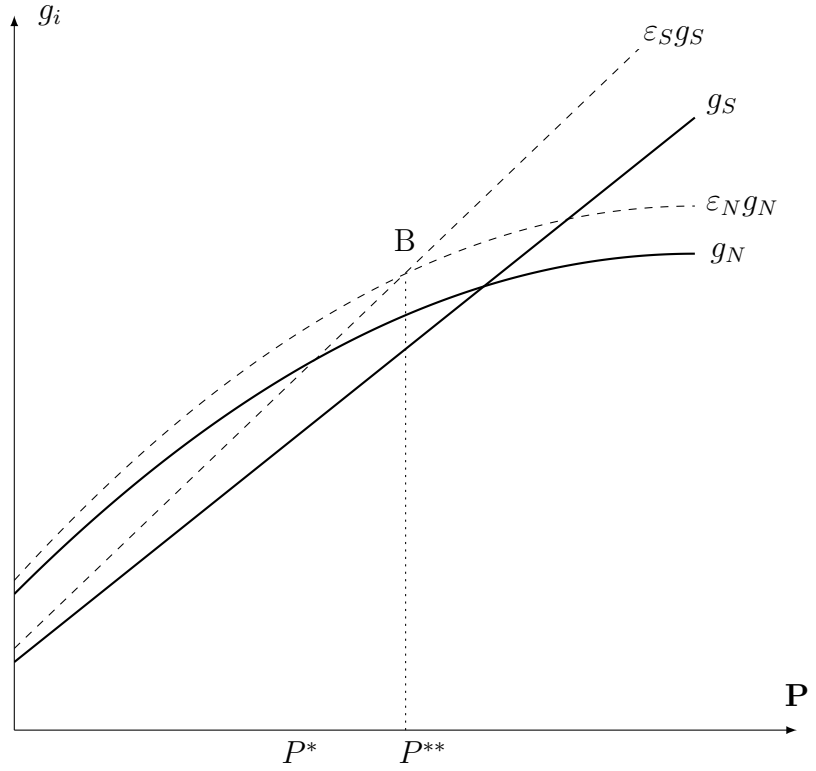

Figure 5 – Long-run dynamics of growth and terms of trade - $\varepsilon_S > \varepsilon_N > 1$

consideration the open economy effects, now the Southern current account deficit actually boosts the regions' capital accumulation. Thus, as raises in π_{SS} have a positive impact in Southern imports, it will positively impact g_{SS} as well. In this way, it is clear that the Southern economy has a profit-led overall growth regime. Moreover, as variations in the Southern external savings have a positive impact in u_N^*, it is clear that changes in π_{SS} will have a positive impact in the Northern growth rate. The net effect on Ω, however, is ambiguous (depends on the relative magnitude of the effect on the Southern and Northern growth rates). Thus, we have that :

$$\frac{\partial g_S}{\partial \pi_{SS}} > 0; \quad \frac{\partial g_N}{\partial \pi_{SS}} > 0; \quad \frac{\partial \Omega}{\partial \pi_{SS}} \gtrless 0$$

Regarding the Northern functional distribution of income, variations in the Northern profit share will have a dual impact on the ratio of growth rates. Although these variations will negatively affect the consumption in the Northern region, it will also reduce the Northern imports and, thus, will loosen the external constraint, which has a positive impact in u_N^* and, therefore, in g_N. That said, it is not clear if the Northern region has a profit-led or wage-led growth regime: although domestically the growth rate is wage-led, when we take into consideration the commercial relations between both regions, the growth regime, again, becomes ambiguous. Nevertheless, these variations will also impact the Southern growth rate, as it could reduce or increase their net exports. Therefore, we have:

$$\frac{\partial g_S}{\partial \pi_N} \gtrless 0; \quad \frac{\partial g_N}{\partial \pi_N} \gtrless 0; \quad \frac{\partial \Omega}{\partial \pi_N} \gtrless 0$$

Furthermore, it is interesting to examine how variations in the propensities to save would affect the growth rates ratio. Increases in the Southern capitalists' propensity to save have a positive impact in P^* and, therefore, in g_S (that is, the "paradox of thrift" is not observed in this case). This will have a positive impact in g_N and, thus, the net result is ambiguous. Moreover, increases in the Northern capitalists' propensity to save have a negative impact in u_N^* and g_N. Nevertheless, this variation will negatively impact the Southern growth rate, as it will tighten their external constraint. The net effect is, then, ambiguous, and depends on which of the impacts have a greater magnitude: the direct impact on the Northern growth rate or the indirect impact on the Southern one. Thus, we can express:

$$\frac{\partial g_S}{\partial s_{SS}} > 0; \quad \frac{\partial g_N}{\partial s_{SS}} > 0; \quad \frac{\partial \Omega}{\partial s_{SS}} \gtrless 0$$

$$\frac{\partial g_S}{\partial s_N} < 0; \quad \frac{\partial g_N}{\partial s_N} < 0; \quad \frac{\partial \Omega}{\partial s_N} \gtrless 0$$

Moreover, it is clear that variations in the terms of trade will positively impact the growth rate on both regions, so the result on Ω will depend on the relative magnitude of the effects. From Figure 5, however, we can see that the net effect on the ratio of growth rates will depend on the level of P.

Nevertheless, it is important to note that, although variations on the determinants of both the Southern and the Northern growth rate might have ambiguous effects on the ratio Ω, when we look to the long-run equilibrium, those effects will be stabilized. In other to present this point clearly, let us look back to the long-run dynamics of the model in this case in which the Southern region operates under full capacity utilization. From Equation 1.52, it is direct to see that $\hat{P} = 0$ only when $\varepsilon_N g_N = \varepsilon_S g_S$. Furthermore, as we assumed that both income elasticities of import demand are constant and exogenously determined, we can express the ratio between both growth rates in the long-run equilibrium (that is, when $\hat{P} = \hat{k} = 0$) as:

$$\frac{g_S}{g_N} = \frac{\varepsilon_N}{\varepsilon_S} \tag{1.58}$$

Thus, it is clear that the ratio between both regions' growth rates, in the long-run equilibrium, is equal to that presented in Equation 1.44, following Thirlwall's analysis. That is, in the long-run equilibrium we have that this ratio is determined by the external constraint (or the balance-of-payments constraint).

By way of conclusion, let us turn our attention to two questions related to the model. First, since we assumed that $\varepsilon_S > \varepsilon_N$, that is the income elasticity of import of the South is greater than the Northern one, the model implies that in the long-run equilibrium the Northern capital and output grow at a faster rate than the Southern. Even if we consider a short-run in which the South grows faster, the outcome, in the long run, will still be one of uneven development, that is $\Omega < 1$. Notwithstanding, later on this essay we take a first step into the possibility of those income elasticities of import to vary, in special due to variations in the Southern capital stock composition, what can be related to different development paths in the long run.

Second, the model herein developed has considered North-South capital flows and so far analyzed four channels through which FDI could affect the economic productive structure, especially in the Southern region. For both case (when $u^*_{SS} < 1$ and $u_{SS} = 1$), the aggregate effect of the capital accumulation channel is positive for the Southern region, as FDI inflows boost the accumulation process of a fraction of the Southern capital stock (that detained by Northern capitalists). However, as the Southern capital stock composition grows, that is, when the Southern economy becomes more "internationalized", the growth rate slows down.[39] Furthermore, those FDI inflows have a long-run negative impact through the balance-of-payments components channel, since they raise Southern imports (as Y_S grows).[40] It is also important to note that the introduction of FDI inflows in the Southern region gave rise to a new form of "duality" within the economy - one in which the rationale of investment is different for each type of capital stock (that is, that detained by Southern and Northern capitalists in the South).[41] Moreover, the inclusion of the effects of FDI inflows on labor productivity growth rate in the Southern region, a positive mechanism through which the technological change channel functions, could indicate a different path of global development in the long run, in this case, a more even development trajectory. In summary, the introduction of FDI flows in the model represented, in the case where there is excess capacity in both the North and the South, the emergence of some different possibilities of development trajectories between the regions (even development and another "type" of uneven development), depending not only on the ratio of income elasticities of trade but also on the components of aggregate demand in both regions. On the other hand, in the case where the Southern economy operates at full capacity utilization, the consideration of those capital flows did not indicate an even development trajectory between regions, but rather gave rise to a less perverse development path. Even so, it is important to note that the introduction of such capital flows is also

[39] An interesting empirical exercise related to this result is to test the presence of non-linearities in the relationship between FDI and economic growth.

[40] Note that this result could be different if we consider that TNCs export their products.

[41] This result would hold even without the enclave assumption. However, in that case, the net result would also depend on the "trade balance" between the foreign and the domestic sectors of the Southern economy.

related to the emergence of possible unstable long-run dynamics. Therefore, the general result of the model is that, although FDI inflows may, in fact, represent a mechanism that "shortens distances" (regarding economic development) between the North and the South, the positive results may not be sustainable. Still, it is worth pointing out, again, that this possible long-run instability might, in fact, be positive for the Southern region (depending on the initial conditions).

Nevertheless, although the results of long-run uneven development, at least for the case in which the Southern economy operates with full capacity utilization, are similar (qualitatively) to that derived in Dutt (2002), the introduction of capital flows from the North to the South allowed us to analyze a new set of interesting questions and results that came formally from the capital stock composition in the Southern region and further altered the ratio between growth rates. Therefore, it is worth mentioning some fundamental differences between this and Dutt's models. First, we consider that both regions are demand-driven, which generated quite different short and long-run dynamics, giving other fundamentals for the ratio between the growth rates of the regions, Ω, to be less than unity. Second, under this demand-led closure, we considered the possibility that the Southern economy might operate under full capacity utilization, analyzing both cases (that is, when $u_{SS} < 1$ and $u_{SS} = 1$). It is direct to see from the last subsection that, when we are examining the full capacity utilization case, the long-run dynamics for the growth rates and the terms of trade are quite similar to Dutt's, so these results are a particular case of our model. Finally, this model did not assume that trade would be balanced in the short run, an assumption made by Dutt (2002), but it rather allowed the trade balance to vary (it is balanced in the long run only). This possibility brought some complications, especially for analytically obtaining closed solutions, but it brought interesting mechanisms to the analysis of the long-run behavior of the variables, as we saw in the previous subsections.[42]

Having presented the short-run behavior of the model, its long-run dynamics, and some of the conclusions derived from it, let us focus our attention on a first extension of the model, one that takes into consideration another channel through which FDI inflows can impact underdeveloped economies: the market structure.

[42] It is important to say that we developed, for instance, a simple demand-led version of Dutt (2002)'s model with balanced trade in the short run, but the results and the dynamics regarding FDI and its consequences, the terms of trade and income elasticities of trade were not so promising.

1.3 The market structure channel: mark-up factor and functional income distribution

The functioning of this channel, as discussed earlier in this essay, is related to the effects of FDI inflows on the level of competition between firms in the recipient country or, in our case, region. There are several theoretical arguments and empirical evidence supporting the existence of such relation, although it is not quite clear if the correlation between foreign presence and market concentration is positive or negative. In this section, we develop an extension of the model in order to take into consideration this effect as well as the ambiguities that underlie its functioning. In a simplified manner, we use the average mark-up factor of firms operating in the Southern region as a measure of competition in the domestic market, so that higher levels of the mark-up factor are associated with lower levels of competition.

In addition, it is worth noting that, as pointed out at the beginning of this essay, the analyzed channels (through which FDI can affect the host economy) tend to operate in a typically interconnected manner. In this particular case, when considering the effects of FDI inflows on the mark-up factor of firms in the South, we are also considering the effects of such capital flows on the functional income distribution since, all else constant, variations in the mark-up affect the profit share (and, consequently, the wage share) of income in the region.

First, it is important to say that, in this section, we will only analyze the model's long-run dynamics (although we use the short-run solution of the excess capacity case), keeping the hypothesis that both the mark-up factor and, consequently, the functional income distribution are constant in the short run. Furthermore, we will focus our attention on the case in which the Southern economy operates under excess capacity, since this case proved to be more interesting for analyzing the impacts of FDI inflows on the dynamics of key variables for the characterization of the model's long-run equilibrium, such as the terms of trade.[43]

That said, let us remember how prices are determined in the North and the South. For both regions, we assumed a typical "Kaleckian" mark-up equation. In order to clearly present the mark-up factor, we can rewrite Equation 1.1 as:

$$P_i = \tau_i \frac{W_i}{a_i} \tag{1.59}$$

where $\tau_i = (1 + z_i) > 1$, with $i \in \{N, S\}$, is the mark-up factor of region i. Now we consider that τ is given in the short-run, but it might vary in the long run (it is endogenously

[43] Moreover, it is important to remember that, in the other case (with full capacity), the price level would adjust to clear the goods market.

determined).

Applying logarithm to both sides of Equation 1.59 and deriving with relation to time, we have:

$$\hat{\tau}_S = -(\hat{W}_S - \lambda - \hat{P}_S) \tag{1.60}$$

Moreover, we know that the growth rate of the wage share, by definition, is equal to the growth rate of the real wage less the growth rate of the labor productivity. Thus, we can rewrite Equation 1.60 as:

$$\hat{\tau}_S = -\hat{\sigma}_S \tag{1.61}$$

Nevertheless, we also know from Equations 1.34 and 1.35 that both the growth rate of the Southern nominal wage and the proportionate rate of change of labor productivity are functions of the Southern capital stock composition. In order to focus our attention on the effects of FDI inflows on the mark-up factor, let us assume that although the nominal wages and the labor productivity continue to be related to the degree of internationalization of the Southern economy, they evolve in a certain manner. In special, assume that the Southern region has a wage rule in which the nominal wages grow exactly as the labor productivity. That is, the capitalists (both domestic and foreign) will pay higher wages when the labor productivity growth is positive, and lower wages whenever it is negative. Thus, we can rewrite Equation 1.60:

$$\hat{\tau}_S = \hat{P}_S = \hat{P} \tag{1.62}$$

that is, the growth rate of the terms of trade is equal to the growth rate of the mark-up factor.

As discussed in the first section of this essay, the aggregate effect of FDI inflows on the recipient economy through this channel is ambiguous. On one hand, there is evidence that the presence of multinationals firms might increase their market power and, thus, their mark-up as their technological and cost advantages reduce the number of firms that are able to compete in the market. De Backer and Sleuwaegen (2003), for instance, find that FDI drives out domestic entrepreneurs, thus reducing the survival probability of domestic firms. On the other hand, Kosova (2010) and Lu, Tao and Zhu (2017) find evidence that the presence of FDI has a positive effect on the survival probability of domestic firms in certain industries, which might be related to a negative effect of FDI inflows on firms' mark-ups. Moreover, temporary costs associated with cultural differences and knowledge of consumers' preferences may reduce the margins of foreign firms, thus diminishing their mark-up.

Although the sign of the effect of FDI inflows on firms' mark-ups is not clear, the theoretical arguments and empirical evidence indicate that there is a relation between the presence of foreign firms and the mark-ups. Going further, although we cannot define the sign of the relation, the evidence suggests that the aggregate effect depends on the relative intensity of the foreign presence on the host economy, that is, the economy's degree of internationalization. That said, from our model we can conjecture that the dynamics of the mark-up is a function of the Southern capital stock composition. In a general way, we can present this relation as:

$$\hat{\tau}_S = \tau_0 + \tau_1 k \tag{1.63}$$

where both the parameters τ_0 and τ_1, although they could assume positive or negative values, should do it with opposite signs. In line with the conceptual and empirical evidence presented in the first section of this essay as well as in the last paragraphs, an increase in k can raise or reduce the proportionate rate of change of the mark-up factor.

It is direct to see that the general form presented in Equation 1.63, although quite simple, allow us to analyze both possibilities of aggregate positive and negative effects of the presence of foreign firms on mark-ups. Furthermore, it allows us to examine how the region's degree of internationalization might alter the initial dynamics of the mark-up. For instance, this functional form allows us not only to consider the evidence presented by Barrios, Görg and Strobl (2005) that initially the number of firms will decrease with the presence of multinational firms but would increase in the long run (indicating an initial positive evolution of the mark-ups, but a dynamic that decreases with the foreign presence), but also the one presented by Sembenelli and Siotis (2008) that the presence of foreign firms dampens margins in the short-run but the effect vanishes over time (indicating an initial negative evolution of the mark-up, but a with a positive relationship with k).

In order to properly address these possibilities, we will divide the presentation of our analysis into two subsections: one considering that the effect of the internationalization of the Southern economy is positive on the mark-up and one considering that the effect is negative, that is, $\tau_1 > 0$ and $\tau_1 < 0$, respectively.

1.3.1 Positive effect on the mark-up ($\tau_1 > 0$)

First, it is important to characterize the dynamic system that will be solved in order to define the long-run equilibrium. From last section, we know that the Southern capital stock composition evolution, when the Southern economy operates with excess capacity, is given by Equation 1.33. So we have the first component of this dynamic system. Moreover, in this section we are considering that the mark-up is endogenous to the (Southern region) economy's degree of "internationalization" and, therefore, a measure of this evolution

needs to be considered in the dynamic system. To better expose the results, in a way that clearly indicate the relation between the functioning of this channel and the income distribution one, we choose to present the long-run dynamics in relation to the evolution of the Southern capital stock composition and the wage share. From Equations 1.61 and 1.63, we can define this dynamic system as:

$$\hat{k} = \left(\frac{\pi_{SN}}{k} - \gamma_{1S}\right) u^*_{SS} + \pi_{SN} - \gamma_2 P \tag{1.64}$$

$$\hat{\sigma}_S = -\tau_0 - \tau_1 k \tag{1.65}$$

Equations 1.64 and 1.65 constitute a system of differential equations in which variations of k and σ_S over time, depend on the level of k, σ_S and other parameters of the system, with u^*_{SS} implicitly defined in Equation. The Jacobian matrix M for this dynamic system is given by:

$$M = \begin{bmatrix} \frac{\partial \hat{k}}{\partial k} & \frac{\partial \hat{k}}{\partial \sigma_S} \\ \frac{\partial \hat{\sigma}_S}{\partial k} & \frac{\partial \hat{\sigma}_S}{\partial \sigma_S} \end{bmatrix} \tag{1.66}$$

With that in mind, we can advance to the analysis of the existence and the stability of a long-run equilibrium in this case considering the dynamic system formed by $(\hat{k}, \hat{\sigma}_S)$. Thus, in this case, we have the terms of the Jacobian matrix (defined in Equation 1.66) given by:

$$M_{11} = -\frac{\pi_{SN} u^*_{SS}}{k^2} + \frac{\pi_{SN}}{k}\frac{\partial u^*_{SS}}{\partial k} - \gamma_{1S}\frac{\partial u^*_{SS}}{\partial k} \tag{1.67}$$

$$M_{12} = (\frac{\pi_{SN}}{k} - \gamma_{1S})\frac{\partial u^*_{SS}}{\partial \sigma_S} + (1 + \frac{u^*_{SS}}{k})\frac{\partial \pi_{SN}}{\partial \sigma_S} - \gamma_2 \frac{\partial P}{\partial \sigma_S} \tag{1.68}$$

$$M_{21} = -\tau_1 \tag{1.69}$$

$$M_{22} = 0 \tag{1.70}$$

Analyzing the sign of each term, first, we have an ambiguous impact of variations on capital stock composition on the proportionate rate of change of the same variable. It is clear that the sign of this term depends on the sign of $\frac{\partial u^*_{SS}}{\partial k}$. That said, we should examine how variations in the Southern capital stock composition affect the Southern rate of capacity utilization (of the Southern capitalists' stock). From the short-run analysis in Section 1.2.1, we know that Southern external savings is a function of both capital

stocks in the South. Furthermore, we also know that this external savings are differently impacted by variation in K_{SS} and K_{SN}, since we are analyzing the case where $u_{SS} < 1$ (so variations in the capital stock of Northern capitalist in the South has a greater impact). As variations in k can be understood as relative variations in K_{SN} (compared to K_{SS}), changes in the Southern capital stock composition have a positive impact on the external savings and, thus, will represent a negative impact in u_{SS}. With that in mind, we can see from Equation 1.67 that the first and second terms are negative. Although, as the last term is positive, the sign is ambiguous. Nevertheless, we assume that the first two terms have a greater magnitude than the last one, in a way that $M_{11} < 0$. In summary, we keep the assumption made earlier, that variations in Southern capital stock composition have a stronger (negative) impact in the growth rate of Northern capitalist capital stock in the South than in the growth rate of Southern capitalist capital stock.

Second, variations in the functional income distribution have an ambiguous effect on the proportionate rate of change of the Southern capital stock composition. It is clear that the sign of this term depends on the sign of $\frac{\partial u^*_{SS}}{\partial \sigma_S}$, $\frac{\partial P}{\partial \sigma_S}$, $\frac{\partial \pi_{SN}}{\partial \sigma_S}$ and the relative magnitude of a combination of parameters. Nevertheless, it is possible to determine the sign of these partial derivatives. As the Southern economy is wage-led overall (considering both domestic and open economy factors), the first derivative has a positive sign. Moreover, we also know that the terms of trade vary in the opposite direction to the wage share, so the sign of this partial derivative is negative. Lastly, the effect of variations in the wage share on the profit share of Northern capitalist in the South is not clear. It is important to note that variations in σ_S, the mean wage share of the Southern region, might be caused by variations in the relative remuneration of Southern workers in domestic firms, in foreign firms or both at the same time. So, the sign of this partial derivative depends on the type of variation in σ_S. Let us assume that variations in σ_S are caused by variations in both Southern wage shares, so $\frac{\partial \pi_{SN}}{\partial \sigma_S}$ is negative. In summary, the effect of variations in the Southern wage share on the growth rate of k will be determined by the relative effect of these variations in g_{SN} and g_{SS}. It is direct to see from Equation 1.68 that, if the effects of variations in σ_S are stronger in g_{SS} than in g_{SN} (what is expected, as the fraction of the capital stock detained by Southern capitalists is "strongly" wage-led), M_{12} will be negative, as a positive effect on g_{SS} represents a negative effect on $\hat{k}$. On the other hand, if variations in the Southern wage share have a positive and stronger effect on g_{SN} relative to g_{SS}, a quite less likely scenario, M_{12} will be positive.

Furthermore, variations on the Southern capital stock composition have a negative effect on the rate of growth of the wage share, as we are analyzing the case in which $\tau_1 > 0$, that is, the mark-up factor is positively related to the degree of internationalization of the Southern economy. Thus, we have that $M_{21} < 0$. Moreover, it is clear that the growth rate of the wage share is not affected by variations of its own level, that is, $M_{22} = 0$.

In order to present the most interesting case, let us focus our attention on the stable long-run equilibrium. The trace of matrix M is negative, as $M_{11} < 0$ and $M_{22} = 0$, so we only need a positive determinant to define a stable long-run equilibrium. As M_{21} is negative in this case, M_{12} needs to be positive for the determinant to be positive. As we discussed above, the scenario in which M_{12} is positive is relatively unlikely, as we need to assume that the effects of variations in the Southern wage share are positive on g_{SN} and, more than that, are stronger than the effects on g_{SS}. Thus, if FDI inflows positively affect the mark-up in the Southern region, we actually would expect a saddle-path long-run equilibrium, as the determinant of matrix M is likely to be negative. This means that the presence of foreign firms might represent an unstable dynamic for the functional distribution of income in the Southern region. Nevertheless, for simplicity, let us keep our analysis to the stable case, that is when M_{12} is positive and, thus, the determinant of matrix M is positive. Figure 6 presents a simplified sketch of the long-run equilibrium under these circumstances. The slope of isoline $\hat{\sigma}_S$ is parallel to the x-axis, indicating that this line does not depend on the level of the wage share. As, for this combination of parameters, we have $\frac{\partial \hat{\sigma}_S}{\partial k} < 0$, the wage share growth rate varies in the opposite direction to the capital stock composition, what explain the direction of the horizontal vectors. The slope of isoline $\hat{k} = 0$ is given by $-(\frac{M_{12}}{M_{11}})$, so it is positive. Given that $\frac{\partial \hat{k}}{\partial k} < 0$, the growth rate of capital stock composition varies in the opposite direction to the composition itself, thus the direction of the vertical vectors are explained.

1.3.2 Negative effect on the mark-up ($\tau_1 < 0$)

Let us now present the second case, the one in which the increase in foreign presence reduce the firms' mark-ups. In order to define the long-run equilibrium as well as discuss its existence and stability, we shall once again analyze the dynamic system formed by Equations 1.64 and 1.65. Thus, we have to examine the same matrix as that presented in Equation 1.66 and the partial derivatives of Equations 1.67, 1.68, 1.69 and 1.70.

Analyzing the sign of each term, first, we have the same ambiguous impact of variations on capital stock composition on the proportionate rate of change of the same variable. We will keep the assumption made earlier, that variations in Southern capital stock composition have a stronger (negative) impact in the growth rate of Northern capitalist capital stock in the South than in the growth rate of Southern capitalist capital stock, that is, $M_{11} < 0$. Furthermore, we also know that, in this case, $M_{21} > 0$ (as $\tau_1 < 0$) and that $M_{22} = 0$.

For the long-run equilibrium to be stable (a stable focus), as the trace of the matrix M is negative, we need the determinant of the matrix, $-(M_{12}M_{21})$, to be positive. As M_{21} is positive in this case, M_{12} needs to be negative. As discussed in the earlier case, M_{12} is negative if the effect of variations in the wage share is stronger (positive) on g_{SS}

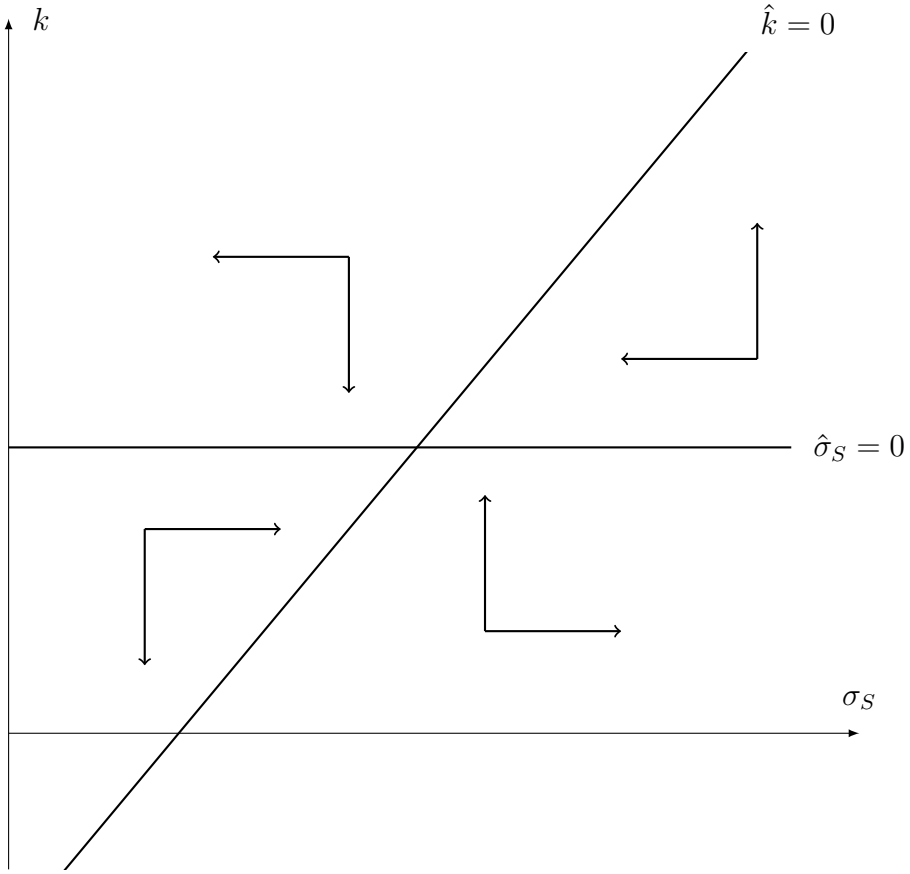

Figure 6 – Stable long-run equilibrium - Positive effect on the mark-up

than in g_{SN} or it is negative for g_{SN}. Both of these situations are likely to be the case for the Southern region. Figure 7 presents a simplified sketch of the long-run equilibrium under these circumstances. The slope of isoline $\hat{\sigma}_S$ is parallel to the x-axis, indicating that this line does not depend on the level of the wage share. As, for this combination of parameters, we have $\frac{\partial \hat{\sigma}_S}{\partial k} > 0$, the wage share growth rate varies in the same direction as the capital stock composition, what explain the direction of the horizontal vectors. The slope of isoline $\hat{k} = 0$ is given by $-(\frac{M_{12}}{M_{11}})$, so it is negative. As $\frac{\partial \hat{k}}{\partial k} < 0$, the growth rate of capital stock composition varies in the opposite direction to the composition itself, thus the direction of the vertical vectors are explained.

By way of conclusion, it is worth summarizing the main points of this section. In this part of the essay, we have extended the model to analyze the effects that an increased foreign presence could have on competition in the Southern domestic market. For this purpose, we consider that the mark-up factor is endogenous to the Southern capital stock composition, that is, variations in the degree of "internationalization" of the Southern economy affect the evolution of the mark-up over time. With some simplifications, we show that such variations in the mark-up factor can be understood as variations, in the opposite direction, in the share of wages in the Southern income (the wage share in the South). Thus, in addition to dealing with the market structure channel, we also deal directly with

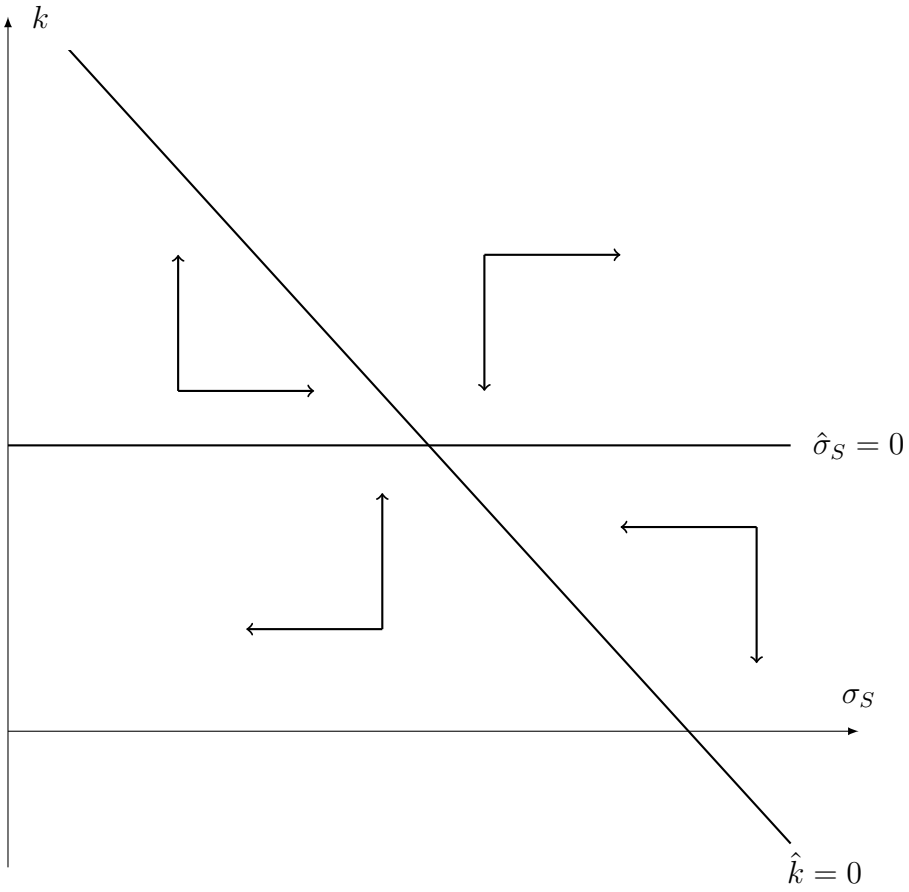

Figure 7 – Stable long-run equilibrium - Negative effect on the mark-up

the income distribution channel.[44]

Furthermore, we consider the ambiguity present in the literature (both theoretical and empirical) with the division of our analysis in two cases: one in which the effect of an increased foreign presence is positive on the mark-up factor and another in which such effect is negative. In summary, we could see that in the first case, that is when $\tau_1 > 0$, it is likely that we have a locally unstable long-run equilibrium, since the dynamic system follows a saddle-path trajectory. Thus, an increase in the "internationalization" of the Southern economy would be associated with long-run instability in the South, which can be either positive or negative for the region with respect to relative development trends and to the functional distribution of income. Nevertheless, if we have the stability of the saddle point (it will occur if, by coincidence, the initial condition is located at some point in its stable arms) or we have the unlikely case in which the equilibrium is locally stable (that is $M_{21} > 0$), this long-run equilibrium is associated with a worsening in the share of income detained by workers in the South, which might lead to variations in the ratio

[44] In this channel, it is interesting to point to another possible extension: one in which the dynamics of the mark-up factors in the two regions are interdependent. For instance, FDI from the North may be intended to escape from fierce competition in the Northern markets and to have more market power in the South. However, these capital outflows might reduce competition in the Northern market and increase it in the South, with further consequences to the mutual dynamics.

between the Southern and Northern growth rates. On the other hand, in the case where $\tau_1 < 0$, the long-run equilibrium associated with the presented dynamic system is more likely to be locally stable. Moreover, the long-run equilibrium, in this case, is associated with a higher wage share in the Southern region.[45]

It is important to note, again, that the consideration of the effects of FDI inflows on the variables of interest in our model, in this case, the markup factor and, therefore, the wage share, brings up a trade-off between instability of the dynamic system (and the long-run equilibria) and the possibility of overcoming the pattern of uneven development. This dichotomy will be discussed in more detail in the next section, where we further consider an essential channel for the possibility of different long-run development trajectories between the North and the South.

After presenting the entire structure of the theoretical-formal model, its behavior in the short-run and in the long-run for both the cases analyzed and an extension considering the functioning of the market structure, in the next section we look to a possibility of overcoming the uneven development trajectory through the easing of the external constraint.

1.4 Income elasticities and (un)even development

After the discussions of the last sections, a question that arises is whether it is possible to obtain a plausible long-run trajectory of even development within this theoretical-formal framework. In this section, we will address this point, introducing another channel through which FDI flows will affect the global economy: the balance-of-payments components channel.[46]

Aiming to address the question highlighted before, let us first recall some points from the long-run equilibrium presented in the second section of this essay. First, let us restrict our analysis to the case in which the Southern region operates with full capacity utilization, that is, $u^*_{SS} = 1$. It is important to remember that our result for the long-run in this case, as well as that of Dutt (2002), is directly related to the assumption that Northern income elasticity of imports is smaller than the Southern one, that is $\varepsilon_N < \varepsilon_S$.[47] Although it seems to be a reasonable theoretical assumption, empirically the estimations of import

[45] For both cases the long-run ratio between the Southern and Northern growth rates, as presented in Equation 1.45, could either increase or decrease, depending on the effects of variations in the functional distribution of income on those growth rates (majorly ambiguous as analyzed in the second section of this essay).

[46] In fact, this channel has already been covered in previous sections, in particular, due to the effects of investment flows on the Southern external savings. In this section, we will deal in more detail with some of the mechanisms underlying the functioning of this channel.

[47] Thirlwall (1983) discuss how various center-periphery models, developed by authors such as Prebisch, Seers and Kaldor, have the assumption of lower income elasticity of demand for primary commodities in world trade than manufactures goods as an essential feature of their analysis.

and export elasticities for large and different groups of countries are not always conclusive. Dutt (2003) presents a brief review of those estimations, discussing the issues related to small samples and biased groups of countries, as well as problems such as simultaneity and misspecification. Using aggregate data to estimate North and South import and export elasticities (represented by groups of OECD and non-OECD countries), the author finds evidence that indicates the validity of the assumption under different methods of estimation. Nevertheless, it is interesting to analyze another question regarding those income elasticities: the possibility of changes over time. Dutt (2003) finds evidence that the income elasticity of imports may have varied in the last decades, while the coefficient associated with income elasticity of exports indicates a constant behavior in the same period. For instance, a plausible theoretical argument is that changes in the commodity composition of Southern exports are likely to imply changes on income elasticities and thus it can affect the pattern of development in the long-run (as well as the dynamics of Southern terms of trade).[48]

As discussed in the first section of this essay, several theoretical arguments are pointing to possible positive and negative effects of the presence of foreign firms on the income elasticities of imports and exports demand of both regions. First, let us turn our attention to the possible effects on ε_S. On one hand, the presence of foreign firms in the South might be related not only to a decrease in imports - for instance, consider that those foreign firms will produce domestically final and intermediate goods that were imported before - but also to a variation in the composition of those imports (DUTTARAY; DUTT; MUKHOPADHYAY, 2008). Thus, this reduction in the import demand of high value-added goods (that are now produced domestically) might represent a decrease in the Southern income elasticity of import demand. On the other hand, another possible effect of the presence of foreign firms in the South is an increase in the demand for intermediate and capital goods which - if the domestic market for those goods is not competitive or even non-existent - will be accommodated through imports from the North. Thus, even if we consider that FDI inflows might improve the regions' exports, it may present a negative net effect in the trade balance (JENKINS, 2013). Moreover, there is also a possible composition effect underlying this increase in imports: the goods that will be imported now might have greater added value, representing a shift in the composition of the bundle of imported goods. If this is the case, the increased presence of foreign firms might be related to a higher income elasticity of import demand for the Southern region.

Furthermore, looking now at ε_N, the theoretical arguments are similar to those presented in the last paragraph. In summary, the possible effects of FDI inflows on the

[48] However, Dutt (2003) findings suggest that increasing globalization due to trade liberalization may have strengthened the force of this uneven development mechanism as it has increased South's income elasticity of imports from the North, besides it did not indicate an increase in the Northern income elasticity of Southern exports.

Southern imports - both positive or negative - might also be related to composition effects. As argued earlier in this essay, the presence of foreign firms may alter the Southern region productive structure. Furthermore, it can also alter the composition of Southern exports. On one hand, FDI inflows can be related to the domestic production of higher value-added products that might be exported, especially if we consider that the presence of foreign firms in the domestic market will result in greater access to foreign markets. In this case, FDI inflows might have a positive impact in the Southern region structural competitiveness, resulting in a higher value for the Northern income elasticity of import demand. On the other hand, although seemingly less likely, it is possible that FDI inflows are related to ε_N in a negative way, either by a negative impact in the Southern productive structure and its structural competitiveness or a variation in the bundle of exported goods (a shift with greater participation of low value-added products).

Nevertheless, what interests us most is to capture the aggregate effect of FDI inflows on the ratio between the Northern and the Southern regions' income elasticities of import. We can see from the model that, considering the case in which the Southern economy operates with full capacity utilization, in the long-run, this ratio determines the pattern of relative development between the two regions. From Equation 1.58, it is clear that the separate effects analyzed earlier in this section might, in fact, not only alter the dynamics of uneven development but may also indicate the overcoming of such perverse pattern.

Having that in mind, let us extend the model in order to incorporate changes in income elasticities coming from FDI inflows. For this purpose, we will only examine, as commented earlier, the case in which the South operates with full capacity utilization, because in this case those elasticities play a more important role in the long-run dynamics (and, therefore, on development patterns) than with excess capacity. Furthermore, it is important to say that we keep the assumption that both income elasticities of import demand, ε_S and ε_N, are constant in the short-run and, thus, we can focus our analysis in the long-run dynamics. In a stylized manner, we allow the composition of Southern exports and imports to be affected by FDI inflows, as technology transfers affect the goods produced and demanded in the South as well as the value-added in their production. It is worth saying that this mechanism functions within the balance-of-payments components channel, although it is clearly not restricted to it. The relation can be summarized as:

$$\frac{\varepsilon_N}{\varepsilon_S} = f_5(k) \tag{1.71}$$

where $\frac{\varepsilon_N}{\varepsilon_S} > 0$, $f_5'(k) \gtreqless 0$ and $f_5''(k) \gtreqless 0$. Note that this general specification allows us to consider a large set of different effects of FDI on each region's income elasticity of import demand.

With that in mind, we will now present the long-run dynamics, its results and implications for two general cases: i) one in which the effects of FDI inflows are positive on the income elasticities ratio, that is $f_5'(k) > 0$ and ii) the case in which those effects are negative, that is $f_5'(k) < 0$.[49]

1.4.1 Positive effect on the income elasticities ratio

First, we analyze the case in which $f_5'(k) > 0$, that is, the ratio of income elasticities of import demand is positively related to the Southern capital stock composition or, in other words, to FDI inflows.

As we are considering that both income elasticities of import demand depend on the level of k and might vary along time, we need to define a new long-run dynamic system. Looking to the terms of trade, we can use Equation 1.51 and the definition of the Southern external savings, considering that trade is balanced in the long-run and that the functional income distribution is given, to express[50]:

$$\hat{P} = \frac{\varepsilon_N(k)g_N + \varepsilon_N(k)\hat{\varepsilon_N}lnY_N - \varepsilon_S(k)g_S - \varepsilon_S(k)\hat{\varepsilon_S}lnY_S}{\mu_S + \mu_N - 1} \tag{1.72}$$

where $\hat{\varepsilon_S}$ and $\hat{\varepsilon_N}$ are the growth rates of the Southern and Northern income elasticity of import demand, respectively, lnY_S is the log of the Southern region income (or product) and lnY_N is the log of the Northern region income.

The model's long-run behavior is defined by the dynamic system formed by Equations 1.50 and 1.72. Those expressions constitute a system of differential equations in which variations of k and P along time, depend on the level of k, P, ε_S, ε_N and other parameters of the system, with P^* implicitly defined in Equation. The Jacobian matrix, J, for this dynamic system is given by Equation 1.38.

With that in mind, we can advance to the analysis of the existence and the stability of a long-run equilibrium in this case considering the dynamic system formed by $(\hat{k}, \hat{P})$. Thus, in this case, we have the terms of the Jacobian matrix given by[51]:

$$J_{11} = -\frac{\pi_{SN}}{k^2} - \gamma_2\frac{\partial P^*}{\partial k} \tag{1.73}$$

$$J_{12} = -\gamma_2 \tag{1.74}$$

[49] Although the general specification allows a variety of behaviors for f_5, we assume, for simplicity and tractability, that in the case in which $f_5' > 0$, we have $f_5'' < 0$, and in the case in which $f_5' < 0$, we have $f_5'' > 0$.

[50] Here, we also use the definition that $\hat{\varepsilon_i} = \frac{\dot{\varepsilon_i}}{\varepsilon_i}$, for $i \in \{N, S\}$.

[51] Note that we simplified Equation 1.75, considering that the effects of variations of k on the growth rate of both income elasticities of import demand are close to zero (if not zero). That is, we omitted two terms in Equation 1.75.

$$J_{21} = \frac{\frac{\partial \varepsilon_N}{\partial k} g_N + \varepsilon_N \frac{\partial g_N}{\partial k} + \frac{\partial \varepsilon_N}{\partial k} \hat{\varepsilon_N} lnY_N + \varepsilon_N \hat{\varepsilon_N} \frac{\partial lnY_N}{\partial k} - \frac{\partial \varepsilon_S}{\partial k} g_S - \varepsilon_S \frac{\partial g_S}{\partial k} - \frac{\partial \varepsilon_S}{\partial k} \hat{\varepsilon_S} lnY_S - \varepsilon_S \hat{\varepsilon_S} \frac{\partial lnY_S}{\partial k}}{\mu_S + \mu_N - 1} \tag{1.75}$$

$$J_{22} = \frac{\varepsilon_N(k) \frac{\partial g_N}{\partial P} - \varepsilon_S(k) \frac{\partial g_S}{\partial P}}{\mu_S + \mu_N - 1} \tag{1.76}$$

Analyzing the sign of each term, first, we have an ambiguous impact of variations on capital stock composition on the proportionate rate of change of the same variable. It is clear that the sign of this term depends on the sign of $\frac{\partial P^*}{\partial k}$, which also depends on the sign of $\frac{\partial P^*}{\partial \varepsilon_S}$, $\frac{\partial P^*}{\partial \varepsilon_N}$, $\frac{\partial \varepsilon_S}{\partial k}$ and $\frac{\partial \varepsilon_N}{\partial k}$. That said, we should examine how variations in the Southern capital stock composition affect the terms of trade. From the short-run analysis, we know that Southern external savings is a function of both capital stocks in the South. Moreover, we also know that, in this case where $u_{SS} = 1$, variations in both Southern capital stock will have the same effect on the external savings. Thus, it is necessary to specify what type of variations in k we are analyzing, that is, if it is characterized by raises in K_{SN}, falls in K_{SS}, or any combination of these changes. For simplicity, let us assume that variations in k are caused by raises in K_{SN} in relation to K_{SS} (e.g. K_{SS} raised less than K_{SN}). This way, those variations in the Southern capital stock composition will positively impact the external savings and, therefore, the terms of trade. Furthermore, we assume that the effects of variations in both income elasticities of import demand on P^*, even if they are negative, do not overcome the positive impact of the direct effect of variations in k on the Southern external savings. Thus, J_{11} is negative. Second, it is direct to see from Equation 1.74 that $J_{12} < 0$, since variations in the terms of trade affect the growth rate of Southern capital stock composition in a negative way, as it boosts g_{SS}.

Furthermore, variations in capital stock composition have an ambiguous effect on $\hat{P}$. It is direct to see from Equation 1.75 that the sign of the expression depends on the relative magnitude of effects of variations in k on ε_S, ε_N, g_S, g_N and the log of both regions' income weighted by a combination of those variables. From the model, we know that $\frac{\partial g_S}{\partial k} < 0$. Furthermore, we keep the assumption that variations in k have a stronger impact in the Southern growth rate than in the Northern one (since the effect on g_N is derived from the effect on g_S). As the sign of this term is quite ambiguous, in order to present the results in a clear manner let us subdivide this case in two more cases, one in which the effect of FDI inflows on the ratio of income elasticities are strong enough and, consequently, we have a situation where $\varepsilon_N > \varepsilon_S$ (and, thus, we know that g_S is likely to be higher than g_N), and the other in which, even with variations in the income elasticities ratio, we still have a long-run with $\varepsilon_N < \varepsilon_S$. In the first case, with the assumption made it is possible to see from 1.75 that the terms with a negative sign (especially those associated with $\frac{\partial g_N}{\partial k}$ and g_S) are likely to overcome the terms with a positive sign, and, more than that, are more likely to do so the greater is the effect of variation in k on the income

elasticities ratio. Therefore, under those assumptions, J_{21} is likely to be negative. On the other hand, for the case in which the $f_5'(k)$ is positive but not strong enough (that is, we still have $\varepsilon_N < \varepsilon_S$), the positive terms are likely to overcome the negative ones (as it was the case for the simple long-run analysis presented by Equations 1.53, 1.54, 1.55 and 1.56) and, going further, are more likely to do so the smaller is the effect of variations in k on the income elasticities ratio. Thus, in this case, it is more likely that $J_{21} > 0$.

Lastly, let us consider that the effect of variations in the terms of trade on the Southern growth rate is stronger than the effect on the Northern growth rate. Moreover, as we are analyzing situations in which ε_N might be greater than ε_S, let us further assume that the effect of variations in the terms of trade on the Southern growth rate is stronger enough (than the effect on the Northern growth rate), in a way that even if the income elasticities ratio is greater than unity, J_{22} will be negative. Thus, under these assumptions, we have that the trace of the Jacobian matrix is negative and its the sign of the determinant will depend on the case analyzed.

That said, let us examine the behavior of the dynamic system in the case in which $J_{21} < 0$. As we know that J_{12} is also negative, the determinant of matrix J has an ambiguous sign and will depend on the relative magnitude of $J_{11}J_{22}$ and $J_{12}J_{21}$. Thus, if we have that $J_{11}J_{21} > J_{12}J_{21}$, the determinant will be positive and, as the trace of the matrix J is negative, the long-equilibrium is stable (a stable focus). Notwithstanding, it is important to note that the greater the effect of variations in k on the income elasticities ratio, the greater $J_{12}J_{21}$ tends to be and, therefore, it is more likely that the determinant of the matrix J is negative. In this case, we have an unstable long-run equilibrium that follows a saddle-path. In order to clarify those situations, Figures 8 and 9 present a simplified sketch of the long-run equilibrium for the case in which $J_{11}J_{21} > J_{12}J_{21}$ and $J_{11}J_{21} < J_{12}J_{21}$, respectively.

For both cases, the slope of isoline $\hat{P}$ is negative. As we have $\frac{\partial \hat{P}}{\partial k} < 0$, the terms of trade growth rate varies in the opposite direction to the capital stock composition, what explain the direction of the horizontal vectors. The slope of isoline $\hat{k} = 0$ is given by $-(\frac{J_{12}}{J_{11}})$, so it is negative. As $\frac{\partial \hat{k}}{\partial k} < 0$, the growth rate of capital stock composition varies in the opposite direction to the composition itself, thus the direction of the vertical vectors are explained. The difference between the two cases is the relative slope of isolines $\hat{P} = 0$ and $\hat{k} = 0$: when the determinant of the matrix J is positive, as in Figure 8, $\hat{P} = 0$ has a steeper slope (negative) than $\hat{k} = 0$ and, when the determinant is negative, as in Figure 9, we have the opposite.

In order to present the long-run dynamics of the model clearly, Figure 10 summarizes the behavior of growth rates and terms of trade associated with both long-equilibrium cases presented so far, that is, with $J_{21} < 0$ and, as we argue, with $\varepsilon_N > \varepsilon_S$.[52]Given the

[52] It is further assumed, for simplicity, that $\varepsilon_N > \varepsilon_S > 1$.

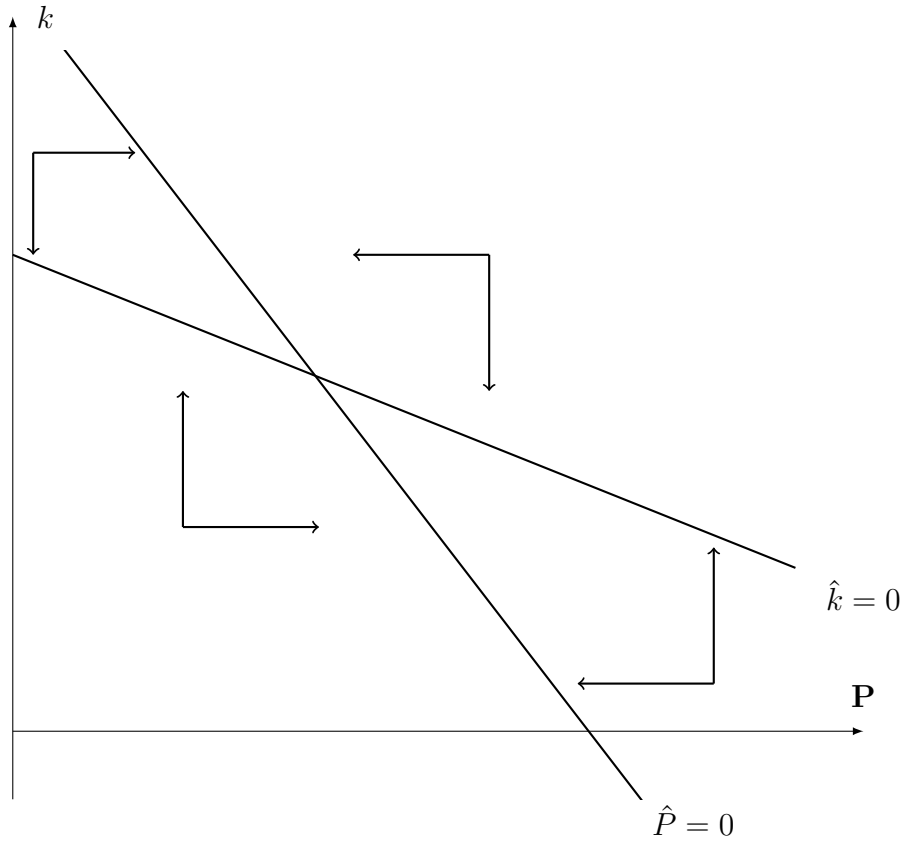

Figure 8 – Stable long-run equilibrium - $J_{21} < 0$ and $J_{11}J_{21} > J_{12}J_{21}$

values of K_{ij}, we know that u_N and P will be determined in the short run, nevertheless the curves $\varepsilon_S g_S$ and $\varepsilon_N g_N$ show how P behaves over time. For any initial short-run equilibrium value of terms of trade, say P', if $P' > P^*$, we have $\varepsilon_S g_S > \varepsilon_N g_N$, so that P falls over time until it reaches the long-run equilibrium value P^*, in which we have from Equation 1.72 that $\hat{P} = 0$.[53] Thus, the "global" economy will pass through a declining P, g_S and g_N phase, although the Northern growth rate will decline less than the Southern, until it reaches point A. On the other hand, if $P^* > P'$ we will have a rise in terms of trade until it reaches P^*, i.e. the global economy will experience a rise in the terms of trade as well as for both growth rates. Note that, in this long-run equilibrium, $g_S > g_N$ and, thus, we have a distinct uneven development trajectory.

The equilibrium analyzed above is a long-run one in the sense that $\hat{k}$ (and, therefore, k), g_S, g_N, $\hat{P}$ (and P), ε_S and ε_N become stationary. The most interesting result of this extension is that, in this case when we consider that the effect of the FDI inflows in the Southern region on the income elasticities ratio is positive and, moreover, strong enough that we have in the long-run (when k becomes stationary) $\frac{\varepsilon_N}{\varepsilon_S} > 1$, the pattern of relative development of both regions is an uneven one but in a different direction: in the long run, the Southern region grows faster than the North, so we have a trajectory of divergence

[53] Note that we simplify our analysis considering that $\varepsilon_N(k)\hat{\varepsilon_N} lnY_N = \varepsilon_S(k)\hat{\varepsilon_S} lnY_S$. Nevertheless, the same would be valid if we assume that both $\hat{\varepsilon_S}$ and $\hat{\varepsilon_N}$ are equal to zero.

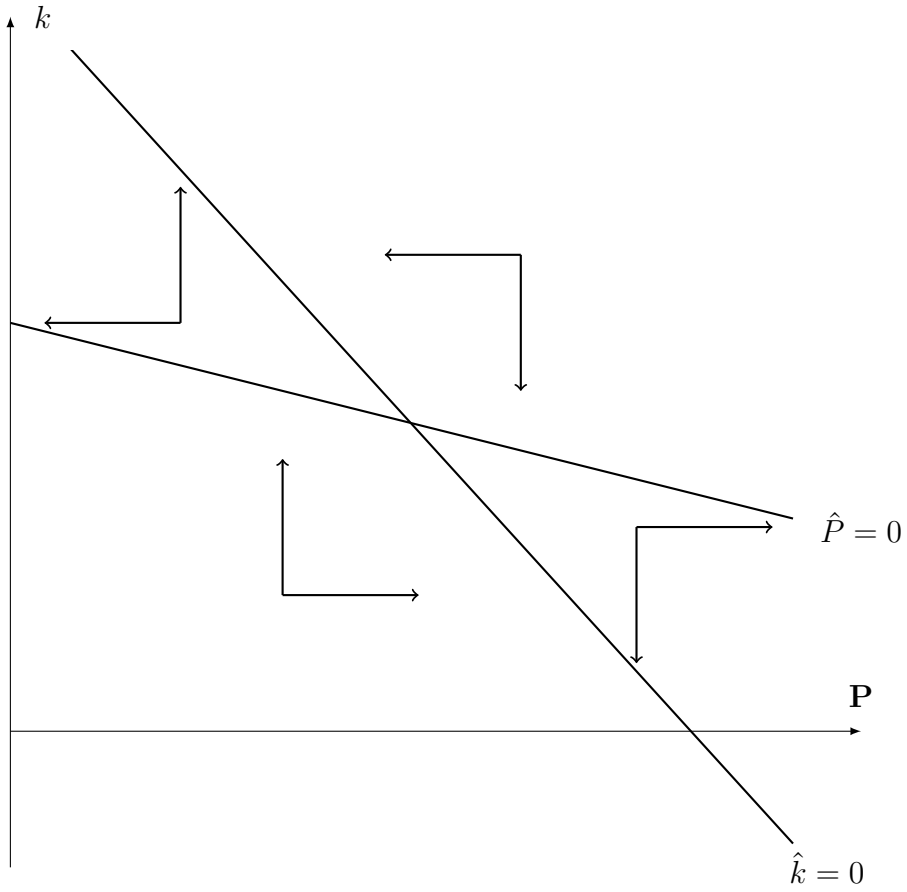

Figure 9 – Saddle-path long-run equilibrium - $J_{21} < 0$ and $J_{11}J_{21} < J_{12}J_{21}$

between the regions (although we may observe a convergence in terms of income between the regions first, as the South is assumed to be poorer than the North).

On the other hand, let us now analyze the other case - when we have a positive effect of changes in the Southern capital stock composition on the income elasticities ratio, that is $f_5'(k) > 0$, but not strong enough, that is, J_{21} is positive.[54] In this case, the Jacobian matrix, J, has a negative trace and a positive determinant, so the long-run equilibrium is locally stable. Figure 11 presents a simplified sketch of the long-run equilibrium in this case.

Similarly to the cases presented earlier, the slope of isoline $\hat{P}$ is negative. As we have $\frac{\partial \hat{P}}{\partial k} > 0$, the rate of growth of the terms of trade varies in the same direction as the capital stock composition, what explain the direction of the horizontal vectors. The slope of isoline $\hat{k} = 0$ is given by $-(\frac{J_{12}}{J_{11}})$, so it is negative. As $\frac{\partial \hat{k}}{\partial k} < 0$, the growth rate of capital stock composition varies in the opposite direction to the composition itself, thus the direction of the vertical vectors are explained.

Furthermore, Figure 12 illustrates the long-run dynamics of growth and terms of trade in this case. It is worth noting, once more, that these results are quite similar to

[54] This case is quite similar to the one presented in Figure 3.

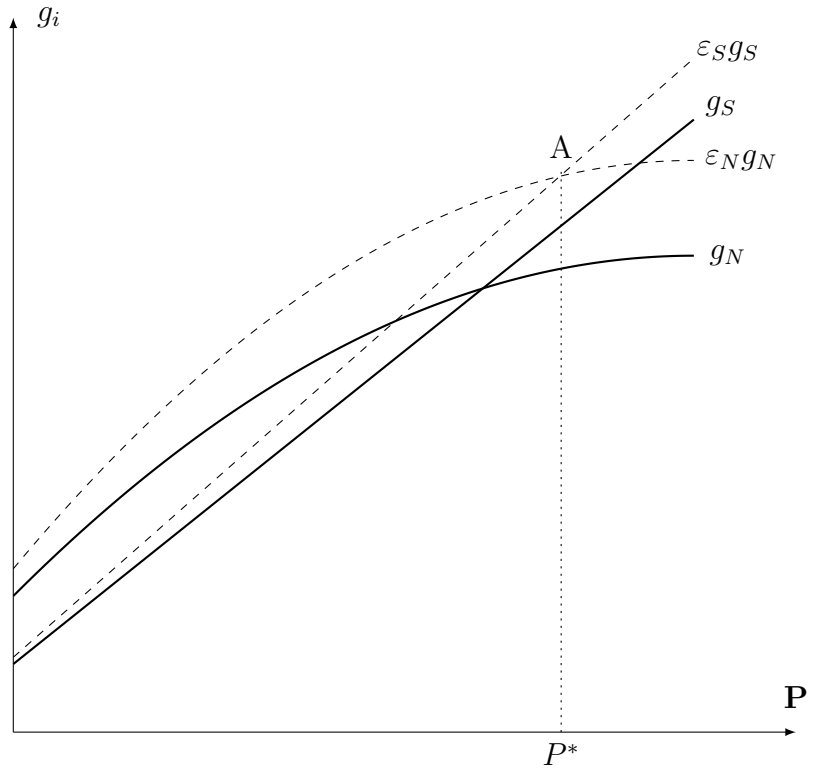

Figure 10 – New long-run dynamics of terms of trade and growth - $\varepsilon_N > \varepsilon_S$

those examined in Figure 5.

The equilibrium analyzed in Figures 11 and 12, as stated earlier in this section, is a long-run one in the sense that $\hat{k}$ (and k), g_S, g_N, $\hat{P}$ (and P), ε_S and ε_N become stationary. Nevertheless, in this case, we still have an equilibrium characterized by the persistence of uneven development, that is $g_N > g_S$ in the long run, a result quite similar to the one presented earlier in this essay and that of Dutt (2002). Note that even if we started from a point in which $g_S > g_N$, the deterioration of the Southern terms of trade will reduce g_S until we have, once more, uneven development.

In this subsection, we consider some cases in which the effect of changes in the Southern capital stock composition positively affects the income elasticities ratio. Comparing Figures 10 and 12, we see that the stronger the effect of the foreign presence on the income elasticities of import, the greater the ratio between growth rates, that is, it is more likely that $g_S > g_N$. In summary, we also saw that the stronger this effect on the income elasticities ratio, the more likely it is that the long-run equilibrium associated with the dynamics presented will be locally unstable (although this instability might not be perverse for the Southern region). Nevertheless, we show that it is possible to overcome the pattern of uneven development if this effect has a high magnitude. Therefore, there is a certain trade-off between instability and overcoming uneven development.

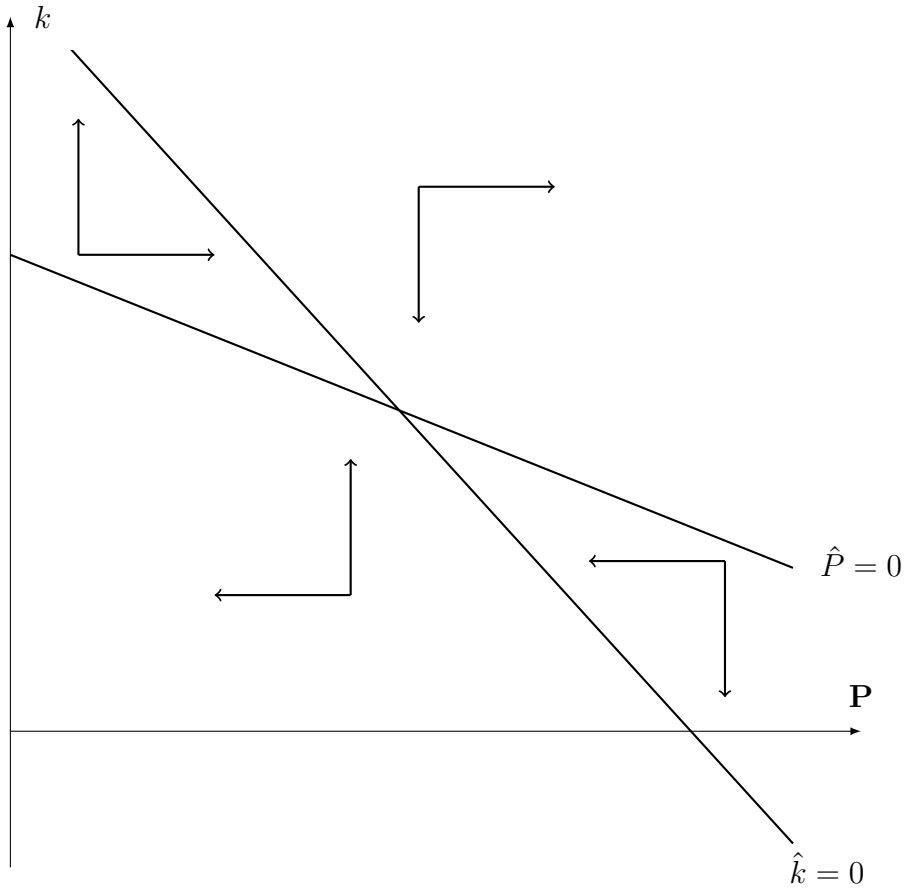

Figure 11 – Stable long-run equilibrium - $J_{21} > 0$

1.4.2 Negative effect on the income elasticities ratio

Now, let us turn our attention to the second case proposed in this section, with $f_5'(k) < 0$, that is, the income elasticities ratio is negatively related to the Southern capital stock composition or, in other words, to FDI inflows.

In this case, the long-run dynamic system is defined by Equations 1.50 and 1.72. Those expressions constitute a system of differential equations in which variations of k and P along time, depend on the level of k, P, ε_S, ε_N and other parameters of the system, with P^* implicitly defined in Equation. As earlier in this section, the Jacobian matrix, J, for this dynamic system is given by Equation 1.38. With that in mind, we can advance to the analysis of the existence and the stability of a long-run equilibrium in this case, considering the dynamic system formed by $(\hat{k}, \hat{P})$. Thus, we have the terms of the Jacobian matrix given by Equations 1.73, 1.74, 1.75 and 1.76.

Analyzing the sign of each term, first have, again, an ambiguous impact of variations on capital stock composition on the proportionate rate of change of the same variable. Now, variations in k positively affect the Southern external savings, as it positively impacts ε_S is relation to ε_N. That said, if we also keep the assumptions regarding the direct effect of variations in k on the terms of trade, we have that J_{11} is negative. Second, it is direct

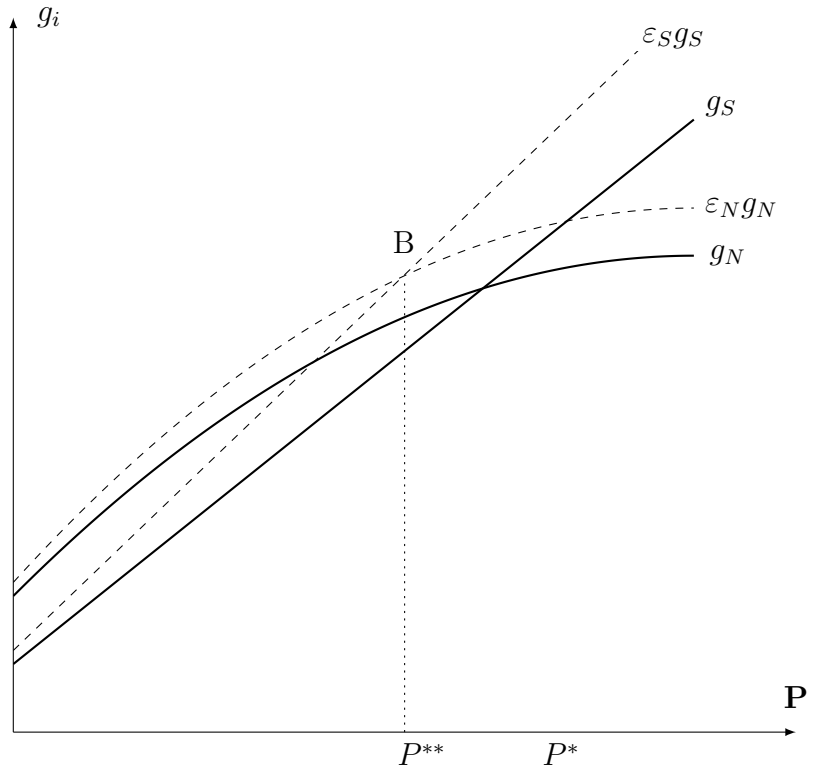

Figure 12 – New long-run dynamics of terms of trade and growth - $\varepsilon_S > \varepsilon_N > 1$

to see from Equation 1.74 that $J_{12} < 0$, since variations in the terms of trade affect the growth rate of Southern capital stock composition in a negative way, as it boosts g_{SS}.

Furthermore, variations in the Southern capital stock composition have an ambiguous effect on $\hat{P}$. From Equation 1.75, we know that the sign of the expression depends on the relative magnitude of effects of variations in k on ε_S, ε_N, g_S, g_N and the log of both regions' income weighted by a combination of those variables. From the model, we know that $\frac{\partial g_S}{\partial k} < 0$. Moreover, we keep the assumption that variations in k have a stronger impact in the Southern growth rate than in the Northern one (since the effect on g_N is derived from the effect on g_S). Nevertheless, as we have seen in the last case, the sign of this term remains ambiguous. Here, it is also possible to have two cases: one in which the effect of variations in k on the income elasticities ratio are so negative that J_{21} is negative and another in which J_{21} remains positive (as in the baseline model presented in the second section of this essay). Based on our discussion at the beginning of this section, although it is reasonable to argue that ε_S might raise with the presence of foreign firms, it is not that likely that for ε_N to fall. That said, in order to simplify our presentation, we analyze only the most likely case - with $J_{21} > 0$.

Lastly, let us consider that the effect of variations in the terms of trade on the Southern growth rate is stronger than the effect on the Northern growth rate. Moreover, as we are analyzing situations in which ε_N is smaller than ε_S, J_{22} will be negative. Thus, under these assumptions, we have that the trace of the Jacobian matrix is negative and its

the sign of the determinant is positive. So, the long-equilibrium is stable (a stable focus). Notwithstanding, it is important to note that the greater the effect of variations in k on the income elasticities ratio, J_{21} tends to be negative and, therefore, we might have a long-run equilibrium that is locally unstable. Nevertheless, Figure 13 presents a simplified sketch of the long-run equilibrium for the "mild" and stable case.

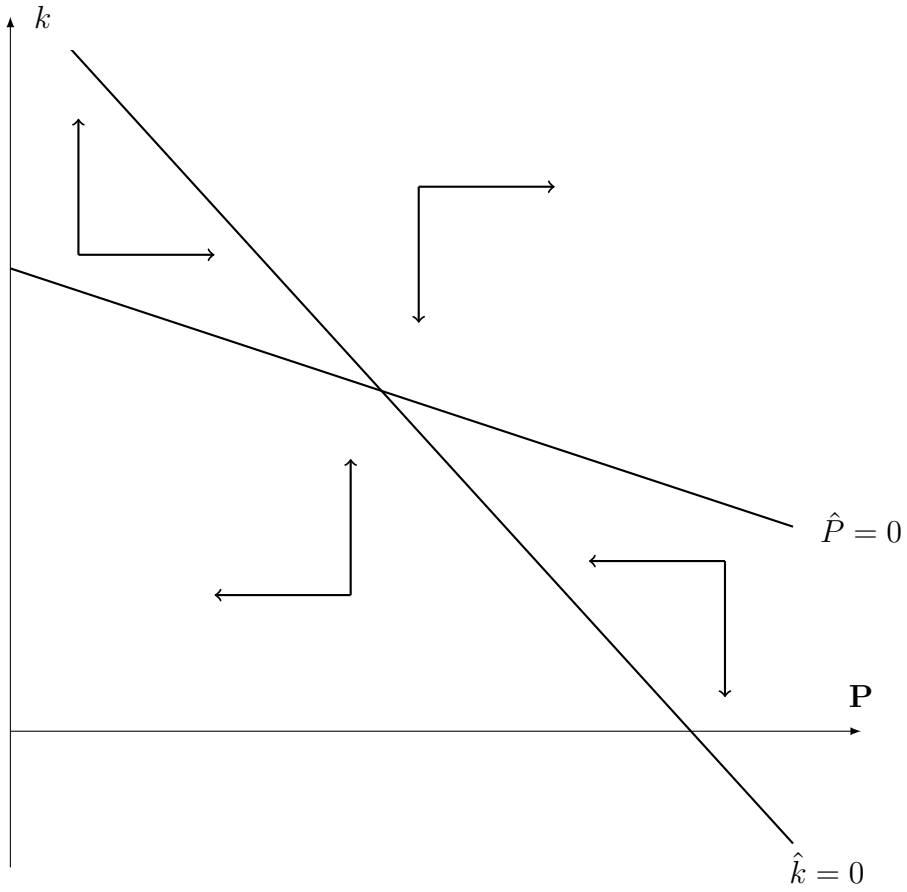

Figure 13 – Stable long-run equilibrium - $f_5'(k) < 0$

Following our discussion, we know that the slope of isoline $\hat{P}$ is negative. As we have $\frac{\partial \hat{P}}{\partial k} > 0$, the terms of trade growth rate varies in the same direction to the capital stock composition, what explain the direction of the horizontal vectors. The slope of isoline $\hat{k} = 0$ is given by $-(\frac{J_{12}}{J_{11}})$, so it is negative. As $\frac{\partial \hat{k}}{\partial k} < 0$, the growth rate of capital stock composition varies in the opposite direction to the composition itself, thus the direction of the vertical vectors are explained.

Furthermore, Figure 14 illustrates the long-run dynamics of growth and terms of trade in this case.

Note that in the new long-run equilibrium, represented by point C, g_N is higher than g_S, so we have uneven development. Moreover, note that the equilibrium value of the terms of trade, P^{***}, is much lower than the other long-run cases analyzed in this section (represented by P^{**} and P^{*}). In general, the more negative the effect of changes in k on

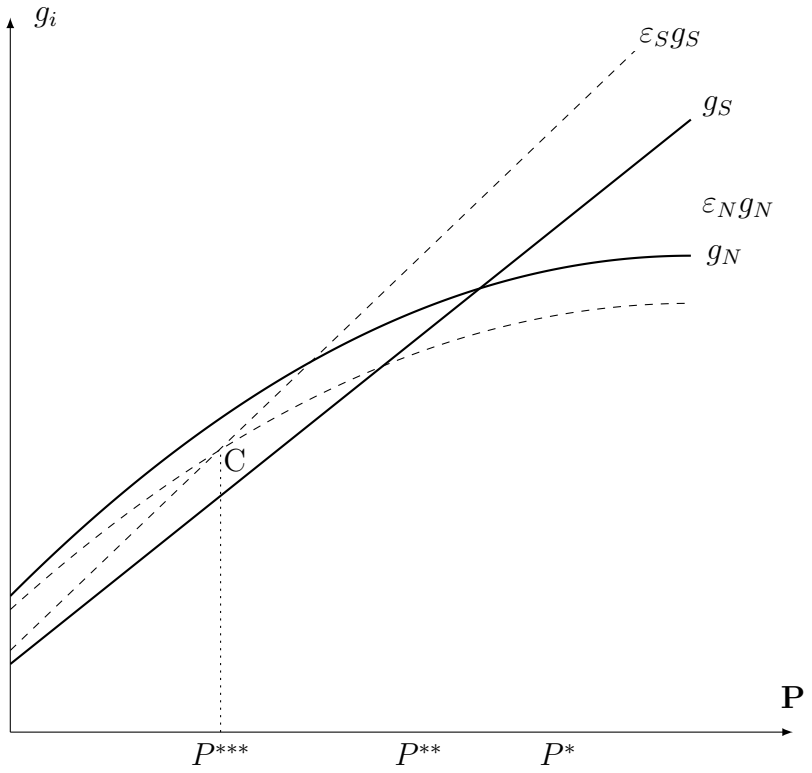

Figure 14 – New long-run dynamics of terms of trade and growth - Impoverishing pattern

the income elasticities ratio, the resulting long-term equilibrium will be characterized by even more deteriorated terms of trade and with an increase in the growth rate differential between regions, that is, a pattern of uneven development even more impoverishing for the South.

Before moving to the conclusions of this essay, it is worth briefly going through the main results of this section, as well as their implications. In summary, the introduction of the effects of variations in the Southern capital stock composition on the regions' income elasticities of import demand, especially in the ratio between ε_N and ε_S, represent a step forward in understanding how FDI flows can affect the productive structure of developing countries, especially their structural competitiveness, and the balance-of-payments components. If, on the one hand, the presence of foreign firms can be associated with a substantial improvement in the income elasticities ratio which, in the end, may represent the overcoming of uneven development (that is, $g_S > g_N$ in the long-run), on the other hand, an increase in the "internationalization" of the Southern productive structure may represent a worsening in such income elasticities ratio and, thus, point to an even more perverse uneven development trajectory.

Nevertheless, it is important to highlight the intrinsic limitations of the functioning of this channel. As we have seen in the analyzed cases - this is both when $f_5'(k) > 0$ and $f_5'(k) < 0$ - if the effects that variations in k have on the income elasticities ratio have high magnitudes, the long-run equilibrium may present a saddle-path trajectory and be locally

unstable. This means that small disturbances, which are inherent to the functioning of any economy, can lead to explosive dynamics, which can be positive or negative for the regions. Thus, the consideration of such effects of FDI inflows on the income elasticities ratio brought a certain trade-off to the model: a dichotomy between the possibility of overcoming uneven development and the tendency to instability. We can see from Figure 14 that, in a simplified manner, the region demarcated between the long-run equilibrium values of the terms of trade P^{***} and P^{*} represents a region of " stability", that is, in these cases, the introduction of the effects of FDI flows on the income elasticities ratio did not lead to possibly unstable trajectories in the long run. If the effects intensify, that is, if we analyze cases in which the corresponding long-run equilibrium values of the terms of trade are to the right of P^{*} or to the left of P^{***}, we would certainly be dealing with situations where the equilibrium is locally unstable and small disturbances can cause unpredictable trajectories. Notwithstanding, it is necessary to point out that even with strong effects of variation in k on the income elasticities ratio and, consequently, with possible instabilities, it is possible to have positive long-run results for the Southern region.[55] For instance, the case presented in Figures 9 and 10 indicate a saddle-path trajectory for long-run dynamics, but if it is possible to reach equilibrium without major disturbances, we have a case in which the pattern of development is more egalitarian, that is, there is an overcoming of uneven development. The stability of the saddle point will occur if, coincidentally, the initial condition is somewhere in your stable arms. Although it is possible to achieve such a result, it is worth saying that this scenario is unlikely to be observed.

Finally, it is worth saying that this is just a first step towards endogenizing the foreign trade income elasticities within this North-South model, especially considering the effects of foreign direct investment - our main object of study in this essay. With this in mind, it is interesting to point to some possible paths to follow in future research. A natural advance would be to study in more detail the variables that could imply variations in the income elasticities ratio within a framework similar to the one presented here. In particular, an interesting advance would be to consider that, in addition to the Southern capital stock composition itself, the income elasticities ratio is also a function of the growth rates of both regions (or the ratio between them)[56] and the terms of trade.[57] Also, it is worth noting that the field for empirical works focused on this relationship between foreign direct investment and the income elasticities of international trade seems to be quite fruitful and can help to solve many of the theoretical ambiguities present in the

[55] Similarly, it is possible to reach (and stay in, without disturbances) the locally unstable long-run equilibrium in the other side as well, that is, the impoverishing case.

[56] In this point, we can see from Equation 1.58 that it could be interesting to analyze the determinants and consequences of a certain relation (or "causality") given by $\frac{g_S}{g_N} \longrightarrow \frac{\varepsilon_N}{\varepsilon_S}$, an idea presented by Krugman (1989).

[57] This possibility is related to the literature that analyzes the relations between income elasticities of trade and real exchange rate. See, for instance, Ferrari, Freitas and Filho (2013).

literature and in the model developed here.

1.5 Concluding remarks

This essay has examined a different application of Thirlwall's analysis: one that addresses the issue of uneven development between rich and poor countries, in other words, divergence, a question that has been widely discussed in the literature. It is worth saying that this application of Thirlwall's Law has been neglected in theoretical and empirical work following Thirlwall (1979).

We have developed a theoretical-formal model of North-South trade, including capital flows from the North to South and taking into consideration some channels through which these FDI inflows can affect Southern long-run growth rate and its productive structure. The model shows how Thirlwall's analysis can be incorporated into North-South models to explain uneven development in a broad manner, in which the North grows faster than the South in the long-run equilibrium. Following Dutt (2002), this model overcomes some of the objections to the existing applications of Thirlwall's analysis, since it does not assume the terms of trade are fixed nor assume a trade balance from start and because it makes explicit the internal structures of regions and hence the determinants of growth in rich and poor countries. Thus, similar to Dutt (2002) and others such as Vera (2006), our effort can be seen as a further step in understanding how Thirlwall's analysis can be incorporated into North-South models. Nevertheless, this model is quite different from the literature mainly because we consider a demand-driven closure - in which Dutt's results are obtained in a particular case of our analysis (when the South operates under full capacity utilization) - and we also allow trade balance to vary in the short-run, a feature that brought a new set of implications and mechanisms to the long-run analysis and, especially, to the ratio of growth rates between the regions. In summary, the model shows once more that, at least for the case in which the Southern economy operates with full capacity utilization, if the income elasticity of imports for the South is higher than of the North, the world economy will come to a long-run equilibrium characterized by uneven development, that is with North growing faster than the South, so that the gap between Northern and Southern income will grow indefinitely. Nevertheless, for the case in which the Southern economy operates with excess capacity, there are several determinants, besides the income elasticities of import demand, of the ratio between the Southern and Northern growth rates in the long-run, such as the functional income distribution and the terms of trade.

In a more specific way, we considered five channels through which capital flows could affect Southern growth rates: capital accumulation, balance-of-payments components, technological change, market structure, and income distribution. Although the qualitative results are similar to those of Dutt (2002), at least for one of the cases considered, the

introduction of the described channels and, consequently, the mechanisms by which they work has enabled a better understanding of the effects of capital flows from rich to poor countries. Technological changes caused by FDI flows, in the model captured by the growth rate of labor productivity in the South, have somewhat altered the productive structure in the region. Also, FDI inflows caused a greater capital accumulation in the South, even in the case in which the region has a wage-led overall growth regime, as we considered a dual rationale for the investment in the South and we further assume that there are no profit remittances, which lead in the long run to an equilibrium with faster growth rate for the South that, despite not representing an overcoming of the uneven development pattern, indicates a new path of development: a less unequal one. Furthermore, the effects of FDI on the market structure of the Southern region, captured by the evolution of the mark-up factor, represented a possibility of new long-run equilibrium with further variations in the functional income distribution, thus possibly with an equilibrium in which the workers in the South are benefited (that is, the wage share is higher). These effects on the functional distribution are directly related to the ratio between the regions' long-run growth rates, especially for the case in which the Southern economy operates with excess capacity. Moreover, the consideration of the effects of FDI inflows on the income elasticities ratio indicated a possible change in the long-run development pattern: if the effects of foreign presence in the Southern economy are strong enough on the income elasticities ratio, in the long-run we have that the South grows faster than the North and, thus, there is a quite different divergence in the global economy.

Nevertheless, these positive effects of FDI inflows on the Southern posed a potential problem: the possible instability of the economy in the long run. In particular, when we consider strong effects of the "internationalization"of the Southern economy on variables such as labor productivity, the wage share and, mainly, the income elasticities ratio, the dynamic systems showed a certain tendency towards local instability in the long run (with saddle-path trajectories). Therefore, in summary, the stronger the positive effects of FDI flows on the South, that is, the closer the region's economy is to overcoming uneven development, the greater the tendency to long-run instability. Thus, this essay also indicated the existence of an important long-run trade-off - a dichotomy between instability and the possible overcoming of uneven development. Even so, it is important to point out that this instability may, in fact, be positive for the Southern region. In addition, even the saddle-path case could be stable in the equilibrium neighborhood if, by coincidence, the initial condition is located at some point in its stable arms.

By way of conclusion, it is important to shed light on some possible extensions of the model presented here as well as further empirical exercises. First, as it is quite difficult to obtain closed analytical solutions for the short-run equilibrium variables of interest of the model, a future computational analysis might be positive for studying

the questions proposed here, especially in order to better analyze the behavior of the ratio between the Southern and Northern growth rates in the long-run for a variety of parameters combinations. Moreover, one extension that often appears as a suggestion within models in Thirlwall's tradition (and was partially considered in the model herein developed) is to allow the income elasticities of imports to vary over time. Another interesting way of approaching this question is to establish a relation between the income elasticities of imports and income distribution in the regions, especially the profit share in the South. For instance, we can consider that an increase in Southern profit share will alter the composition of imports through "demonstration effect", i.e. Southern capitalists will mimetize Northern capitalists' consumption pattern, altering the composition of Southern imports[58], which could increase the Northern income elasticity of imports over time.

Second, it is worth saying that the channels considered in this model can be introduced in many different ways, affecting North and South economic structure through other mechanisms and possibly indicating new paths of interaction between regions and trajectories of development. For instance, the introduction of mechanisms by which the balance-of-payments constraint can be further affected, either by separate incentives for exports and imports or even by the dynamics of profit remittances can be interesting for analyzing the pattern of development for the regions as well as the dynamics of Southern terms of trade. As pointed earlier in this essay, an interesting extension to be considered here is to suppose that all Southern goods produced by Northern capitalists will be exported (or a simplification where Northern consumers only import Southern goods produced by foreign firms). Besides that, one question that still presents a long way to advance is that related to Equation 1.9, which represents the capital inflows introduced in the model analyzed in this essay. As briefly discussed earlier, some effects need to be considered further on, especially those related to a measure of profitability between the two regions. Once more, an interesting extension to consider is the introduction of an accelerator effect from the Southern growth rate to new FDI inflows. Another possible advance in this direction is to consider some crowding-in or crowding-out effect of FDI inflows to the Southern region, deepening our analysis on the capital accumulation channel.

Bearing that in mind, let us briefly discuss some other possibilities of empirical advances having as motivation some evidence presented in the literature. Using linked employer-employee data for Brazil, Helpman et al. (2017) find that much of the increase in wage inequality (between 1986 and 1998) has occurred within sector-occupations and this within component of wage inequality was driven by wage dispersion across firms that, in turn, is closely related to trading participation.[59] Even that it looks like a "maneuver", these

[58] This effect is discussed in Duesenberry (1949) and was incorporated in the following decades on structuralist developments, especially in the works of Celso Furtado (after an interesting series of debates with Ragnar Nurkse - as can be seen, for instance, in Nurkse (1951)) and other authors related to ECLAC (Economic Commission for Latin America and the Caribbean). See Rodríguez (1993).

[59] More evidence regarding trade and wage inequality for Brazil (especially related to the trade liberal-

evidences regarding trade and inequality can be related to FDI impacts on wage inequality as we already identified some of the channels through which FDI inflows could impact the balance-of-payments, especially the trade balance, so that could be a path to follow on our empirical exercise. Nevertheless, there are some interesting analysis for direct FDI impact on employment and wages that could be examined in further empirical-econometric research. Figini and Görg (2011) find evidence that the effect of FDI on wage inequality differs according to the level of development of the recipient country: for developing countries (in their analysis, non-OECD economies) the results suggest the presence of a non-linear effect, with wage inequality increasing with FDI inward stock but this effect diminishes with further increases in FDI (an evidence related to the inverse U-shaped curve discussed earlier on this essay), whilst for developed countries wage inequality decreases with FDI inward stock. For the Brazilian economy, Fajnzylber and Fernandes (2009), find that both the use of imported inputs and FDI by firms have a positive effect on skilled labor demand, although the effect of exports (that is, firms that export their production) in that same labor demand is ambiguous.

Furthermore, another interesting point to bring into this North-South model and, of course, to further empirical research is related to environmental questions. Ben-David, Kleimeier and Viehs (2018), for instance, find that foreign firms generally "export" pollution (in the case, CO2 emission levels) to countries with relatively weaker environmental policies, that is, perform their polluting activities abroad. Cole and Elliott (2005), in turn, show that besides lenient environmental regulations, a high level of capital endowment must also be considered when analyzing the "pollution haven" hypothesis. The authors argue, for instance, that the Brazilian economy is most likely to be a pollution haven (in comparison with other developing countries) and found evidence that US industries with higher abatement costs indeed perform their pollution activities in Brazil. In a North-South model framework, it would be interesting to consider FDI inflows to the Southern region causing higher pollution and, consequently, affecting labor productivity. Still on this point, the introduction of emission permits trade could affect the relation between the North and South through very different channels, possibly leading to new development patterns.[60]

Finally, in addition to the theoretical-formal extensions and other empirical-econometric questions briefly addressed in this section, it is worth mentioning that the empirical field of work on issues closely related to the model developed here - such as the behavior of income elasticities over time, long-term growth rates and the evolution of terms of trade between structurally heterogeneous groups of countries - is broad and possibly very useful, representing a promising way forward. In the next essay of this thesis,

ization process) can be found in Pavcnik et al. (2004), Ferreira, Leite and Wai-Poi (2007) and Adão (2015).

[60] Razmi (2015) developed a North-South model that considered the presence of trade in environmental permits, finding a new trade-off between global distribution of capital and environmental efficiency.

we look at some of these empirical questions.

2 Imports, functional income distribution and FDI: an empirical exercise

2.1 Introduction

The last few decades have been marked by significant changes in income distribution, both on personal and functional levels. On one hand, top incomes have raised to levels unseen since the *Belle Époque*, especially in the US (PIKETTY; SAEZ, 2003; PIKETTY, 2014; ALVAREDO et al., 2017). On the other hand, wage shares have been falling substantially since the 1980s across most OECD countries but also across developing countries, although with certain heterogeneity. Although changes in the former have had more prominence, as argued by Atkinson, Piketty and Saez (2011) and Stockhammer (2017), there is an increasing interest in the determinants of functional income distribution and the macroeconomic implications of this recent trend.

On a deeper analysis of the recent trajectories of the functional income distribution, Stockhammer (2017) shows that in the advanced economies the adjusted wage share has fallen, on average, from around 73 percent in 1980 to 64 percent in 2007. In summary, these changes in the functional income distribution have taken different forms in different countries, with a moderate decline in the wage share in Anglo-Saxon countries (although accompanied by a sharp polarization of personal income distribution) and a more prominent shift in the wage share in continental European countries.

For developing countries, however, data on functional income distribution is mainly available only for recent years, and the evidence appears to be ambiguous (ILO, 2015). Nevertheless, Stockhammer (2017) shows that several groups of developing countries (grouped by the date when each available series begins) present a pronounced decline in the adjusted wage shares since 1990. Moreover, ILO (2015) presents evidence that in many developing countries the decline in the labor income share is even more pronounced than in advanced economies. It is important to highlight that some of the countries in these groups have actually presented a quite different path for the wage share, with increases in the share of income received by workers - a phenomenon that is also associated with an improvement (on average) in the personal distribution of income.[1]

[1] For the Brazilian economy, Bastos (2012) presents evidence of increasing wage share from the beginning of the 2000s. Carvalho and Rugitsky (2015) and Rugitsky (2017) discuss the relationship between such trend and government policy, as well as the one between the personal income distribution and the latter (especially minimum-wage increase policies) and its macroeconomic implications (and limitations). Regarding the personal income distribution see, for instance, Medeiros, Souza and Castro (2015), Gobetti, Orair et al. (2015), Souto (2015) and Medeiros and Castro (2018).

In view of this recent trend, the main objective of this essay is to better understand how these variations on the functional income distribution can impact a specific component of the aggregate demand of different groups of countries - the imports. Going further, our analysis is directed to capture possible distinct effects of these variations of the wage share on imports for different groups of countries: developed and underdeveloped economies. Moreover, our empirical exercise also examines the relationship between FDI flows and imports, with special attention to the impacts of those capital flows on the income elasticity of import demand of underdeveloped countries.

Even though the discussion in this essay focuses on the functional distribution of income, it is important to point out that there is a relationship between the functional and the personal distribution of income (BEHRINGER; TREECK, 2018). Atkinson (2009) and Bengtsson and Waldenström (2018) analyze this relation between factor shares and personal income inequality, arguing that profit share and personal income inequality can be expected to be positively correlated (for plausible distributions of personal income and levels of profit-share). Regarding the connection between capital share and income inequality, Piketty (2014) indicates that capital income tends to be more unequally distributed than labor income, so a transfer from labor to capital income will increase inequality. Nevertheless, this relationship between factor shares and personal distribution becomes more complex when economic agents derive their earnings from several different sources (ILO, 2015). Although not demonstrating causality, ILO (2015) presents a simple correlation evidence that suggests that the decline in the wage share tends to evolve in the same direction as the widening of market-income inequalities.

Karabarbounis and Neiman (2014) argue that labor shares have long been considered stable and this stability is a key foundation in macroeconomic models. Therefore, it is clear that the presented global trends of decline in the wage shares have caught the attention of researchers. Stockhammer (2017) argues that the literature regarding the determinants of these variations in the functional distribution of income falls into four relatively independent groups. Nevertheless, we prefer to present the literature's arguments in terms of four different determinants of the decline in the wage shares - that might be related and probably operate at the same time: i) technological change; ii) globalization (trade theory approach); iii) welfare state retrenchment and iv) financialization.

That said, let us make a brief analytical review of the literature, seeking to present the theoretical arguments and empirical evidence that underlie each of the aforementioned determinants of the decreasing tendency of the wage shares.

Regarding the first determinant, Stockhammer (2017, p. 7) argues that the core idea of the neoclassical theory of income distribution is that technological change is the major determinant of changes in distribution. The main argument present in the literature is that, since the early 1980s, technological changes have become capital augmenting

rather than labor augmenting and, consequently, wage shares have fallen. In fact, the literature often reports significant effects of technological change on income distribution in developed countries.[2] For instance, empirical works presented in the International Monetary Fund's "World Economic Outlook" and the European Commission's "Employment in Europe" (IMF, 2007; EC, 2007) find evidence that technological progress made the largest contribution to the fall in aggregate labor income share. Although there are certain difficulties in finding a measure of technological change in developing countries, the empirical evidence also indicates an important contribution of technological change to the fall in the wage share. Moreover, another theoretical argument present in the literature is that average labor productivity may have grown faster than the real factor remuneration (i.e. average real wages), which would indicate a fall in the relative participation of the factor on the aggregate output (or income).[3] ILO (2015) presents evidence that in most developed countries, the aggregate growth of real wages was significantly slower than that of aggregate productivity (even taking into consideration the dynamics of relative prices), which accounts to the decline in the wage share. Furthermore, Karabarbounis and Neiman (2014) indicates that the decrease in the relative prices of investment goods explains a major part of the observed decline in the labor share of income, with capital augmenting technologies being the second biggest responsible for such declining tendency.

Second, regarding the role of globalization, there are two main approaches in the literature that are linked to trade theory. Following the Stolper and Samuelson (1941) theorem, we expect that the abundant factor will gain (in relative remuneration terms) from international trade. As Stockhammer (2017) argues, this abundant factor is capital for the developed countries whilst developing countries tend to be labor abundant. Therefore, globalization would be associated with improvements in the remuneration of capital in developed economies and labor in developing ones.[4] However, the empirical evidence supports only half of the theoretical predictions: while workers in developed countries have indeed lost out, those in developing countries also seem to have lost relative remuneration in comparison to capital. On the other hand, the "Political Economy of globalization" approach (STOCKHAMMER, 2017, p. 8) argues that the main effect of trade on income distribution is through the bargaining position of labor and capital and not via relative

[2] Regarding personal income distribution, it is worth highlighting a large literature on the skill-biased nature of technological change in the last decades and its consequences on the observed increase in income inequality. See, for instance, Acemoglu (1998), Berman, Bound and Machin (1998), Acemoglu (2002). Moreover, for a detailed analytical review of this literature, see Acemoglu and Autor (2011).

[3] This argument can be valid even considering the documented labor productivity slowdown experienced by many advanced economies in recent years. Nevertheless, it is important to indicate that decreases in the wage shares might be related to this labor productivity slowdown. Tridico and Pariboni (2018) present evidence that weak GDP growth, wage share decreases, increases in financialization and inequality negatively affect the dynamics of labor productivity.

[4] The discussion regarding the limitations of the Stolper-Samuelson theorem is beyond the scope of this work. Nevertheless, it is worth mentioning that the result is derived under hypothesis such as perfect competition, full employment and absence of factor mobility and trade costs.

prices (RODRIK, 1998b; ONARAN, 2011). With the possibility of production relocation, trade liberalization tends to benefit the more mobile factor, which is typically capital (RODRIK, 2008). Thus, globalization tends to benefit capital - and therefore would be associated with decreases in the wage share - in both developed and developing economies or, in other words, in the North and the South. IMF (2007) presents findings that show that globalization is, in fact, one of the several factors that have acted to reduce the labor share of income in developed economies. Considering both developed and developing economies, Rodrik (1998a), Harrison (2005) and Jayadev (2007) find that globalization (measured by increased trade) has a negative effect on the wage share.

Third, regarding the analysis of welfare states, the arguments are mainly related to the bargaining power of labor. Stockhammer (2017, pp .9-10) points out that, while aggregate social expenditures may be historically high, there has been a substantial reduction in welfare state generosity. Within a power resources theory framework, Bengtsson and Waldenström (2018) and Kristal (2010) argue that income distribution might be determined by the relative power positions of labor and capital. These relative power positions are related to variables such as: union density, strike activity, government civilian spending, unemployment benefits generosity, employment protection legislation, and ideology of the government. The empirical evidence present in the literature is mainly concentrated in developed countries. For instance, Kristal (2010) finds that union density and unemployment benefits play key roles in determining the bargaining power of labor and are positively related to it. Therefore, the welfare state retrenchment might, in fact, be related to decreases in the bargaining power of labor and, to a declining tendency of the labor share of income.

Moreover, regarding the fourth determinant, Stockhammer (2017, pp. 10-11) indicates that the literature presents four main channels by which financialization may affect income distribution.[5] First, firms can invest in financial assets besides real assets, a possibility that increases firms' exit options and, therefore, make them less likely to negotiate labor agreements, since an increasing fraction of their profits comes from financial activities. Moreover, financialization has led to gains in shareholder and rentier power, managing to extract most of the corporate profits in the form of interest and dividends payments, which may represent a downward pressure on wages (and, therefore, on the relative remuneration of the factor). Furthermore, financialization may also have increased commutative pressures on capital markets and established a market for corporate control, which might have altered the firms' priority to profitability (and share value) rather than

[5] The discussions on the origins and complete definition of financialization are beyond the scope of this thesis. Here we understand financialization as a set of changes in economy and society in the last decades that are characterized by "an increased role of financial activity and rising prominence of financial institutions"(STOCKHAMMER, 2017, p. 10). For detailed works on the topic, see, for instance, Stockhammer (2004), Epstein (2005), Lapavitsas (2011) and Palley (2013).

expansion and growth. This shift in priorities has led firms to adopt a "downsize and distribute" strategy, with negative effects on the labor share of income (STOCKHAMMER, 2017; PARIBONI; TRIDICO, 2019). Fourthly, this increased role of financial activity of households may have eroded working-class identities and, therefore, undermined the strength of organized labor, reducing the bargaining power of labor. Kim, Lima and Setterfield (2019) explore the possibility that household indebtedness is an important cause of rising income inequality. If workers experience rising debt burdens, their cost of job loss may rise if they need labor-market income to continue borrowing and servicing existing debt. This, in turn, will reduce their bargaining power and increase income inequality. Dünhaupt (2013) finds evidence that financialization and globalization are important variables to understand the recent trajectory of the wage share. Stockhammer (2017), in turn, finds that financialization has had the largest contribution to the decline of the wage share (taking into consideration the four main determinants discussed here), although globalization has also had substantial effects in both developed and developing economies. Moreover, Pariboni and Tridico (2019) find that the labor share of income is negatively affected by financialization, dividend distribution, and globalization. Kohler, Guschanski and Stockhammer (2019, p. 964) conclude that international financial openness and financial payments of firms have the strongest (negative) effects on the wage share.

Lastly, recent works indicate the important role market structure plays in understanding the declining trend of the wage share (AUTOR et al., 2020; DE LOECKER; EECKHOUT; UNGER, 2020). De Loecker, Eeckhout and Unger (2020) find that the average mark-ups in large US firms have increased significantly in the last decades and that this tendency has contributed to the decreasing labor share in the country. Furthermore, Autor et al. (2020) find that the falling labor share in the US has been driven by increasing industrial concentration.

It is important to note, as briefly pointed out earlier, that these five determinants seem to operate concurrently and in a very interconnected manner. In particular, this interconnection is more evident in the relationship between financialization, globalization, and decreases in labor bargaining power.

Having discussed the global declining trend of wage shares as well as the main reasons presented by the literature for such path, an important question arises: what are the macroeconomic implications of this variation in the functional distribution of income? In fact, if labor share stability is considered a key foundation in macroeconomic models, the impacts of this recent trend must be quite relevant. The existing empirical literature is divided (with results that align with the methodologies employed) into those who follow an aggregative approach, by directly estimating the relation between the rate of capacity utilization and the wage share, and those who follow a structural approach, separately estimating the effects of wage share on each component of aggregate demand

(STOCKHAMMER; WILDAUER, 2015; BLECKER; CAUVEL; KIM, 2020). The former literature generally finds evidence of profit-led demand - that is, variations in the profit share have positive effects on the aggregate demand - and a profit-squeeze in distribution in the short-run (BARBOSA-FILHO; TAYLOR, 2006; KIEFER; RADA, 2014; CARVALHO; REZAI, 2016). As the main focus of this essay is on the role of functional income distribution on imports, we will discuss in more detail the literature that addresses the components separately. To better understand these impacts, we focus our attention on the components of aggregate demand - consumption (C), investment (I), government expenditure (G) and net exports (NX). In a general formulation, consumption, investment, government expenditure, and net exports are written as functions of income, the functional distribution of this income, and some other control variables. For simplicity, let us assume that these control variables (ω) are independent of output and distribution.[6] Thus, aggregate demand and, from the expenditure approach, product can be determined by: [7]

$$AD = Y = C(Y, \sigma, \omega_C) + I(Y, \sigma, \omega_I) + G(Y, \sigma, \omega_G) + NX(Y, \sigma, \omega_{NX}) \tag{2.1}$$

where σ is the wage share and ω_C, ω_I, ω_G, ω_{NX} are, respectively, the set of control variables related to the aggregate consumption, investment, government expenditure and net exports.

That said, let us first look at consumption and investment. In classic "stagnationist" (Neo-)Kaleckian models, changes in the functional distribution of income have particular effects on the long-run economic growth rate equilibrium. In particular, as workers present a greater propensity to consume than capitalists, any variation in the functional distribution to the benefit of workers, that is, increases in the wage share, would increase aggregate consumption and, thus, result in higher capacity utilization. Furthermore, this effect would also be associated with higher capital accumulation, growth, and even higher profit rate (assuming a strong accelerator effect in the investment function) (ROWTHORN, 1981; DUTT, 1982; TAYLOR, 1983; DUTT, 1984; TAYLOR, 1985; AMADEO, 1986; DUTT, 1987). Nevertheless, Blecker (2002, p. 131) argues that, later, several economists have showed that "stagnationism" is not a necessary outcome in more general Kaleckian models, even considering oligopolistic firms with mark-up pricing and excess capacity. In special, the contributions of Bhaduri and Marglin (BHADURI; MARGLIN, 1990; MARGLIN;

[6] It is important to highlight that the literature that follows what Blecker, Cauvel and Kim (2020) call the "structural approach" usually treats wage share as exogenous, an assumption that could bring identification problems. Skott (2017) argues that the profit share is not an exogenous variable, and the correlations between factor shares and economic growth can be positive for some exogenous shocks but negative for others. Moreover, Barrales and Arnim (2017) find evidence of bi-directional causality (in the sense of Granger (1969)) between the rate of capacity utilization and the wage share, indicating that effects of output on wage share should not be neglected.

[7] A similar general formulation is presented by Stockhammer, Onaran and Ederer (2008), Onaran and Galanis (2012) and Blecker (2016).

BHADURI, 1990) presented the "exhilarationism" case, in which a higher profit-share stimulates aggregate demand and raises capacity utilization. In summary, this result is the outcome of an independent investment function that takes into consideration the profitability effects related directly to the profit-share (and not through the profit rate). Thus, even though the effect of increases in the wage share on consumption may be positive, it may also reduce aggregate demand depending on the impact that lower profit margins have on investment. Moreover, Taylor (1990) has shown that an "exhilarationist" result can also emerge within a "stagnationist" framework - if workers also save a relevant fraction of their income, this reduces the consumption-stimulating effect of an increase in the wage share.[8] Naastepad and Storm (2006), and Stockhammer, Onaran and Ederer (2008) present empirical evidence supporting the positive effect of increases in the wage share on aggregate consumption (the hypothesis of a lower propensity to consume out of profits than out of wages is confirmed), and a negative effect of such distributional variations on the aggregate investment of developed countries (although this second effect is frequently small or even statistically non-significant). Nevertheless, in contradiction to these results, Hein and Vogel (2007) find evidence of a (non-significant) positive effect of changes in the wage share on investment for certain OECD countries. Considering some G20 developing countries (such as Mexico, Argentina, India, China and South Africa), Onaran and Galanis (2012) find similar evidence that the aggregate consumption is positively affected by wage share increases and investment is negatively related to such variations, although the latter effect seems to overcome the former in most of those economies (that is, they are likely to be domestically profit-led).

Moreover, the effects of income taxation, especially when effective tax rates differ between labor and capital income, might also impact the effects of variations in the functional distribution of income on aggregate demand. Blecker (2002, p. 140) argues that income taxes also constitute a source of "leakages" from income-expenditure flows and, moreover, personal income tax rates can be quite larger than workers savings rates. In summary, Blecker (2002) shows that a more regressive tax system makes, *ceteris paribus*, the economy more likely to be "exhilarationist", whilst a more progressive tax system makes the economy more likely to be "stagnationist". Even in the second case, higher taxation of wages relative to profits makes the economy more likely to have a profit-led demand regime, that is, increases in the wage share may result in lower aggregate demand levels.[9] In addition, another side of government fiscal policy might be affected by the functional distribution of income: the government expenditure. Just as a more restrictive fiscal policy, with lower social spending, can reduce the relative remuneration of workers

[8] For a synthetic theoretical-formal treatment of the various specifications of investment functions, combinations of parameters (such as the propensities to save) and their macroeconomic implications, see Blecker (2002) and Lavoie (2014).

[9] Nevertheless, this connection between functional income distribution and economic growth, as measured by the structure of the tax system, has not been widely examined in the empirical literature.

(by reducing their bargaining power in comparison to capital), it is plausible to argue that variations in the wage share can direct the focus of fiscal policy (and/or monetary policy) towards a relative improvement in capital remuneration, whether to maintain the *status quo* in the context of the distributive conflict (a bargaining power "equilibrium") or for other specific purposes.[10,11]

Lastly, in order to understand the net effect of functional distribution variations on aggregate demand we need to take into consideration not only the domestic impacts of such variations but also the open economy impacts. In several works, Robert Blecker analyzes how international competition might play a major role in determining the impact of wage share variations on net exports and, therefore, aggregate demand (BLECKER, 1989; BLECKER, 2002; BLECKER, 2011; BLECKER, 2016). A usual argument is that an increase in real wages (or unit labor cost (ULC)) might have a negative impact on the trade balance. If increased nominal wages are, to some extent, passed through into higher goods prices, domestic products might become less competitive in international markets and, thus, the trade balance may be negatively affected. Moreover, if we consider that international competitive pressures might prevent firms from fully passing through these wage increases into higher prices, this would lead to a reduction in profit margins (a profit squeeze) and, thus, might reduce the variety (and quantity) of exported goods. Thus, a redistribution of income towards wages might represent a downward pressure on aggregate demand via the trade balance.[12] Considering this channel, the existent empirical evidence is mostly related to price competitiveness, that is it captures the effects of changes in the wage share (or ULC) through changes in relative prices. Moreover, this literature can be divided into empirical econometric works that estimate the effects of changes in functional income distribution on the net exports, and on export and import volumes separately. Regarding the former, Naastepad and Storm (2006) find that changes in the profit-share have a positive small effect on aggregate demand in developed economies. Hein and Vogel (2007), in turn, find a strong positive effect of such variations in some

[10] In this point, the possible bi-directional causality between the functional distribution of income and economic policies (in this case, government expenditure) is clear. This possibility is somewhat related to the arguments of Palley (2014) and Skott (2017), that an approach which treats the coefficient on the profit share (or wage share) as a policy invariant parameter may be subject to a "Lucas critique" (for the original argument, see Lucas (1976)).

[11] It is worth noting, again, that for the Brazilian case, Carvalho and Rugitsky (2015), Rugitsky (2016) and Rugitsky (2017) present an interesting analysis of the effects of economic policies in personal and functional distribution of income, as well as the limitations of this process (associated with the effects of variations in the functional distribution of income on the government economic policies or at least the apparent focus of those economic policies). See Brenck (2019) for an analytical review of the argument as well as for a theoretical-formal model related to it.

[12] Furthermore, if we take into consideration capital mobility (in special FDI flows), Blecker (2002, p. 142) argues that if increased wages lead to a reduction in profit margins, investment in the home country will become less attractive compared with investment in foreign countries, which might lead to lower domestic investment and, thus, even lower aggregate demand. An econometric test for this specific effect on the investment function seems to be an interesting path to follow in future research.

developed countries, although not finding significant effects on other OECD economies. On the latter, Stockhammer, Onaran and Ederer (2008), Onaran and Galanis (2012), Onaran and Obst (2016) and Stockhammer and Wildauer (2015) find that, for developed countries, changes in the wage share have a negative impact on exports and a positive effect on imports (although relatively smaller), with a negative liquid effect of net exports. Moreover, looking at some of those G20 developing economies, Onaran and Galanis (2012) find similar evidence, however, the liquid impact on net exports is stronger in these countries compared to developed economies. Furthermore, although looking to the current account as a whole, Behringer and Treeck (2018), in a recent work for G7 economies and China, find that trends in the distribution of income, both in terms of personal income inequality and factor shares, can explain a substantial fraction of the current account imbalances observed in recent periods (especially prior to the Great Recession). In summary, the authors found that increases in the top 1% and 5% income shares and the private sector wage share negatively impact the current account balance. Applying system GMM methods to estimate structural models of demand and distribution (thus controlling for simultaneity bias) for the US economy, Blecker, Cauvel and Kim (2020) find that rises in ULC definitely worsen net exports, but decreases in firms' monopoly power have no negative impact on net exports.[13]

Notwithstanding, the literature has shown little interest in non-price factors and in how functional distribution can affect exports and imports through them. Arestis and Driver (1987) argue that the composition of imports in consumer expenditure, in terms of the characteristics of the goods imported in relation to domestically produced consumer goods and services, might be influenced by income distribution. For instance, it can be argued that, especially in developing countries, wage workers have their consumption restricted to basic needs (or even subsistence consumption), as a result of low-income levels. This consumption is generally met by local production and, therefore, these workers do not consume imported goods. On the other hand, high-income classes (such as managerial or land-owning classes) spend a fraction of their consumption expenditure in foreign goods and, in particular, might import luxury goods in order to imitate the consumption pattern of developed countries' high-income classes - a possibility called "demonstration effect".[14] Thus, any income distribution variation in favor of high-income classes in these countries might be related to the balance of payments difficulties. Nevertheless, in developed economies, this rationale might not apply, as workers tend to have a greater propensity

[13] Note that both variations are positively related to the wage share, that is, they are different sources of distributional shifts towards workers. Thus, it is important to consider those possibilities of wage share variations in further empirical-econometric and theoretical-formal works.

[14] This effect is discussed in Duesenberry (1949) and was incorporated in the following decades into structuralist developments, especially in the works of Celso Furtado (after an interesting series of debates with Ragnar Nurkse - as can be seen, for instance, in Nurkse (1951)) and other authors related to ECLAC (Economic Commission for Latin America and the Caribbean). See Rodríguez (1993).

to spend their marginal income on imported commodities.[15] In fact, Arestis and Driver (1987), using data for the United Kingdom, find evidence that increases in wages and salaries relative to other sources of incomes have a positive and significant effect on imports. In a recent work, Stockhammer and Wildauer (2015) estimate, using panel data for 18 OECD countries, separate equations for exports and imports including the wage share directly in both equations. Controlling for several factors, including the nominal effective exchange rate, they find evidence that variations in the wage share have negative impacts on exports and non-significant effects on imports.

In view of this, two other questions arise: is this result regarding the impacts of functional income distribution on imports and exports observed for a wide range of developed countries and in more recent periods? Furthermore, is the effect in underdeveloped (or developing) countries substantially different from that in developed economies? The apparent lack of answers to such questions seems to indicate a gap in the literature, especially related to an integrated treatment of price and non-price factors through which variation in wage share can affect the volume of imports.

In this essay, we seek to address these questions, as well as try to contribute to a better understanding of the implications of the recent declining trend in wage shares both in developed and underdeveloped countries. In summary, we find robust empirical evidence that variations of the wage share have a negative statistically significant impact on the volume of imports of underdeveloped countries (and for the entire sample). When indicating the importance of the functional distribution of income for the determination of imports, this essay points out not only the omission of a relevant variable in much of the empirical literature that estimates this trade flows, but also the omission of a relevant channel in the discussions of real exchange rate undervaluation and its impacts, external constraint and economic growth. Moreover, our results suggest that FDI flows do not impact the imports of underdeveloped countries (and for the entire sample). Although this result does not allow us to understand the net impact of those capital flows on the trade balance, this evidence rules out a potential negative effect of FDI flows on the long-run equilibrium growth rate determined by the external constraint. Furthermore, we take into consideration the possible effects of FDI flows on the income elasticities of import demand of the countries and we find evidence that supports the argument that FDI flows do not impact the income elasticity of imports of underdeveloped countries.

With this in mind, the rest of this essay proceeds as follows. In Section 2.2, we present a simple accounting structure that shows that a general specification (vastly used in open macroeconomics literature) of the import function can present a composition effect

[15] On this subject, Arestis and Driver (1987, p. 85) argue that the recipients of unearned income and the self-employed in these developed economies tend to spend more of their marginal income items such as land, second homes, art objects and luxury services and, thus, most certainly spend less of their consumption expenditure on imports compared to low-wage and salary recipients.

of income besides the usual quantity effect - highlighting the importance of functional income distribution. Section 2.3 presents an empirical-econometric exercise that estimates the import functions derived earlier, focusing on the role of the functional distribution of income both in developed and underdeveloped countries and its implications for the existing literature. We also examine an empirical question related to the first essay of this thesis and of major implications to the uneven development result - the income elasticity differential hypothesis. In Section 2.4, we explore another empirical link that appears in the first essay of this thesis: the relationship between FDI and imports and, moreover, FDI, and income elasticity of import. Lastly, Section 2.5 presents our conclusions and sheds light on some interesting questions that could be analyzed in further works.

2.2 Functional distribution of income and exporting and importing behavior

After presenting a brief analytical review of the literature as well as the main motivations of this essay, let us focus our attention on the development of an accounting structure that highlights the role of the functional income distribution in import and export functions widely used in international trade literature. For this purpose, we assume a general division of the world in two regions - North and South- that, in a simplified manner, represent, respectively, the two groups of countries analyzed in our empirical exercises: developed and underdeveloped economies.

2.2.1 Capitalists and workers behavior

In the North, capitalists save a fraction $s_{\pi N}$ of their income, and workers save a fraction $s_{\sigma N}$ their income. Northern capitalists spend a fraction α of their consumption expenditure on the Southern good and the rest, $(1-\alpha)$, on the Northern good. Furthermore, those capitalists will spend a fraction β of their investment expenditure in Southern goods, and $1-\beta$ in Northern goods. At this point, it is interesting to consider that Northern firms may use the Southern good as an intermediate product or as raw material for their production. Moreover, Northern workers spend a fraction δ of their expenditure consumption on the Southern good, and $1-\delta$ domestically, and spend a fraction ϕ of their investment expenditure on the Southern good, with the rest, $1-\phi$, in the Northern one. With that in mind, it is possible to determine the demand for the Southern good in the North, in other words, the Northern region import demand:

$$M_N = \alpha(1-s_{\pi N})\pi_N Y_N + \beta s_{\pi N}\pi_N Y_N + \delta(1-s_{\sigma N})\sigma_N Y_N + \phi s_{\sigma N}\sigma_N Y_N \tag{2.2}$$

where π_N is the profit-share in the Northern region, σ_N is the wage share in the North and Y_N is the Northern domestic output or income.

In the Southern region, capitalists save a fraction s_S of their income and consume the rest, devoting a fraction λ of their consumption expenditure on the Northern good and $1-\lambda$ on the Southern one. Besides that, these Southern capitalists spent a fraction η of their investment expenditure in the Northern good and the rest, $1-\eta$, domestically. On the other hand, workers in the South do not save and spend a fraction κ of their consumption expenditure on the Northern good and the $1-\kappa$ on the Southern good. Therefore, we can also determine the Southern region import demand:

$$M_S = \lambda(1-s_S)\pi_S Y_S + \eta s_S \pi_S Y_S + \kappa \sigma_S Y_S \tag{2.3}$$

where π_S and σ_S are, respectively, the profit-share and the wage share in Southern region and Y_S is the Southern domestic output or income.

After generally determine the import demand functions for both regions, let us now turn our attention to the fractions (of the investment and consumption expenditures) that compose both Equations 2.2 and 2.3. Initially, let us look to the Northern region. The fraction of consumption expenditure of capitalists in the North that is spend on Southern goods is determined in a quite general form:

$$\alpha = \alpha_0(\pi_N Y_N)^{\varepsilon_N - 1} P^{1-\mu_N} \tag{2.4}$$

where $\alpha_0 > 0$ is a constant, $\varepsilon_N > 0$ is the income elasticity of demand for imports in the Northern region, $\mu_N > 0$ is the absolute value of the price elasticity of demand for imports in the Northern region and $P = \frac{P_S E}{P_N}$ are the terms of trade, where P_i is the price of region's i (with $i \in \{N, S\}$) and E is the nominal exchange rate.

It is worth noting that this formulation, as Dutt (2002) argues, is compatible with a large variety of assumptions of price and income elasticities of the demand for the goods produced in both regions. For instance, if $\varepsilon_N = \mu_N = 1$, the shares of consumption expenditure spent on the two goods are constant (and equal to the intercept α_0 and $1-\alpha_0$). If $\mu_N < 1$, the share of Northern consumption expenditure on the Southern good rises when P rises, despite the increase in the terms of trade, implying price inelastic demand for the Southern good. If $\mu_N > 1$, we have a price elastic demand for the Southern good. Moreover, if $\varepsilon_N < 1$, increases in Northern capitalists' income will result in a lower proportion of consumption expenditure being spent on the Southern good, implying that the Southern good is income inelastic, and conversely if $\varepsilon_N > 1$. It is important to point out that this proportion of consumption expenditure is related not only with the Northern income but also with the composition of this income, that is, the functional distribution of income in the North. That said, note that, depending on the magnitude of ε_N, an increase in the Northern profit-share will result in a higher ($\varepsilon_N > 1$) or lower ($\varepsilon_N < 1$) fraction α, even if the aggregate product remains the same.

Furthermore, we can define the other fractions of expenditure of Northern capitalists and workers in a similar manner. Thus, the fraction of investment expenditure of capitalists

spend in the Southern good is given by:

$$\beta = \beta_0(\pi_N Y_N)^{\varepsilon_N - 1} P^{1-\mu_N} \tag{2.5}$$

where $\beta_0 > 0$ is a constant. Note that, for fraction β, the same analysis presented above (for α) are valid, as their components and functional form are almost the same.

Similarly, if we now look to the behavior of Northern workers, the fraction of their consumption expenditure that is destined to the Southern good is defined as:

$$\delta = \delta_0(\sigma_N Y_N)^{\varepsilon_N - 1} P^{1-\mu_N} \tag{2.6}$$

where $\delta_0 > 0$ is a constant and $\sigma_N Y_N$ is the share of the Northern income detained by workers. Moreover, the fraction of investment expenditure of workers in the Southern good is given by:

$$\phi = \phi_0(\sigma_N Y_N)^{\varepsilon_N - 1} P^{1-\mu_N} \tag{2.7}$$

where $\phi_0 > 0$ is a constant. Note that, both Equations 2.6 and 2.7 present not only a volume measure of the Northern product but also a composition measure. That is, the fraction of consumption and investment expenditure of Northern workers depend not only on the income itself but also on the functional distribution of the Northern income.

On the other hand, if we look at the behavior of capitalists and workers in the Southern region, we can similarly define the fractions of their consumption and investment expenditure. First, the fraction of capitalists' consumption expenditure that is destined to the Northern good is defined as:

$$\lambda = \lambda_0(\pi_S Y_S)^{\varepsilon_S - 1}(1/P)^{1-\mu_S} \tag{2.8}$$

where $\lambda_0 > 0$ is a constant, $\varepsilon_S > 0$ is the income elasticity of demand for imports in the Southern region, $\mu_S > 0$ is the absolute value of the price elasticity of demand for imports in the Southern region and $\pi_S Y_S$ is the share of Southern income detained by capitalists. Note that the definition of this fraction also follows the general form proposed by Dutt (2002), one that allows a variety of combinations of income as price elasticities. For instance, if $\varepsilon_S = \mu_S = 1$, the shares of consumption expenditure spent on the two goods are constant. Moreover, if $\varepsilon_S < 1$, increases in Southern capitalists' income will result in a lower proportion of consumption expenditure being spent on the Northern good, implying that the Southern good is income inelastic, and conversely if $\varepsilon_N > 1$. Once more, it is important to say that this fraction is defined not only by the Northern income but also by its functional distribution. Besides, if $\mu_S < 1$, the share of Northern consumption expenditure on the Southern good falls when P rises, despite the increase in the terms of trade (which, *ceteris paribus*, represents a positive effect for the South), implying price inelastic demand for the Southern good. If $\mu_S > 1$, we have a price elastic demand for the Northern good.

Furthermore, we can define the other expenditure fractions of Southern capitalists and workers in a similar manner. Thus, the fraction of investment expenditure of capitalists spend in the Northern good is given by:

$$\eta = \eta_0(\pi_S Y_S)^{\varepsilon_S - 1}(1/P)^{1-\mu_S} \tag{2.9}$$

where $\eta_0 > 0$ is a constant. Note that, for fraction η, the same analysis presented above (for λ) are valid, as their components and functional form are almost the same.

Similarly, if we now look to the behavior of workers in the South, the fraction of their consumption expenditure that is destined to the Northern good is defined as:

$$\kappa = \kappa_0(\sigma_S Y_S)^{\varepsilon_S - 1}(1/P)^{1-\mu_S} \tag{2.10}$$

where $\kappa_0 > 0$ is a constant and $\sigma_S Y_S$ is the share of the Northern income received by workers.

2.2.2 Imports and exports functions

Having presented the behavior of consumers and workers in both regions, special regarding their demand for imports, we now focus our attention on the volume of imports and exports for the Southern and Northern regions.

Our assumptions imply that the value of Northern imports from the South - that is, of Southern exports - is given by:

$$P_S X_S = P_N(\alpha(1 - s_{\pi N})\pi_N Y_N + \beta s_{\pi N}\pi_N Y_N + \delta(1 - s_{\sigma N})\sigma_N Y_N + \phi s_{\sigma N}\sigma_N Y_N) \tag{2.11}$$

which, using Equations 2.4, 2.5, 2.6 and 2.7, can be written as:

$$M_N = X_S = \Theta_S P^{-\mu_N} Y_N^{\varepsilon_N} \tag{2.12}$$

where $\Theta_S = \pi_N^{\varepsilon_N}[\alpha_0(1 - s_{\pi N}) + \beta_0 s_{\pi N}] + \sigma_N^{\varepsilon_N}[\delta_0(1 - s_{\sigma N}) + \phi_0 s_{\sigma N}]$.

On the other hand, the value of Southern imports from the North - that is, of Northern exports - is given by:

$$P_N X_N = P_S(\lambda(1 - s_S)\pi_S Y_S + \eta s_S \pi_S Y_S + \kappa\sigma_S Y_S) \tag{2.13}$$

which, using Equations 2.8, 2.9 and 2.10, can be written as:

$$M_S = X_N = \Theta_N(1/P)^{-\mu_S} Y_S^{\varepsilon_S} \tag{2.14}$$

where $\Theta_N = \pi_S^{\varepsilon_S}[\lambda_0(1 - s_S) + \eta_0 s_S] + \sigma_S^{\varepsilon_S}\kappa_0$.

Note that both import (and, consequently, export) functions presented in Equations 2.12 and 2.14 are quite similar to those generally used in balance-of-payments constrained

growth models (but not restricted to these models), following Thirlwall's tradition.[16] Notwithstanding, it is important to highlight that the "intercept" terms of these expressions, Θ_S and Θ_N, are directly determined by the functional distribution of income in the regions. Thus, both import demand functions are determined, not only by a quantitative measure of income (or output), but also by a composition measure of the region's income - the functional distribution of this income.

That said, it is interesting to examine how variations in each one of the components of these import and export functions impact the volume of trade between the regions. As usual, it is direct to see that increases in the Southern and Northern regions' income positively impact their respective import demand volume (the magnitude of these effects depends on the value of the region's income elasticity of import demand). Moreover, variations in the terms of trade positively impact the import demand in the Southern region and negatively impact the volume of Northern imports.

Nevertheless, it is not direct to see how variations in the functional distribution of income, both in the North and the South, impact the volume of import and export demand in both regions. First, if we look at the Northern imports, from Equation 2.12 we can calculate[17]:

$$\frac{\partial M_N}{\partial \sigma_N} = \frac{\partial \Theta_S}{\partial \sigma_N} = \varepsilon_N \left\{ \sigma_N^{\varepsilon_N - 1} [\delta_0 (1 - s_{\sigma N}) + \phi_0 s_{\sigma N}] - \pi_N^{\varepsilon_N - 1} [\alpha_0 (1 - s_{\pi N}) + \beta_0 s_{\pi N}] \right\} \quad (2.15)$$

Therefore, the sign of Equation 2.15 is ambiguous and depends on the relative value of the parameters δ_0, ϕ_0, α_0, β_0, the propensities to save of both classes in the North and the wage share and profit-share in the Northern region. Although the wage share has presented a decreasing tendency in the last decades (as discussed earlier in this essay), we still expect that the wage share of developed countries is greater than their profit-shares, that is, we expect that $\sigma_N > \pi_N$. Thus, if the share of consumption expenditure and investment expenditure of Northern workers spend in the Southern good are similar to that of Northern capitalists, we would expect that the sign of the partial derivative expressed in Equation 2.15 is positive. A possible explanation for this result is that an eventual increase in the share of the income collected by workers in the North leaks abroad through the demand for imports, especially through a mechanism of search for variety of consumption goods (a "love of variety" kind of argument[18]). This, in fact, might be the case in developed countries (North), especially if we consider that the mass of workers in that region already has a consumption level higher than the subsistence one

[16] For a general analytical view of the vast literature that follows the seminal work of Thirlwall (1979) see, for instance, Thirlwall (2012) and Setterfield (2012).

[17] Here we use the definition that $\pi_i = (1 - \sigma_i)$, with $i \in \{N, S\}$.

[18] This argument appears, for instance, in two relevant international trade models presented by Krugman (1979) and Krugman (1980).

within the domestic market itself. Nevertheless, if capitalists in the North spend a greater fraction (than workers) of their consumption and investment expenditure in Southern goods, the sign of the partial derivative will be negative and, therefore, variations in the Southern wage share would have a negative impact on the volume of Southern imports.

On the other hand, if we look at the Southern import demand, from Equation 2.14 we can calculate:

$$\frac{\partial \Theta_N}{\partial \sigma_S} = \varepsilon_S \left\{ \sigma_S^{\varepsilon_S - 1} \kappa_0 - \pi_S^{\varepsilon_S - 1} [\lambda_0 (1 - s_S) + \eta_0 s_S] \right\} \tag{2.16}$$

Similarly to the Northern case, the sign of Equation 2.16 is ambiguous and depends on the relative value of the parameters κ_0, λ_0, η_0, the Southern capitalists' propensity to save and the factor-shares of income in the Southern region. Nevertheless, we expect that, for the South, the wage share is close to the profit-share (if not smaller) and, moreover, it is reasonable to argue that the Southern capitalists spend a greater share of their consumption expenditure in foreign goods than workers, especially if we consider that workers in the Southern region almost exhaust their disposable income to achieve subsistence consumption. Furthermore, as capitalists in the South also spend a fraction of their investment consumption in the Northern good, it is likely that the sign of the partial derivative expressed in Equation 2.16 is negative. This means that variations in the functional distribution of Southern income towards workers, that is increases in the wage share, are likely to have a negative impact on the volume of import demand of the Southern region.

Although these specifications for import demand functions are quite general and reasonable, there is an apparent gap in the literature regarding the consideration of this composition effect of income on international trade functions. Recently, new models for estimating trade flows have been developed giving special focus to different measures of economic activity and to the key role that accounting for distinct components of aggregate demand plays in understanding trade dynamics. Bussière et al. (2013) propose a new empirical model of international trade flows, based on an import intensity-adjusted measure of aggregate demand (henceforth, IAD) - while standard empirical trade models typically use GDP (or domestic demand) as a measure of aggregate demand, the authors argue that there is value added in giving different weights to the components of GDP, which typically have very different import intensities (their results suggest that the recent decline in developed countries imports was mainly caused by falls in investment and exports). Giansoldati and Gregori (2017) present an econometric exercise that compares six alternative methods of computing the import demand functions and argue that the preferred models take into account the separate effects of each final demand component. Their results (based on a panel including developed and developing countries) show that

private consumption exerts the largest effect in shaping imports. Furthermore, in another comparative exercise, Gregori and Giansoldati (2020) indicate that the most appropriate economic activity variable to assess import demand should encompass intermediate goods as suggested by the recent literature on global supply chains. Nevertheless, the consideration of different components of aggregate demand is not accompanied by a similar attention to the key role that the functional income distribution plays on such components, as discussed in the introduction of this essay. In short, the recent literature seems to have focused on one aspect of the composition of income - the disaggregation of aggregate demand in several components - but not on a distinct facet of this composition highlighted in is this section: the functional distribution of income.

After showing how this effect can actually be present in quite usual import functions, in our case in the "intercept", we will seek to fill this gap by estimating these import functions, analyzing whether, in fact, this composition effect is empirically observed, that is, whether the functional income distribution is relevant to determine the import volume of countries. In addition, as we can see in Equations 2.15 and 2.16, the sign of the relation between the functional distribution of income and the volume of imports (exports) is not very clear, as the signs of the partial derivatives are, *a priori*, ambiguous, especially for the Northern case. Thus, we will also seek to examine what are the signs of these relations and analyze the possible implications of the results. Having that in mind, in the next sections of this essay we will develop an econometric exercise to verify the empirical validity of those import functions and the sign of the relation between the functional distribution of income and import demand, as well as its implications for the North and South regions, or in other words, the developed and underdeveloped countries.

Furthermore, we will also analyze the behavior of the income elasticities of import demand for developed and underdeveloped countries (North and South, respectively) to clarify some of the hypotheses and results presented in the first essay of this thesis.

2.3 Imports, functional distribution and income elasticities: an econometric exercise

Having presented the basic theoretical-formal model of this work, let us now proceed to a first advance in an important path pointed out in the last essay of this thesis and in the last section of this essay - the empirical field. In particular, this research focused on two theoretical issues directly derived from the structure of the model presented earlier: i) the role of functional income distribution in the import and export functions and ii) the differential of income elasticities of imports between regions.

Regarding the first point, this article seeks to explore an interesting and majorly

unexplored channel to understand the determinants of trade flows between regions: the functional distribution of income. As previously discussed, the import and export functions derived in last essays' model, as well as in the simple accounting relations presented above, from the behavior of the different classes - capitalists and workers - in both the North and the South can be represented by the generalized way, as is Equations 2.12 and 2.14, that is widely used in open macroeconomics models. Nevertheless, the "intercept" of both functions indicate that, besides a quantitative effect of income, there is also a composition effect of income that should be considered. In the next subsection, we briefly discuss this relationship in light of the existing literature.

2.3.1 The role of functional income distribution

Initially, we will focus our attention at the role of functional income distribution in the import functions[19] of developed and underdeveloped countries. First, it is important to briefly present a theoretical framework that motivates and directs this part of our empirical exercise. In the introduction of this essay, we presented an analytical review of the related literature, but it is worth highlighting and summarizing some of the arguments that are related to the two channels through which variations in functional income distribution may affect trade flows: the country's (or region's) price and non-price competitiveness.

One important literature that is intrinsically related to our empirical question is that of growth regimes, that is the theoretical and empirical works on wage-led and profit-led growth regimes in open economies. According to Blecker (1989), while a rise in the wage share boosts aggregate consumption (as the workers' marginal propensity to consume is higher than capitalists') it may reduce the profitability that is expected by capitalists (if the economy is domestically profit-led) as well as it negatively affects the price competitiveness of domestic goods in foreign trade (as it raises the labor unit costs), and so adversely affects investment and net exports. If this is the case, even if the economy has a wage-led growth regime, it might turn to a profit-led "overall" regime when one takes into consideration the open economy effects. Nevertheless, Ribeiro, McCombie and Lima (2019, p. 3) discuss that there is a large literature, both theoretical and empirical, showing that rising wages may result in an incentive to labor-saving technological progress, which can result in capital deepening and so increase labor productivity (ROWTHORN, 1999; STORM; NAASTEPAD, 2011). That said, the overall effect of a rise in wages, or in our case, in the share of the national income that is received by workers, on price competitiveness in open economies appear to be an important empirical question.

[19] It is important to say that, although it would be interesting to consider export functions as well, there are several limitations regarding data availability, especially for such a large sample of less developed and developing countries. For instance, it is difficult to compute a robust measure for the functional income distribution of the main trading partners of each of the countries in the sample.

Furthermore, there is also another channel through which variations in functional income distribution may affect trade flows (as well as GDP growth): the country's non-price competitiveness. As presented in Ribeiro, McCombie and Lima (2019, p. 3), international trade can be greatly influenced by within-country income inequality, especially if one considers the impacts of this inequality in consumption patterns.[20] On this point, Latin American structuralists claimed that high levels of income inequality in underdeveloped countries led to important differences in consumption patterns between classes: the upper classes, with surplus income, tend to imitate the consumption pattern of the foreign elite with imports of superfluous goods and highly technological products, which would lead to a leakage of domestic savings to maintain the trade deficit and, thus, slowing down investment and economic growth.[21] The consequences of this demonstration effect can also be analyzed within a framework *à la* Thirlwall. If we consider that those underdeveloped countries generally export low value-added goods (from primary goods to low-tech goods) with low-income elasticities, and if a large portion of national income is detained by the upper classes, which bases its consumption on imports of luxury products and highly technological goods, with high-income elasticities, it is clear that the balance-of-payments constraint will quickly tighten and thus the "feasible" long-run growth rate will be relatively low. Moreover, a more recent literature shows a similar consumption pattern effect: if we consider the existence of non-homothetic preferences, countries that are characterized by higher income inequality tend to export goods with income elasticity of demand less than unity (necessity goods) and import more luxury goods (with income elasticity of demand greater than unity) (BOHMAN; NILSSON et al., 2006; HUMMELS; LEE, 2018).

2.3.2 Methodology and data description

Having those points in mind, in order to capture the effects obtained by the theoretical model and, in particular, to verify the empirical validity of such results, we departure from the general functions given by the Equations 2.12 and 2.14 and, taking the log of the variables, we have a simplified form:

$$\ln M_i = \psi_0 + \mu_i \ln P + \varepsilon_i \ln Y_i + \psi_1 \ln \sigma_i \tag{2.17}$$

where $i \in \{N, S\}$, ψ_0 is a constant, μ_i and ε_i are respectively the price and income elasticity of import demand for region i (as in the accounting relations presented earlier) and ψ_1 is the coefficient associated with the functional income distribution variable (which could be

[20] In fact, Behringer and Treeck (2018) find evidence that income inequality, regarding both the personal distribution of income and the factor shares, have an impact on the current account balance on developed countries.

[21] However, the case seems to be the opposite of developed countries, as presented by Arestis and Driver (1987).

either positive or negative, depending on the combination of parameters for the region analyzed as we can see from the partial derivatives presented in Equations 2.15 and 2.16).

It is clear that Equation 2.17 already presents a possible way to estimate the relations that interest us in order to answer both questions posed in this empirical section. Nevertheless, the availability of data as well as the quality of it poses an initial barrier to such an effort. To design a feasible and, at the same time, econometrically robust exercise, some changes will be made in the form presented by the previous equation. A first important change concerning the accounting structure presented earlier (and, of course, the theoretical-model presented in the previous essay of this thesis) and to the estimates of Dutt (2003) is that we will start with a less aggregated specification, that is, we will not deal with only two countries (or regions), but with two broad groups: developed and underdeveloped countries. The choice for a lower level of aggregation is mainly due to the greater malleability of the estimates as well as the possibility of capturing heterogeneous effects for the different countries that compose each of the groups analyzed.

Furthermore, it is worth saying that the empirical analysis of this essay is based on a sample of several countries over several periods. Moreover, we follow a well-established empirical literature by describing a country's exports and imports as a function of economic variables, such as measures of income and relative price. In this case, the sample consists of 124 countries and covers a period of seventeen years, from 2001 to 2017 (see the list of countries in the sample as well as the description of the variables and its sources in Appendix B[22]). For the econometric estimates, all the variables were transformed into natural logarithms.

Several variables can be used to explain import and export flows. To maintain this work consistent and comparable with the existing empirical literature, we will take into consideration some of the most commonly used variables in previous related studies. In general, we will use variables related to the real output, relative prices, and income distribution to estimate the imports function. In particular, the variables of greatest interest in this exercise will be the imported volume (a clean measure of import flows); the real GDP, as a measure of output; the import unit price, as a measure of relative price (complemented by control variables); and wage share as a measure of the functional income distribution. It is important to discuss that we chose to use the wage share as the measure of income inequality mainly for the clear and direct relation to the theoretical model developed earlier in this thesis and to the accounting structure presented in this essay,

In addition, we will also consider as explanatory variables: the terms of trade

[22] It is important to say that we made a minor modification in the variable that represents FDI inflows in order to properly treat it in natural log form: we added the minimum value of the sample to all observations, in a way that guarantees that all observations of the variable are positive.

(calculated from the import and export prices already discounting the exchange rate effect) and the exchange rate as complementary variables for a better specification of the relative prices; the capital stock at constant prices, introduced in order to capture supply-side effects, trying to consider a channel often omitted in the balance-of-payments constrained growth empirical literature as Razmi (2016) argues; and the share of gross capital formation and of government consumption at current PPPs (% of real GDP), in order to incorporate further supply-side and institutional effects that may impact import demand[23]. The list of control variables is conditioned to consider enough potentially explanatory variables and to have a good amount of developed and underdeveloped countries in our sample. The period considered was also chosen based on the same principle[24].

Moreover, in order to capture a persistence effect of past imports flows, we will include two lags of the imported volume as independent variables.[25] We chose this number of lags to be able to calculate long-term effects and at the same time to control for a certain persistence of the independent variables of the model, without unnecessarily increasing the number of explanatory variables (and, therefore, of instruments in the GMM estimates).This way, we will also be controlling possible temporal heterogeneous effects related to the model's explanatory variables. That said, we propose a general specification of the form below:

$$\ln M_{i,t} = \beta_0 + \beta_1 \ln M_{i,t-1} + \beta_2 \ln \ln M_{i,t-2} + \beta_3 \ln P_{i,t} + \beta_4 \ln Y_{i,t} + \beta_5 \ln \sigma_{i,t} + \beta_6 X_{i,t} + \lambda_i + \delta_t + u_{i,t} \quad (2.18)$$

where β_0, β_1, β_2, β_3, β_4, β_5 and β_6 are parameters (the expected signs are: $\beta_0 \lesseqgtr 0$, $\beta_1 > 0$, $\beta_2 \lesseqgtr 0$, $\beta_3 < 0$, $\beta_4 > 0$, $\beta_5 \lesseqgtr 0$ and $\beta_6 \lesseqgtr 0$), $\ln M_{i,t-j}$ denotes the log of import volume and is considered an independent variable in the first and second lags, $\ln P_{i,t}$ denotes the log of import unit price, $\ln \sigma_{i,t}$ is the log of the wage share of income, $X_{i,t}$ is a set of control regressors consisting of economic and political variables (all in log), λ_i represent unobserved country-specific effect, δ_t is a period-specific effect, and $u_{i,t}$ is the regression residual.

[23] In regard of the government spending, Ribeiro, McCombie and Lima (2019) discussed the incorporation of this variable in mainstream growth models as a proxy for government burden (distortion for market signals), although a positive effect could be considered if one take into consideration the importance of public investments on health, education and security to promote economic development.

[24] For the complete description of variables and a synthetic table of descriptive statistics, see Appendix B. For further notes on Penn World Table variables computation, see Feenstra, Inklaar and Timmer (2015).

[25] In a analytical review of the literature, Goldstein and Khan (1985) indicate that most of the estimations for imports demand used 2 or 3 lags of the variable.

2.3.3 Estimation strategy

In this subsection, we outline the econometric techniques used to estimate the general structure given by Equation 2.18. First, it is important to say that the import regression exposed above presents numerous challenges as it deals with the presence of both time and country-specific unobserved effects. However, the methods used to account for these specific effects, such as fixed-effects and first difference equations, tend not to be appropriate for the estimation, especially due to the dynamic nature of the regression (WOOLDRIDGE, 2010; PESARAN, 2015). Furthermore, it is direct to argue that most of the independent variables used in our estimation tend to be endogenous to import flows, thus simultaneity must be properly controlled for.

Having those complications in mind, we deal with these problems following the dynamic estimations proposed by Arellano and Bond (1991), Arellano and Bover (1995) and Blundell and Bond (1998), through the usage of the Generalized Method of Moments (GMM) to estimate the parameters of the model. Ribeiro, McCombie and Lima (2019, p. 5) discuss that these estimators are based on difference regressions and instruments to control for unobserved country and period-specific effects. Besides that, they also use previous observations of dependent and independent variables as instruments. There are two main types of GMM estimation techniques: the difference GMM and the system GMM.

The first method, the difference GMM, represents a clear improvement with respect to fixed-effects and first difference estimators. The estimator first design by Arellano and Bond (1991) seeks to eliminate country-specific effects and also uses lagged observations of the independent variables as instruments. Nevertheless, this method has its disadvantages: if the variables of interest have a certain degree of persistence over time within a country (which is the case for some of the variables of our regression), this implies that most of the variation of the variables is eliminated when the first differences are taken, in a manner that the lagged observations of the independent variables tend to be weak instruments for the variables in difference, thus resulting in weak estimators.

The second method, the system GMM, is a way to solve this problem. The estimators proposed by Arellano and Bover (1995) and Blundell and Bond (1998) create a system of regression in difference and in level. The regressions' instruments in the first difference remain the same as in the difference GMM. The instruments used in the regression in level are the lagged differences of the independent variables. Admittedly, in this estimation technique, the independent variables can still be correlated with the country-specific effects, although the difference of these variables presents no correlation with these country-specific effects.

In both cases, the validity of the GMM estimators greatly depends upon the exogeneity of the instruments used in the baseline model. The exogeneity of the instruments

can be tested through the commonly used Hansen test, analyzing its J statistics. The null hypothesis of this test implies the joint validity of the instruments. Thus, if we reject the null hypothesis, there is a strong indication that the instruments are not exogenous and hence the GMM estimator is not consistent. Ribeiro, McCombie and Lima (2019, p. 5), following Roodman (2009a) advice, discussed that researchers should not be comfortable with a Hansen test p-value below 0.1. Furthermore, another important test is the Arellano-Bond test for residual correlation in the first difference, called the AR(2) test. The null hypothesis of the test examines if the residual of the regression in difference is second-order serially correlated. If the model is correctly specified, we should expect a first-order serial correlation in the residuals but not a second-order one. Thus, a rejection of the null hypothesis suggests that the instruments used are inappropriate and higher-order lags of the instrumental variables are required. Moreover, another important issue to be concerned about is the number of instruments used in the regressions. Although there is not a clear recommendation in the literature, it is well known that a large number of instruments are likely to overfit the endogenous variables and may distort the J statistic of the Hansen test. Roodman (2009b) suggests that instruments should not outnumber the individual groups in the panel. In our estimations, we tried to keep the number of instrumental variables close to the number of countries in the panel, choosing minimum lag orders of the endogenous variables and using the "collapse" function in order to limit the proliferation of instruments.

Finally, it is worth saying that the estimations were done using 17 periods of time, a rather different procedure than the 4 or 5-years average usually used in panel data analysis. As our number of groups is way higher than the number of periods, we initially discard any possible effects caused by the existence of unit-roots. Moreover, we treat almost all variables as endogenous in our estimations, with only period dummies and the exchange rate as exogenous. That said, we can now move forward to the estimations results as well as their interpretation.

2.3.4 Preliminary results and implications

Initially, it is worth pointing out that we present the estimations of Equation 2.18 for different groups of countries: developed, underdeveloped, and for the entire sample. To begin with, we estimate the import function for a group of developed countries (according to IMF's definition - see the list of countries in Appendix B).[26] These results are reported in Table 47.

The first column shows the results of the fixed-effect (within OLS or Linear Squares Dummy Variables regression) estimator without considering the control variables, the

[26] It is important to emphasize that, in this essay, we consider all the other countries in the sample to be underdeveloped (both less developed countries (LDCs) and developing ones).

	LSDV	Pooled OLS	Fixed Effect	Diff GMM	System GMM
Log of import unit price	-0.614***	-0.023	-0.397***	0.490	-0.022
	(0.08)	(0.04)	(0.06)	(0.34)	(0.10)
Log of real GDP	1.302***	0.010	0.524***	-1.514	-0.098
	(0.08)	(0.01)	(0.08)	(2.66)	(0.11)
Log of wage share	0.759***	-0.085*	0.088	-0.789	-0.198
	(0.11)	(0.04)	(0.07)	(1.04)	(0.13)
Log of import volume, lag 1		1.254***	0.681***	1.343*	1.190***
		(0.05)	(0.06)	(0.68)	(0.09)
Log of import volume, lag 2		-0.277***	-0.118**	-0.313*	-0.262**
		(0.05)	(0.04)	(0.14)	(0.07)
Country-specific effects	Yes	No	Yes	Yes	Yes
Time-specific effects	Yes	Yes	Yes	Yes	Yes
Control variables	No	Yes	Yes	Yes	Yes
Constant	-15.867***	0.484*	1.949		0.368
	(0.864)	(0.22)	(1.04)		(0.76)
Adjusted R^2	0.672	0.972	0.924		
AR(2) test - p value				0.029	0.001
Hansen "J" test - p value				0.266	0.221
Instruments				29	37
Observations	442	390	390	364	390
Groups	26	26	26	26	26

Note: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Standard errors in parentheses.

Table 1 – Estimations for developed countries

lagged values of import volume, and time-specific effects. The second column presents the pooled OLS estimator (considering controls and time-specific effects) and the third column presents the within OLS estimator considering both specific effects and including the control variables. As previously mentioned, these methods are inconsistent in dynamic panel models. The fourth and fifth columns present, respectively, the results of the GMM difference and system. Thus, we will focus our analysis in the last two columns.

In this first result, although the log of wage share has a positive and statistically significant effect on the import volume, when we look to both the fourth and fifth columns, the coefficients associated with the growth rate of wage share are negative but they are not statistically significant. If we look back to Equation 2.15, there is an ambiguity regarding the sign of the partial derivative. Nevertheless, these estimations indicate that the functional distribution of income does not impact significantly the import of developed countries. This result is similar to the findings of Stockhammer and Wildauer (2015) for a panel of 18 OECD countries covering the period 1980-2013. The coefficients associated with the log of real GDP and the import unit price also do not appear to be relevant and the signs are mainly different from those expected. Furthermore, although the Hansen test p-values indicate to not rejecting the null hypothesis in both cases, the AR(2) test p-values indicate that both estimations are not correctly specified, and more lags of the explanatory variables are needed as instruments. The problem, in this case, is that we have only a few developed countries and a specification with a great variety of explanatory variables, in a

way that the number of instruments is already greater than the number of groups. Thus, these results do not appear to be conclusive, and, in fact, they are not statistically robust. For the case of developed countries, then, another identification strategy must be followed, either with individual regressions for each country, considering different components of each sector of the production chain and the determinants of trade flows, or within a time series framework (since, for most of these countries, data is available for a long period of time).

On the other hand, Table 48 presents the case for the underdeveloped countries (which include emerging and LDC countries). From Equation 2.16, there is also an ambiguity regarding the sign of this partial derivative. However, as discussed earlier, it is likely that the parameters that compose Equation 2.16 are such that variations in the Southern wage share will negatively impact the import demand of that region. This result is empirically observed in our estimations, as the coefficients associated with the log of wage share are negative and statistically significant for both GMM estimations. For the GMM difference (system), the coefficient can be interpreted as follows: a 10% increase in the growth rate of wage share has a negative 3.1% (3.4%) impact on the growth rate of import volume. Furthermore, the coefficient associated with the log of real GDP and the log of import price have the expected signs, although the income elasticity is not statistically significant for the GMM system. In both GMM estimations, the AR(2) test p-values indicate to the not rejection of the null hypothesis, thus the residual term is not serially correlated (second-order). The results for the Hansen test are similar, with the null hypothesis not being rejected for both estimations, although the difference GMM presents a p-value for the test lower than 0.1. Nevertheless, the results indicate the joint validity of the instruments utilized on the estimations.

Before discussing in more depth the implications of this result, let's look at the estimates for the entire sample, that is, for all the countries present in our database. Table 3 presents these results. When we take into consideration both developed and underdeveloped countries, the coefficients associated with the log of wage share have negative signs and are statistically significant for both GMM regressions. Thus, a variation in income distribution in the benefit of workers negatively impact the volume of imports for the representative sample of countries considered in our database. Furthermore, the coefficient associated with the log of real GDP and the log of import price have the expected signs, although there are not statistically significant in the GMM system. In both GMM estimations, we do not reject the null hypothesis for the AR(2) test and the Hansen test, thus indicating that the residuals are not serially correlated and the instruments utilized are jointly valid. Once again, note that the number of instruments was kept under the number of groups, an indication that we may not incur problems of over-identification, which could "pollute" the J statistics.

	LSDV	Pooled OLS	Fixed Effect	Diff GMM	System GMM
Log of import price	-0.261***	-0.100***	-0.365***	-0.457***	-0.193**
	(0.03)	(0.02)	(0.04)	(0.09)	(0.06)
Log of real GDP	1.446***	0.065***	0.426***	0.816***	0.051
	(0.03)	(0.01)	(0.04)	(0.13)	(0.07)
Log of wage share	-0.152*	0.009	0.027	-0.315*	-0.341*
	(0.07)	(0.01)	(0.05)	(0.10)	(0.15)
Log of import volume, lag 1		0.975***	0.646***	0.655***	0.939***
		(0.03)	(0.03)	(0.03)	(0.08)
Log of import volume, lag 2		-0.031	-0.036	-0.076***	-0.055
		(0.03)	(0.02)	(0.01)	(0.06)
Country-specific effects	Yes	No	Yes	Yes	Yes
Time-specific effects	No	Yes	Yes	Yes	Yes
Control variables	No	Yes	Yes	Yes	Yes
Constant	-9.711***	0.849***	0.312		
	(0.27)	(0.12)	(0.43)		
Adjusted R^2	0.664	0.938	0.867		
AR(2) test - p value				0.864	0.576
Hansen "J" test - p value				0.083	0.155
Instruments				71	79
Observations	1666	1469	1469	1371	1469
Groups	98	98	98	98	98

Note: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Standard errors in parentheses.

Table 2 – Estimations for underdeveloped countries

Furthermore, it is worth noting that the coefficients of the regressions that include the lagged terms of import volume as explanatory variables present a possible long-term interpretation: the aggregate effect of income or variations in wage share on the volume of imports over time depends, of course, on the autoregressive nature of such variable. With that in mind, let us first determine how these effects, named here as long-run effects, can be calculated from Equation 2.18. For instance, if one is interested in the long-run income elasticity of demand import, ζ, a simple way to calculate it is:

$$\zeta = \frac{\beta_4}{1 - \beta_1 - \beta_2} \tag{2.19}$$

Thus, it is also interesting to calculate the long-run impacts of functional income distribution variations on the import volume. Table 4 presents the results for all the estimation methods. As expected, the long-run effects are stronger than the short-term ones. Again, the results of the first line, referring to developed countries, are not very illuminating: even for the most robust estimates, those using GMM estimators, the coefficients are not statistically different from zero. Thus, more empirical work should be done for this group of countries to present a solid answer to the empirical question presented in this paper. Nevertheless, it is worth highlighting that our results regarding this group of countries are similar to those of Stockhammer and Wildauer (2015) for 18 OECD countries: that the coefficient associated with the wage share (and, in their case,

	LSDV	Pooled OLS	Fixed Effect	Diff GMM	System GMM
Log of import price	-0.208***	-0.079***	-0.337***	-0.672***	-0.092
	(0.03)	(0.02)	(0.03)	(0.03)	(0.07)
Log of real GDP	1.444***	0.052***	0.464***	1.121***	0.053
	(0.03)	(0.01)	(0.04)	(0.04)	(0.08)
Log of wage share	-0.082	-0.006	0.017	-0.307***	-0.368**
	(0.06)	(0.01)	(0.04)	(0.05)	(0.12)
Log of import volume, lag 1		1.005***	0.651***	0.528***	0.967***
		(0.02)	(0.02)	(0.02)	(0.08)
Log of import volume, lag 2		-0.040	-0.043*	-0.076***	-0.062
		(0.02)	(0.02)	(0.00)	(0.06)
Country-specific effects	Yes	No	Yes	Yes	Yes
Time-specific effects	No	Yes	Yes	Yes	Yes
Control variables	No	Yes	Yes	Yes	Yes
Constant	-10.449***	0.710***	-0.431		0.020
	(0.26)	(0.10)	(0.35)		(0.73)
Adjusted R^2	0.778	0.940	0.866		
AR(2) test - p value				0.824	0.387
Hansen "J" test - p value				0.121	0.116
Instruments				113	121
Observations	2108	1859	1859	1735	1859
Groups	124	124	124	124	124

Note: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Standard errors in parentheses.

Table 3 – Estimations for the entire sample

with the first lag of the wage share) in the estimation of the import demand is statistically non-significant. Therefore, it is possible to argue that our results might, in fact, corroborate their findings. Despite this, the results for underdeveloped countries and the entire sample are quite relevant, and, when considering the possible long-run effects, the implications of omitting this effect on the estimates of import functions are even more serious.

	LSDV	Pooled OLS	Fixed Effect	Diff GMM	System GMM
Developed	0.759***	-3.801	0.201	26.382	-2.752
	(0.110)	(2.329)	(0.159)	(464.742)	(2.973)
Underdeveloped	-0.153***	0.165	0.068	-0.748***	-2.927*
	(0.070)	(0.234)	(0.122)	(0.238)	(1.429)
Entire sample	-0.152**	-0.169	0.044	-0.560***	-3.855
	(0.070)	(0.320)	(0.106)	(0.086)	(2.081)

Note: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Standard errors in parentheses.
Short-run effects for the first column.

Table 4 – Long-run distributional effects

By way of conclusion, after presenting the preliminary results for both groups of countries and the entire sample, it now remains to discuss the theoretical and empirical implications of the results and how they relate to the questions initially posed in this essay. First, the statistical significance of the coefficients associated with the measure of

functional distribution in the estimates for underdeveloped countries and the entire sample indicate that, in the end, the non-inclusion of such measure represents the omission of a relevant variable and, therefore, puts in doubt the consistency of the estimators. Moreover, our results for developed countries are close to those found in the literature.

Second, it is worth pointing out that this result contributes to the empirical and theoretical discussions on the effect that variations in the functional income distribution have in the context of economies' price competitiveness, and more so in the case of underdeveloped countries. If we consider that an increase in the wage share is positively related to increases in the unit labor cost, the result obtained in our estimations indicates that, although such a price effect may deteriorate the competitive conditions of domestic goods (theoretically reducing net exports), the effect of such distributional variation on imports is, in fact, negative. This implies that, depending on the strength of each of the components, the variation in income distribution in favor of workers may, in fact, improve the country's trade balance and, thus, alleviate the external constraint (balance-of-payments constraint).

Third, it is also relevant to highlight the impact of our results in view of the country's non-price competitiveness. The negative effect that an increase in the wage share has on the import volume of countries may be directly related to a composition effect of the demand for foreign goods. This composition effect can be understood both within the framework of Latin American structuralists and in more recent literature based on non-homothetic preferences. Anyway, the explanation is simple: in countries marked by income inequality, an increase in profit income (thus a decrease in the wage share), in addition to increasing the volume of imports, tends to increase the import of luxury goods to the detriment of more necessity goods (which, it is worth saying, are mainly exported by underdeveloped countries). Moreover, another plausible explanation for this result is that the propensity to import from wage income tend to be lower than from profit income, especially since in many underdeveloped countries these workers will consume all their surplus income in meeting basic needs, which implies decreases in the volume of imports (in addition to the composition) after distributional variations.

Finally, it is worth reiterating that this empirical result, with the implications, analyzed above, seems to be relevant to a wide literature that encompasses (but is not restricted to) both theoretical-formal models and empirical-econometric estimates of i) wage-led and profit-led growth regimes; ii) balance-of-payments constrained growth and iii) the role of the real exchange rate (RER) misalignment for economic growth[27]

For the first two themes, the analysis made so far already makes explicit the inter-relation with such specific literature. Focusing on the last point, the result of this empirical

[27] In this discussion see, for instance, Rodrik (2008), Razmi, Rapetti and Skott (2012) and Ribeiro, McCombie and Lima (2019).

exercise presents further evidence that the impacts of currency undervaluation on income distribution should be taken into consideration to correctly analyze the possible benefits of such a policy. The explanation is quite simple: when we consider the distributional effects of currency undervaluation, that is, that it raises income inequality (as it negatively impacts real wages and, therefore, the wage share), our results show that this variation will positively impact the import volume and, thus, may deepen the balance-of-payments constraint (even if we consider the positive effect on exports when the Marshall-Lerner condition holds). Furthermore, even if the economy might be "overall" profit-led and this distributional impact may boost the economic growth, in the long-run an increase in the profit share will limit the possible growth path as it diminishes the balance-of-payments equilibrium growth rate.

In fact, not considering the effects of variations in income distribution on imports does not just indicate an omission of a relevant variable. As Lima and Porcile (2013) and, more recently, Ribeiro, McCombie and Lima (2019) argue, this corresponds to the omission of an important channel that can represent a change in a wide range of results, both in theoretical-formal scope as well as in empirical-econometric one and, of course, has important policy implications, especially concerning the design of industrial and trade policies.

2.3.5 Income elasticities ratio

After presenting the main empirical result of this thesis, as well as its implications both empirically and theoretically, it is worth looking at the evidence found concerning the second empirical question posed at the beginning of this section: the differential of income elasticities of import demand between regions.

First, let us briefly derive a relation between the growth rates of the two regions that have been the focus of our thesis so far: the North and the South.[28] Following Thirlwall (1979), let us departure from both export functions derived earlier in this essay - Equations 2.12 and 2.14. Thus, the balance of payments equilibrium condition can be written as:

$$P_S X_S + P_N F = P_N X_N \tag{2.20}$$

where F is the net outflow of capital from the North to South in terms of the Northern good. We can rewrite this relation as:

$$P X_S + F = X_N \tag{2.21}$$

[28] In a simplified manner, these regions can be understood, respectively, as the group of developed and underdeveloped economies used in the empirical exercise.

Equation 2.21 can be expressed in growth rate form as:

$$[1-(F/X_N)](p+x_S)+(F/X_N)f=x_N \tag{2.22}$$

where lower case symbols denote the rates of growth of the variable denote by the upper case symbol. That is, $p=\hat{P}$, $x_S=\hat{X}_S$ and so forth. Log-differentiating Equations 2.12 and 2.14 and substituting into Equation 2.22, we have:

$$y_S=(1/\varepsilon_S)\{(1-\mu_N-\mu_S)p+\theta_S-\theta_N+[1-(F/X_N)]\varepsilon_N y_N+(F/X_N)[f-(1-\mu_N)p-\theta_S] \tag{2.23}$$

In the special case in which trade is balance (so we have that $F=0$ and $f=0$) and, moreover, the terms of trade do not change (so $p=0$), Equation 2.23 reduces to:

$$y_S=\frac{\varepsilon_N y_N+\theta_S-\theta_N}{\varepsilon_S} \tag{2.24}$$

Note that, from the accounting relations derived in the second section of this essay, $\theta_S=\hat{\Theta}_S=f(\hat{\sigma}_N)$ and $\theta_N=\hat{\Theta}_N=f(\hat{\sigma}_S)$. Furthermore, given the empirical results presented in the last subsection, it is clear that variations in the functional distribution of income in both regions might, in fact, play a major role in determining their balance-of-payments restrictions and, thus, their long-run economic growth rate associated to external equilibrium. Therefore, it is evident that the path to new theoretical-formal and empirical-econometric developments in this line is quite promising and may have several implications for the existing literature. Nevertheless, our contribution to literature, at this point, is just to shed light on this channel and to point out that its omission can be quite problematic. To present and discuss the empirical results regarding the income elasticities ratio in a framework similar to the model presented in the last essay, we will assume that $\theta_S=\theta_N$.[29] Thus, Equation 2.24 can be reduced to the stylized Thirlwall's relation presented by Dutt (2002):

$$\frac{y_N}{y_S}=\frac{\varepsilon_S}{\varepsilon_N} \tag{2.25}$$

From Equation 2.25, we can see that whenever $\varepsilon_S>\varepsilon_N$, $y_N>y_N$. That is, if the income elasticity of import demand of the Southern region is higher than the Northern one, we expect a long-run uneven development trajectory: one in which the North grows faster than the South. It is clear from our first essay that, majorly, the uneven development results are derived under the validity of this income elasticities differential hypothesis, that is, that $\varepsilon_S>\varepsilon_N$.

[29] Note that we could have assumed, with similar implications, that both θ_S and θ_N are equal to zero.

Furthermore, it is often argued that poorer countries, in general, have higher income elasticities of import demand than richer countries, especially because they produce relatively income inelastic goods such as primary products and basic manufactured goods. Although this argument is quite reasonable, an important question may arise from the modern experience: do today's underdeveloped countries, with the great heterogeneity that characterizes them, fit into this situation?

In order to address this question, Dutt (2003) proposed an aggregate exercise to estimate North and South import and export functions. In his motivation, Dutt argues that, although most of the available evidence regarding import elasticities is for developed countries, numerous studies also include underdeveloped countries[30], however, this large literature does not allow us to draw solid conclusions about income elasticities of demand for import and export for rich and poor countries, since the estimates do not follow a consistent pattern as well as it suffers from several problems, such as aggregation, simultaneity and misspecification problems. Despite not overcoming the problems mentioned, Dutt's analysis addressed the North-South dimension of the estimation, finding preliminary results that suggest that the income elasticity of imports of the Southern region is greater than that of the Northern one, so that the elasticity condition under which uneven development occurs, both in Dutt (2002) and in the model presented in the preceding essay of this thesis, is likely to be empirically verified. Moreover, Dutt's exercise analyzed the possibility of changes in income elasticities over time, as it could be argued that the commodity composition of Southern exports had significantly changed over the last decades.

Seeking to continue the discussions about the validity of the income elasticities differential hypothesis, this empirical exercise also seek to estimate income elasticities of import demand for two groups of countries, developed and underdeveloped, in a certain way "updating" Dutt's exercise, even though in a less aggregated way and with more robust econometric techniques. Gregori and Giansoldati (2020) investigate the long-run income and price elasticity of import demand functions with a heterogeneous unbalanced panel of 34 countries over the period between 1985 and 2018, using CCEMG and ARDL estimators. Although the authors do not explore the differences between the long-run income elasticity of import demand of developed and underdeveloped countries, their results suggest that, at least for the statistically significant coefficients, countries that are more developed generally present lower income elasticity of import demand than relatively less developed countries (such as Mexico, India, and Indonesia).

The calculated long-run income elasticities of imports are presented in Table 5. It is important to say that these results come from the different estimations of Equation 2.18. We compute these long-run coefficients for the developed countries (North) and underdeveloped countries (South) for all five econometric estimations. Moreover, we present

[30] For instance, see Bahmani-Oskooee (1986), Faini, Pritchett and Clavijo (1992) and Bairam (1997).

also the ratio of Southern and Northern income elasticities of import, as it makes easier to analyze the possible relative growth paths of the regions and, of course, the validity of the hypothesis (we expect a ratio greater than unity, that is $\frac{\varepsilon_S}{\varepsilon_N} > 1$).

	LSDV	Pooled OLS	Fixed Effect	Diff GMM	System GMM
Long-run ε_N	1.302	0.4347	0.524**	50.607	-1.361
	(0.764)	(0.731)	(0.158)	(863.74)	(1.243)
Long-run ε_S	1.446***	1.159***	1.092***	1.938	0.439
	(0.039)	(0.212)	(0.092)	(2.792)	(0.588)
Ratio $\frac{\varepsilon_S}{\varepsilon_N}$	1.111	2.668	2.084	0.038	-0.322

Note: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Standard errors in parentheses.
Short-run elasticites for the first column.

Table 5 – Long-run income elasticities of import comparison

For the first three estimations, the ratio of income elasticities of import demand has the expected value. That is, the uneven development trajectory presented in our theoretical-formal model is likely to be observed. Nevertheless, this result does not hold when we consider the GMM estimations, as we have seen that the coefficients for the developed countries are not easily understandable and, more than that, the AR(2) test and the Hansen test place serious restrictions on the validity of these regressions. Therefore, in the same way, that we argued for the effect of income distribution, more empirical work should be done considering the developed countries, especially with the usage of other econometric techniques, so that the results can be reliable and comparable. Notwithstanding, the results indicate a preliminary corroboration of Dutt's findings, that is, the elasticities differential hypothesis seems to be observed even when we consider recent periods and "emerging" economies. Besides, although the results are not extremely robust, it is important to note that we took into consideration several variables as controls, including those regarding supply-side and time-specific factors.

As a conclusion, it is worth reiterating that new empirical work needs to be done to reach conclusions regarding the income elasticity differential between the North and the South and its consequences on uneven development. Although this thesis has not managed to advance significantly in this empirical front, our contribution can help to direct new research related to these theoretical and empirical questions.

Before concluding this essay, it is worth exploring yet another empirical issue related to the model of the previous essay. Specifically, we will look at FDI flows and its possible effect on the income elasticity of import demand.

2.4 FDI flows and imports

In the previous essay, we discussed several theoretical arguments pointing to possible positive and negative effects of the presence of foreign firms on the income elasticities of import and export demand of both regions (see Sections 1.1 and, especially, 1.4). In order to present our empirical results regarding this point, let us briefly remember the main points of the discussion.

First, let us turn our attention to the possible effects on ε_S, that is the income elasticity of import demand of the Southern region. On one hand, the presence of foreign firms in the South might be related not only to a decrease in imports - for instance, consider that those foreign firms will produce domestically final and intermediate goods that were imported before - but also to a variation in the composition of those imports (DUTTARAY; DUTT; MUKHOPADHYAY, 2008). Thus, this reduction in the import demand of high value-added goods (that are now produced domestically) might represent a decrease in the Southern income elasticity of import demand. On the other hand, another possible effect of the presence of foreign firms in the South is an increase in the demand for intermediate and capital goods which - if the domestic market for those goods is not competitive or even non-existent - will be accommodated through imports from the North. Thus, even if we consider that FDI flows might improve the regions' exports, it may present a negative liquid effect in the trade balance (JENKINS, 2013). Moreover, there is also a possible composition effect underlying this increase in imports: the goods that will be imported now might have greater added value, representing a shift in the composition of the bundle of imported goods. If this is the case, the increased presence of foreign firms might be related to a higher income elasticity of import demand for the Southern region.

Furthermore, looking now at ε_N, the income elasticity of import demand of the North, the theoretical arguments are similar to those presented in the last paragraph. In summary, the possible effects of FDI inflows on the Southern imports - both positive or negative - might also be related to composition effects. As argued earlier in this essay, the presence of foreign firms may alter the Southern region productive structure. Furthermore, it can also alter the composition of Southern exports. On one hand, FDI inflows can be related to the domestic production of higher value-added products that might be exported, especially if we consider that the presence of foreign firms in the domestic market will result in greater access to foreign markets. In this case, FDI inflows might have a positive impact in the Southern region structural competitiveness, resulting in a higher value for the Northern income elasticity of import demand. On the other hand, although quite unlikely, it is possible that FDI inflows are related to ε_N in a negative way, either by a negative impact in the Southern productive structure and its structural competitiveness or a variation in the bundle of exported goods (a shift with greater participation of low value-added products).

We will divide the exposure of the results into two subsections that, in turn, are directly related to the econometric estimation strategies adopted. First, we will look at the inclusion of FDI flows and their impact on imports. Second, we will also add an interaction term between FDI flows and domestic income, trying to capture the possible effect of foreign presence on income elasticity.

Furthermore, it is important to say that for this econometric exercise we use the same database that served for the analysis presented in the previous section. That said, we will keep considering those 124 countries (and the division between developed and underdeveloped) and the 17 periods of time between 2001 and 2018.[31] Nevertheless, it is also important to remember the clear econometric limitations that the small sample of developed countries bring to our analysis. That said, let us first focus our attention on the direct effects of FDI flows on imports of underdeveloped countries and for the entire sample.

2.4.1 FDI and imports volume

As pointed out in the previous essay, a possibility usually highlighted in the literature is a decrease in imports coming from domestic production of final and intermediate goods by foreign companies in the country and an increase in exports due to the expansion of trade relations with the countries of origin of capital flows (market opening argument). As pointed out by Duttaray, Dutt and Mukhopadhyay (2008), these results could then increase the long-run equilibrium growth rate determined by the external constraint (or the balance-of-payments constraint). On the other hand, another possible effect of the entry of foreign firms is that of increased imports of capital and intermediate goods (if the domestic market is not competitive or does not exist in these sectors) which, coupled with a delay in significantly improving exports (due to the existence of institutional constraints) may actually lead to a negative aggregate balance-of-payments result and thus intensify the external constraint of developing economies (JENKINS, 2013).

In order to capture a persistence effect of past import flows, as we did earlier in this essay, we include two lags of the import volume as independent variables. Furthermore, we also include one lag of the FDI flows, as we would expect that the impacts of the foreign presence on imports usually take a certain time to emerge. This way, we will also be controlling possible temporal heterogeneous effects related to the model's explanatory variables. That said, we propose a general specification, quite related to Equation 2.18, of the form below:

[31] Again, the list of variables as well as their descriptive statistics are presented in Appendix B.

	Fixed Effect	Diff GMM	System GMM
Log of import unit price	-0.363***	-0.455	-0.022
	(0.03)	(0.27)	(0.10)
Log of real GDP	0.421***	1.272***	-0.098
	(0.04)	(0.32)	(0.11)
Log of FDI flow	0.07***	0.197	-0.180
	(0.02)	(0.19)	(0.20)
Log of FDI flow, lag 1	-0.072***	-0.088	0.077
	(0.02)	(0.05)	(0.13)
Log of import volume, lag 1	0.647***	0.719***	0.974***
	(0.02)	(0.89)	(0.07)
Log of import volume, lag 2	-0.034	-0.115***	-0.048
	(0.02)	(0.02)	(0.06)
Country-specific effects	Yes	Yes	Yes
Time-specific effects	Yes	Yes	Yes
Control variables	Yes	Yes	Yes
Constant	0.306		
	(0.77)		
Adjusted R^2	0.367		
AR(2) test - p value		0.409	0.559
Hansen "J" test - p value		0.320	0.097
Instruments		47	56
Observations	1469	1371	1469
Groups	98	98	98

Note: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Standard errors in parentheses.

Table 6 – FDI flows - Estimation for underdeveloped countries

$$\ln M_{i,t} = \beta_0 + \beta_1 \ln M_{i,t-1} + \beta_2 \ln \ln M_{i,t-2} + \beta_3 \ln P_{i,t} + \beta_4 \ln Y_{i,t} + \beta_5 \ln FDI_{i,t} + \beta_6 \ln FDI_{i,t-1} + \beta_7 X_{i,t} + \lambda_i + \delta_t + u_{i,t} \quad (2.26)$$

where β_0, β_1, β_2, β_3, β_4, β_5, β_6 and β_7 are parameters (the expected signs are similar to those of Equation 2.18, but now we expect that $\beta_5 \lesseqgtr 0$ and $\beta_6 \lesseqgtr 0$), $\ln FDI_{i,t}$ is the log of FDI flows, $\ln FDI_{i,t-1}$ is the first lag of the log of FDI flows, $X_{i,t}$ is a set of control regressors consisting of economic and political variables (all in log)[32] and the other variables and parameters have the same meaning as before (see Equation 2.18).

Table 6 presents the results of the estimations for underdeveloped countries. The first column presents the within OLS estimator (fixed effects) considering both specific effects and including the control variables. As previously mentioned, this method is inconsistent in dynamic panel models. The second and third columns present, respectively, the results of the GMM difference and system. Thus, we will focus our analysis in the last two columns.

In this first result, although the log of FDI flow has a positive and statistically significant effect on the import volume, when we look to both the second and third columns,

[32] As we have seen that the functional distribution of income is a relevant variable for explaining the import volume, it is obvious that the wage share is contained in this set of control variables.

the coefficients associated with the growth rate of FDI flows are not statistically significant. Moreover, the coefficients associated to the first lag of the log of FDI flow has a negative and statistically significant effect on the import volume for the first column, but when we look to both the second and third columns, the coefficients associated to the growth rate of the lagged FDI flows are not statistically significant. Thus, the general evidence here is that FDI flows do not seem to have an impact on import volume for underdeveloped countries. Furthermore, the coefficient associated with the log of real GDP and the log of import price have the expected signs for the first two columns, although they are not statistically significant in the GMM system. In both GMM estimations, the AR(2) test p-values indicate to the not rejection of the null hypothesis, thus the residual term is not serially correlated (second-order). The results for the Hansen test are similar, with the null hypothesis not being rejected for both estimations, although the system GMM presents a p-value for the test lower than 0.1. Nevertheless, the results indicate the joint validity of the instruments utilized on the estimations.

	Fixed Effect	Diff GMM	System GMM
Log of import unit price	-0.336***	-0.455*	-0.158*
	(0.03)	(0.20)	(0.06)
Log of real GDP	0.462***	1.654***	0.020
	(0.03)	(0.31)	(0.07)
Log of FDI flow	0.010	0.124	-0.083
	(0.01)	(0.07)	(0.06)
Log of FDI flow, lag 1	-0.010	-0.005	0.002
	(0.02)	(0.01)	(0.13)
Log of import volume, lag 1	0.651***	0.637***	0.998***
	(0.02)	(0.10)	(0.06)
Log of import volume, lag 2	-0.042*	-0.099***	-0.058
	(0.02)	(0.02)	(0.06)
Country-specific effects	Yes	Yes	Yes
Time-specific effects	Yes	Yes	Yes
Control variables	Yes	Yes	Yes
Constant	-0.434		2.649
	(0.46)		(1.47)
Adjusted R^2	0.203		
AR(2) test - p value		0.694	0.382
Hansen "J" test - p value		0.379	0.024
Instruments		47	56
Observations	1859	1735	1859
Groups	124	124	124

Note: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Standard errors in parentheses.

Table 7 – FDI flows - Estimation for the entire sample

Table 7, in turn, expose the results of the estimation for the entire sample. In this case, the coefficients associated with the log of FDI flow and the lagged value of this variable are not statistically significant for the three estimation methods. Thus, we have once more evidence that FDI flows do not seem to have an impact on import volume, not only for undeveloped countries but also considering the whole sample (124 countries). Furthermore, the coefficient associated with the log of real GDP and the log of import

price have the expected signs for the three columns, although they are not statistically significant in the GMM system. In both GMM estimations, the AR(2) test p-values indicate to the not rejection of the null hypothesis, thus the residual term is not serially correlated (second-order). The results for the Hansen test, however, indicate that the null hypothesis is not rejected for the difference GMM estimation, but is rejected for the system GMM.

2.4.2 FDI and income elasticity of import

After presenting the results for the first exercise, let us now complement our analysis with the consideration of an interaction between FDI flows and domestic output. Adding this term to Equation 2.26, we have a new general specification given by:

$$\begin{aligned}\ln M_{i,t} = \beta_0 + \beta_1 \ln M_{i,t-1} + \beta_2 \ln \ln M_{i,t-2} \\ + \beta_3 \ln P_{i,t} + \beta_4 \ln Y_{i,t} + \beta_5 \ln FDI_{i,t} + \beta_6 \ln FDI_{i,t-1} + \beta_7 (\ln FDI_{i,t} * \ln Y_{i,t}) \\ + \beta_8 X_{i,t} + \delta_t + u_{i,t} \quad (2.27)\end{aligned}$$

where β_0, β_1, β_2, β_3, β_4, β_5, β_6, β_7 and β_8 are parameters (the expected signs are the same as those of 2.26, but now we also expect that $\beta_7 \lesseqgtr 0$), $\ln FDI_{i,t} * \ln Y_{i,t}$ is the interaction term between the log of FDI inflows and the log of real GDP, and the other variables and parameters have the same meaning as in Equation 2.26.

The results of the three different estimations of Equation 2.27 for underdeveloped countries are presented in Table 8. In this case, the coefficients associated with the log of FDI flows are statistically non-significant. Moreover, the coefficients associated with the first lag of the log of FDI flow have a negative and statistically significant effect on the import volume for the first and second columns, but when we to the system GMM estimation the coefficient is not statistically significant. Furthermore, the term that measures the impact of FDI flows on the income elasticity of import, the interaction between the log of FDI flows and the log of real GDP, does not seem to be relevant, as the coefficients associated with this term in the three estimations are statistically non-significant. Therefore, the evidence is that FDI flows do not seem to impact the imports of underdeveloped countries in the same year, although it might negatively impact the volume of imports in the next year. Nevertheless, we have not found evidence that the presence of foreign firms impact (in a way or another) the income elasticity of import demand of underdeveloped countries. Furthermore, the coefficient associated with the log of real GDP and the log of import price have the expected signs for the first two columns, although they are not statistically significant in the GMM system. In both GMM estimations, we do not reject the null hypothesis for the AR(2) test and the Hansen test, thus indicating that the residuals are not serially correlated and the instruments utilized are jointly valid.

	Fixed Effect	Diff GMM	System GMM
Log of import unit price	-0.363***	-0.318	-0.148**
	(0.03)	(0.21)	(0.05)
Log of real GDP	0.419*	2.574*	-0.409
	(0.19)	(1.09)	(0.57)
Log of FDI flow	0.07	0.807	-0.179
	(0.09)	(0.51)	(0.32)
Log of FDI flow, lag 1	-0.072**	-0.069*	-0.024
	(0.02)	(0.03)	(0.07)
Interaction FDI*GDP	0.000	-0.049	0.018
	(0.01)	(0.03)	(0.02)
Log of import volume, lag 1	0.647***	0.756***	0.968***
	(0.02)	(0.08)	(0.06)
Log of import volume, lag 2	-0.034	-0.039***	-0.048
	(0.02)	(0.02)	(0.06)
Country-specific effects	Yes	Yes	Yes
Time-specific effects	Yes	Yes	Yes
Control variables	Yes	Yes	Yes
Constant	0.331		
	(2.49)		
Adjusted R^2	0.367		
AR(2) test - p value		0.453	0.441
Hansen "J" test - p value		0.483	0.164
Instruments		51	61
Observations	1469	1371	1469
Groups	98	98	98

Note: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Standard errors in parentheses.

Table 8 – FDI flows and interaction - Estimation for underdeveloped countries

Table 9 present the results of the estimation for the entire sample. In this case, the coefficients associated with the log of FDI flow and the lagged value of this variable are not statistically significant for the three estimation methods. Moreover, the term that captures the interaction between FDI flows and real GDP also present non-significant coefficients for the three estimation methods. Thus, we have once more the evidence that FDI flows do not seem to have an impact on import volume and, further, on the income elasticity of import demand, not only for undeveloped countries but also considering the entire sample. Furthermore, the coefficient associated with the log of real GDP and the log of import price have the expected signs for the first two columns, although the income elasticity of import is not statistically significant in the GMM system. In both GMM estimations, the AR(2) test p-values indicate to the not rejection of the null hypothesis, thus the residual term is not serially correlated (second-order). The results for the Hansen test, however, indicate that the null hypothesis is not rejected for the difference GMM estimation, but is rejected for the system GMM.

By way of conclusion, it is worth to present a summary of the main results examined in this section. First, we presented evidence that FDI flows do not impact imports of underdeveloped countries and the entire sample of countries. Thus, our results suggest that the theoretical argument presented in Jenkins (2013), that the entry of foreign firms

	Fixed Effect	Diff GMM	System GMM
Log of import unit price	-0.337***	-0.551**	-0.139**
	(0.03)	(0.17)	(0.05)
Log of real GDP	0.569***	2.497**	-0.617
	(0.15)	(0.87)	(0.66)
Log of FDI flow	0.067	0.544	-0.435
	(0.07)	(0.47)	(0.36)
Log of FDI flow, lag 1	-0.01	-0.001	0.004
	(0.01)	(0.01)	(0.02)
Interaction FDI*GDP	-0.004	-0.031	0.027
	(0.01)	(0.03)	(0.02)
Log of import volume, lag 1	0.651***	0.657***	1.003***
	(0.02)	(0.09)	(0.07)
Log of import volume, lag 2	-0.042	-0.099***	-0.057
	(0.02)	(0.02)	(0.06)
Country-specific effects	Yes	Yes	Yes
Time-specific effects	Yes	Yes	Yes
Control variables	Yes	Yes	Yes
Constant	-1.820		5.575***
	(1.91)		(0.47)
Adjusted R^2	0.204		
AR(2) test - p value		0.763	0.411
Hansen "J" test - p value		0.329	0.041
Instruments		51	61
Observations	1859	1735	1859
Groups	124	124	124

Note: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Standard errors in parentheses.

Table 9 – FDI flows and interaction - Estimation for the entire sample

in the domestic market of less developed economies would increase the imports of capital and intermediate goods, is not empirically observed for a large sample of underdeveloped countries. Furthermore, this general result also does not follow the particular findings of Laplane and Sarti (1999) and Sarti and Laplane (2002) - that FDI flows are associated with the worsening of the Brazilian trade balance as those capital flows increased import needs without the counterpart of increasing exports. However, we find a delayed negative impact of FDI flows on import volume in one of the difference GMM estimations. As we couldn't execute a similar exercise for the exports, the net impact of FDI flows on the trade balance and, consequently, on the balance-of-payments is not clear. Nevertheless, we can consider that the evidence presented rules out a potential negative effect of FDI flows on the long-run equilibrium growth rate determined by the external constraint (in Thirlwall's tradition). Moreover, we also show evidence that FDI flows do not impact the income elasticity of import demand of underdeveloped countries (and of the entire sample). This evidence also rules out another possible negative effect of FDI flows: an increase in the income elasticity of import of the country due to the internationalization of the economy. Although the net effect of FDI flows on the income elasticities ratio is not clear - and thus, given the relation presented in Equation 2.25, it is unclear if it might impact the development pattern between the regions - our evidence supports that, at least,

ε_S does not seem to be related to FDI flows.

2.5 Concluding remarks

This essay presents an empirical contribution that dialogues, in particular, with a wide literature of growth regimes in open economies, balance-of-payments constrained growth and the role of RER misalignment in economic growth. In summary, we find robust empirical evidence that variations of the wage share have a negative statistically significant impact on the volume of imports of underdeveloped countries (and for the entire sample). When indicating the importance of the functional distribution of income for the determination of imports, this effort pointed out not only the omission of a relevant variable in much of the empirical literature that estimates this trade flows, but also the omission of a relevant channel in the discussions of real exchange rate undervaluation and its impacts, external constraint and economic growth.

Furthermore, we also present evidence regarding two empirical questions that arise from the model developed in the first essay of this thesis: i) the validity of the income elasticity of import differential between regions and ii) the role of FDI flows on imports and income elasticity of import demand. Regarding the first point, the results indicate a preliminary corroboration of Dutt's findings (DUTT, 2003), that is, the elasticities differential hypothesis seems to be observed even when we consider recent periods and "emerging" economies. Although the results are not extremely robust, it is important to note that we took into consideration several variables as controls, including those regarding supply-side and time-specific factors. In summary, we find evidence that supports the argument that the income elasticity of import demand is higher in poor (less developed) countries compared to richer economies, which strengthens the result of uneven development between regions in the long run.

Moreover, regarding the second point, we find evidence that FDI flows do not impact the imports of underdeveloped countries (and for the entire sample). Although this result does not allow us to understand the net impact of those flows on the trade balance, this evidence rules out a potential negative effect of FDI flows on the long-run equilibrium growth rate determined by the external constraint. Furthermore, we took into consideration the possible effects of FDI flows on the income elasticities of import demand of the countries. Nevertheless, the empirical evidence supports the argument that FDI flows do not impact the income elasticity of imports of underdeveloped countries. This result does not help us to measure the net effect of FDI flows on the income elasticities of import ratio between the regions and, therefore, to point this mechanism as a possible means to overcome uneven development, but the evidence presented here at least indicates that the income elasticity of import demand of the Southern region will not increase with

a possible internationalization of the economy. Thus, in general, our results indicate that FDI flows do not seem to represent a negative force for underdeveloped economies, at least concerning their trade balance and, through the imports channel, their long-run economic growth rate associated with external equilibrium. It remains to be seen, on the other hand, if FDI flows can positively impact these countries.

Finally, it is worth pointing out that the path to be followed in both theoretical-formal and empirical-econometric fields related to this work looks promising. First, it is important to emphasize that new empirical studies must be done for better treatment of developed countries, aiming at obtaining econometrically robust and comparable results with those presented in this essay. Moreover, a possible extension that stands out in both fields is that of considering the functional distribution of income in a framework *a la* Thirlwall, using the import and export functions derived in the first section of this essay (from accounting relationships). In particular, if we consider that the functional income distribution has varied greatly in recent decades, it seems quite urgent that we take into account the role of these variations in the long-run economic growth associated with balance-of-payments equilibrium, also considering the possibility of a causality running in the opposite direction (that is, the fall in the wage share may be caused by slower growth due to the tightening of the external constraint), and their implications in economic policy for both developed and underdeveloped countries.

3 FDI flows and their effects on the Brazilian economy: a case study

3.1 Introduction

The last decades have been marked by a strong expansion of economic relations between countries, whether developed or developing. One of the most important aspects of this process was the expansion of capital flows, both financial and physical. In particular, Foreign Direct Investment (FDI) has played a prominent role as the main component of capital flows to developing countries. While in the mid-1990s FDI flows to developing economies were around US$ 150 billion, by 2017 these flows reached US$ 671 billion (almost 43 percent of the world's total amount), of which US$ 151 billion were directed to Latin American and Caribbean countries (UNCTAD, 1999; UNCTAD, 2018).

In the Brazilian case, it is noteworthy that the foreign direct investment liability position at the end of 2017 reached US$ 768 billion (almost 27 percent of GDP), with 70 percent of this position being related to equity participation. Figure 15[1] presents an overview of the total position of FDI in the Brazilian economy in the last decades. In addition to the substantial growth in the importance of these capital flows during this period, the recent expansion of intercompany loans also draws attention.[2] Looking specifically at equity, the broad sectoral decomposition of this FDI stock was, in 2018, the following: 9% for the agriculture, livestock and mineral extraction sector, 33% for the industrial sector, and the other 58% for services (BCB, 2019). Moreover, in a minute description of greenfield FDI in Brazil, Silva Filho (2015) remarks that the regional distribution of such direct investments in the country is quite concentrated in the Southeast and, thus, it follows the concentration of production in Brazil. Furthermore, looking at a detailed sectoral decomposition, the author argues that the pro-cyclical trajectory of FDI in relation to GDP suggests a concentration of inflows to sectors aimed at domestic consumption, in addition to the commodities sectors.

Alongside with these increases in FDI inflows, the literature on the impacts of FDI on economic development has grown significantly (especially in the mid-1990s and 2000s), although it still offers theoretical and empirical results not always conclusive (DUTTARAY; DUTT; MUKHOPADHYAY, 2008; IAMSIRAROJ; ULUBAŞOĞLU, 2015; IAMSIRAROJ, 2016). Although the questions of interest and the methods utilized could modify the

[1] The source of the data used in the figure are the special series of foreign direct investment made available by the Central Bank of Brazil.

[2] Although we will not deal with this variable in our econometric exercises, in Section 3.5 we shed light on some possible advances regarding the study of these intercompany loans for the Brazilian case.

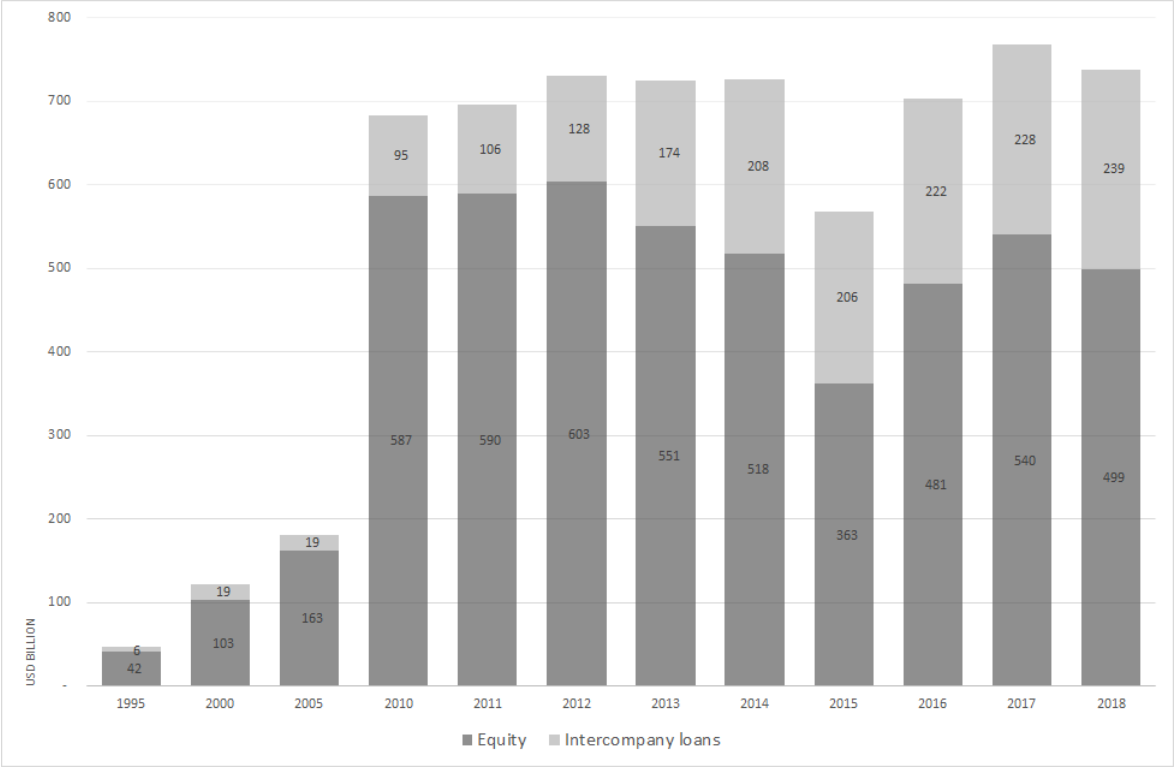

Figure 15 – FDI in the Brazilian economy - Total position

results, it is possible to summarize these results as follows: research at the firm-level since 1990 usually shows that spillover effects are non-significant or even negative, whilst the results on aggregate-level point to a positive effect of FDI inflows on economic growth of developing countries under certain circumstances (HERZER, 2012). Moreover, using a meta-regression analysis (MRA), Iamsiraroj and Ulubaşoğlu (2015) conducted a review of 108 empirical studies using data from around the globe and reporting 880 regression estimates of the effects of FDI on growth, and indicate that the distribution of these estimates are such that 40% of those works find a statistically insignificant effect, 43% find a positive (and significant) effect and 17% find a negative and significant effect.[3] In face of these results, Iamsiraroj and Ulubaşoğlu (2015, p. 200) argue that the theoretical predictions about the positive effects of FDI for the host country might be optimistic and, as they do not receive full support from the data, it might be merely "wishful" thinking.

Given the briefly described processes and the inconclusions in specific literature, two important questions arise: does FDI affect development, measured by economic growth, of developing countries? If so, what causation mechanisms underlie the positive and negative, direct and indirect effects, that can be either theoretically derived or empirically observed?

[3] Iwasaki and Tokunaga (2014) present a similar analysis for transition economies, indicating that the results are mainly positive for the Central and Eastern Europe and former Soviet Union countries. Nevertheless, their results revealed that empirical evaluations of the effect of FDI on macroeconomic growth strongly depend on the study conditions, such as the estimation period, the data type, and the estimators used.

The main objective of this essay is to contribute to the literature by providing a better understanding of the relationship between FDI flows and economic growth for a specific case - the Brazilian economy. Although the intention of this essay is not to present definitive conclusions, we will seek to contribute in terms of suggestions for connections between FDI and the economic development of Brazil. In order to direct the econometric exercises of this essay, the first step to be made is to present an analytical review of the theoretical and empirical literature regarding the nexus between FDI and economic growth. In the first essay of this master's thesis (especially in Section 1.1), we presented an analytical review of the theoretical literature regarding the operation of some of the channels through which FDI can impact the economic growth of developing countries. That said, we still have to look at empirical literature in more detail.

In studies with cross-section data, the general suggestion is that the aggregate effect of FDI flows is positive on economic growth. Notwithstanding, this result seems to be conditional on certain factors that represent the "absorption capacity" of the recipient countries (HERZER et al., 2008). Blomstrom, Lipsey and Zejan (1994), using data for 78 developing countries, points to the heterogeneity of FDI results on economic growth in these countries according to observed per capita income. As the authors argue, there seems to be a certain "development threshold" from which recipient countries can take advantage of technology transfers from foreign direct investment. Another important factor for the positive aggregate result in the context of economic growth would be trade openness, as presented by Balasubramanyam, Salisu and Sapsford (1996) and Balasubramanyam, Salisu and Sapsford (1999), using data from 46 developing countries, indicating that countries with more extensive trade links received greater FDI flows and thus would be more able to take advantage of technology transfers than relatively closed countries.[4] In turn, Borensztein, De Gregorio and Lee (1998) draw on data from 69 developing countries and find that the aggregate effect of FDI flows on economic growth depends directly on the level of human capital existing in the host country (captured by the authors from the educational level of the population). Another "absorption condition" pointed out by the literature is a certain degree of development of the local financial markets, with Alfaro et al. (2004) presenting evidence that this condition has a strong importance in the aggregate effect of FDI flows in the context of economic growth. These studies, although having presented significant results, have some typical problems of the approach: difficulties to capture greater heterogeneity among the analyzed countries (it can be a representative effect in the indicated absorption conditions), possibly they can be very sensitive to the selection of countries in the sample (and, of course, to the year analyzed) and may incur in biased parameters, given the omission of variables (a characteristic of the heterogeneity

[4] This result could be related to a mostly positive effect on the balance-of-payments components, as discussed previously, having a positive effect on the long-run growth rate associated with external equilibrium (that is, balance-of-payments equilibrium).

of the countries analyzed) (HERZER et al., 2008). An issue that is also widely discussed is the possibility of reverse causality in these works, with greater economic growth being directly related to increases in FDI flows, an issue that, if left out, may point to the lack of identification in the estimated models. Hsiao and Shen (2003) and, more recently, Sengupta and Puri (2018) find evidence of the occurrence of double causality between these variables, but point out that this association seems to be an instrument of improvement in the economic growth of the developing countries analyzed in their samples.

Studies with panel data and time series econometrics, in turn, seem to be the solution to some of the problems presented in the previous case. This correction sometimes led to changes in the results found, such as the example of Carkovic and Levine (2005) who, from 5 years periods between 1960 and 1995 in a sample of 68 countries, did not find significant coefficients in the relationship between FDI and growth economic, even with representative control variables of the "absorption conditions" found in the previous literature. In a slightly different estimation, allowing greater heterogeneity in the coefficients of the explanatory variables and using data from 24 developing countries between 1971 and 1995, Nair-Reichert and Weinhold (2001) found a significant and positive mean effect of FDI flows on economic growth, although this relationship is quite heterogeneous among the different countries in the sample (the authors point to a possible evidence that the effect would be greater in more open economies). For the specific case of Latin America, Bengoa and Sanchez-Robles (2003) use a sample of 18 countries between 1970 and 1999 to point out a positive correlation between FDI and economic growth, but again indicate that recipient countries must have "adequate level of human capital", economic stability and trade openness to benefit from long-run capital flows. In a recent analysis for Latin America, Alvarado, Iniguez and Ponce (2017), using a panel for 19 countries for the period 1980-2014, find robust empirical evidence that suggests that the effect of FDI on economic growth is not statistically significant in aggregated form. This result, however, varies when the authors incorporate the levels of development reached by the countries in the region: FDI has a positive and significant effect on product in high-income countries, while in upper-middle-income countries (such as Brazil) the effect is non-significant, and in lower-middle-income countries, the effect is negative and statistically significant. Using cointegration techniques, Basu, Chakraborty and Reagle (2003) found evidence of double causality between FDI and economic growth for relatively open economies. In the case of more closed economies, the dominant long-term causality appears to be that of economic growth to FDI flows. Hansen and Rand (2006) also found a cointegration relationship between FDI and economic growth (measured by GDP growth), with evidence that the dominant long-run causality would be from FDI inflows to economic growth. Herzer (2012), in turn, finds a negative and significant effect of FDI on economic growth for a large sample of developing countries, also not finding significant effects after using control variables that are representative of the countries' "absorption conditions".

In addition, using data from a global sample of 140 countries over the period 1970 to 2009, Iamsiraroj and Ulubaşoğlu (2015) empirical analysis (exploiting the implied model from the MRA discussed earlier in this section) suggests that voluntary exchanges reflected in FDI do generate economic growth. Moreover, the results indicate that FDI–growth relationship exhibits stronger within-region variation than within-country variation and that robust "absorptive capacity" variables are financial development and trade openness. Iamsiraroj (2016), in turn, investigates the linkage between FDI inflows and per capita income growth by using simultaneous system of equations approach of 124 cross-country data for the period 1971–2010 and the results indicate that FDI is associated with higher rates of economic growth and vice versa. Nevertheless, these results are quite region-specific as, for instance, FDI inflows are positively related to GDP growth for North America and Western Europe but negatively related to the economic growth of Latin American countries.

Looking at the empirical work at the firm and sector level, with greater interest now in the relations of capital transfer and spillover effects, most results for developing countries cast some doubt on the occurrence of productivity increases (HADDAD; HARRISON, 1993; AITKEN; HARRISON, 1999; DJANKOV; HOEKMAN, 2000; KONINGS, 2001). Javorcik (2004) argues that these results would be related to the design of these studies, which are quite focused on spillovers within the same sector of activity, pointing to a greater importance of vertical spillovers, as in the case of backward linkages. The results found by the author go along with other similar works for developing countries, with a positive spillover effect at the inter-sector level, but without significant results at the intra-sector level (BLALOCK, 2001; SCHOORS; TOL, 2001). Moreover, in a recent study, Javorcik, Turco and Maggioni (2018) examine whether multinational activity can boost the sophistication of the host country's production structure, measured by the complexity (following Hidalgo and Hausmann (2009)) of products newly introduced by firms. Using firm-product level data from the Turkish manufacturing sector for the period 2006–2009, their findings are consistent with interactions between multinational firms and their Turkish suppliers facilitating product upgrading by the latter group. Furthermore, the authors do not find evidence of spillover effects from FDI presence in the same or upstream sectors. Their conclusions support the view that attracting inflows of FDI may catalyze upgrading the national production structure in a developing economy and, also, that FDI can be a force for intra-national convergence as smaller and less sophisticated firms appear to benefit more from the knowledge brought by foreign investors.

By way of conclusion, an interesting point and relatively not quite addressed by the empirical literature concerns the income distribution channel. Choi (2006) finds greater income inequality in economies where the FDI/GDP ratio is higher. Basu and Guariglia (2007) points to the trade-off between promoting growth related to FDI inflows

and increasing inequality. Herzer, Hühne and Nunnenkamp (2014), in turn, point to the evidence of significant coefficients for the relationship between FDI and income inequality, with no evidence of reverse causality. Besides, Adams and Klobodu (2017) present, looking to several countries in sub-Saharan Africa, recent empirical evidence suggesting that FDI increases income inequality in both the short and long run.

As the main goal of this essay is to understand the relationship between FDI flows and economic growth for the Brazilian economy, seeking to identify some of the relations underlying the operation of the five channels presented by the theoretical and empirical literature, it is necessary to present a brief review of the existing evidence for the Brazilian case.

Laplane and Sarti (1999) indicate that, although FDI flows might represent an important source of foreign exchange entry (that is, might have a positive effect on the balance-of-payments result), the presence of foreign firms in Brazil do not benefit the trade balance of the economy and, consequently, might not alter the external constraint. This constraint might be directly related to the possibilities of long-run sustained growth (in a framework *a la* Thirlwall) and, therefore, FDI flows do not seem to alter the economic development, measured by the long-run economic growth, of the Brazilian economy in this context. Moreover, Sarti and Laplane (2002) point, when analyzing the process of productive internationalization in Brazil, to a negative macroeconomic result of FDI flows with the worsening of the trade balance (increase in import needs without the counterpart of exports by foreign firms) and the increase in the external liabilities of the economy, although the result in terms of competitiveness (microeconomic) has been positive.

Besides, De Negri (2003) analyzed the performance of domestic and foreign (TNCs) firms regarding their contribution to the Brazilian trade balance during the period between 1996 and 2000 and found evidence that TNCs seem to be more integrated in international markets than domestic companies. Nevertheless, this larger integration is associate with increased imports rather than exports. Fernandes and Campos (2008) also analyzed the relationship between FDI and the Brazilian exports during the period 1995-2000, finding evidence that industries with higher exporting capacities and higher volumes of trade are those that have received less FDI flows. In turn, the sectors with low expression in exports or imports and the sectors that present trade deficits are those that have received the largest volume of these capital flows. In terms of external balance, this behavior becomes worrying, since the sectors with the greatest destination of FDI flows do not have a positive relationship with the growth of exports and, moreover, might also be related to growing imports. Moreover, Calegário, Bruhn and Pereira (2014), testing the effects of FDI on both export and import equations of 11 Brazilian industries for the period 1996-2009, find evidence of a positive relationship between FDI and increased exports in the short run. However, in the long run, this positive relationship only occurs for export-oriented

industries. Regarding imports, the results indicate a positive relationship with FDI flows in the short run and a negative one in the long run.

Looking to the recent growth in the economic relations between Brazil and China, Hiratuka and Sarti (2016) analyze bilateral direct investment, and the results highlight the disparity of amounts invested and the fact that investment flows tend to strengthen the trade patterns established between the two countries - that is, those flows tend to reinforce the role of the Brazilian economy as a commodity exporter. It is important to note that, as discussed in the first essay of this thesis (in Section 1.4), this composition of the basket of exported goods might be related to lower values for the income elasticity of exports and, therefore, to a tighter external constraint in the long run. Thus, this bilateral direct investment might be related to the ratio of income elasticities of international trade and, as largely discussed in this thesis so far, to patterns of uneven development.

Moreover, Silva Filho (2015) argues that the pro-cyclical trajectory of FDI in relation to GDP suggests a concentration of inflows to sectors aimed at domestic consumption, in addition to the commodities sectors. In both cases, the pattern of investment of the foreign companies denotes a pattern of international insertion of the country that may reveal deleterious characteristics from the point of view of global value chains. By limiting itself to the production of final goods and services or basic inputs, foreign capital can induce a pattern of international trade that keeps Brazil at the margin of global value chains, whose opportunities demand greater emphasis on the production and trade of intermediate goods.

Furthermore, Bonelli (1999) argues that although there seems to be a supposition that FDI has contributed to increased productivity and competitiveness in Brazil, the empirical evidence is not quite clear. Even that there might be a positive relation between FDI flows and growing competitiveness in some industries (measured by unit labor costs or export performance), this relationship does not apply to several other industries. Analyzing the technological capabilities in the Brazilian industry, comparing domestic and foreign firms, Costa and Queiroz (2002) find evidence that both types of firms present shallow capabilities for locally generating technologies. However, foreign firms appear to have a higher capacity of accumulating more complex capabilities, confirming their centrality in the Brazilian learning system.

In recent works regarding spillover effects for the Brazilian economy, both Jorge and Dantas (2009) and Souza and Pinto (2015) find robust empirical evidence of a negative or non-significant relationship between FDI and sectoral productivity, even though the interaction between FDI and human capital points to a positive relationship on productivity, which would be in line with the arguments presented in the literature. These works focused their analysis on the relations between different sectors of the Brazilian economy, using panel data methodologies, but they present, as a difficulty, the little time availability of the

data. The effort that will guide the econometric exercises of this essay differs from previous contributions by designing a case study for the Brazilian economy based on aggregated data, that is, looking at the macroeconomic effects of FDI flows to Brazil observed in the last decades. The case studies, as pointed out by Javorcik (2004), are quite informative in the analysis of the channels of interest, mainly the technological changes (aggregate productivity) and the total effect on the real GDP growth rate, but they lack generality. Despite this caveat, the choice of this method is closely related to the possibilities of better understanding the operation of the channels described in the literature, in particular by enabling empirical tests to analyze the importance and the aggregate effect of FDI flows on capital accumulation, technological change, balance-of-payments components and, especially, income distribution.

Our main results in this essay point to a positive relationship between FDI flows and Brazilian economic activity in the short term, as well as a positive relationship between FDI flows, aggregate productivity and the real product growth rate in the long run. Despite these positive effects, an important caveat appears in our analysis: when we take into account the effects of such capital flows on income distribution, in both functional and personal context, we find evidence of a certain trade-off between promoting economic growth related to FDI flows (especially through increases in the growth rate of aggregate productivity) and increases in income inequality. These effects on income distribution seem to be related to the net effects of FDI flows on the Brazilian trade balance which, especially indicating a negative relationship between these variables in the long run - a connection that represents a tightening of the external constraint and, therefore, might indicate limited possibilities of economic growth associated with balance-of-payments equilibrium. It is important to highlight that these results, although far from intended to be conclusive, can support specific discussions on the relationship between FDI, domestic investment, trade balance, income distribution, and economic growth in Brazil.

To achieve the proposed objectives, this essay consists of four more sections. In Section 3.2, we make a brief presentation of the methodology that will be used in the empirical exercises of this essay - multivariate methods for time series. In Section 3.3, we present an empirical exercise for the Brazilian economy focused on shorter-term relationships between the variables, seeking to capture the operation of the channels through which FDI can affect Brazil's economic growth using monthly series. Section 3.4 presents a similar empirical exercise, but now looking at long-run relationships between variables, using annual data for a long period. Finally, 3.5 presents the conclusions and shed light on some possible advances in future studies.

3.2 Methodology

After presenting the question of interest in the brief introduction of this essay, we now move on to a discussion about the methodology to be used in subsequent empirical exercises. In short, we will deal here with several multivariate analyses of time series.

When studying economic time series that co-evolve over time, we are usually faced with questions such as: which one is determining the other? Or rather, which is causing which? The concept of causality in bivariate systems was initially introduced by Granger (1969), where the definition of "Granger causality" is elaborated, as currently used in the literature. Formally, we say that a variable X_t "Granger-causes" Y_t if we are better able to predict Y_t using all available information than if we did it without the information present in X_t. A Y_t variable is then considered endogenous when it is caused (in Granger's sense) by some other. To study the relationship between two or more time series that can be, *a priori*, endogenous, there are two elementary methods: that of autoregressive vectors (henceforth, VAR) and the error correction vector (henceforth, VEC). These two methods differ mainly due to the existence or not of cointegration between the variables, a concept that will be further developed below.

The method of estimating multivariate times series models in a VAR system was initially developed by Sims (1972) and is recommended to describe the dynamic relationship between two or more stationary variables over time. Therefore, the first step when dealing with time series is to analyze the (weak) stationarity of the series in question. If a series is integrated of order d - henceforth, I(d) - it is sufficient to differentiate it d times so that it becomes stationary and, therefore, we use this differentiated series to estimate the VAR. However, the series differentiation method may not be the most suitable for treating non-stationary variables in a multivariate context, since it becomes possible for some linear combination of the integrated series to be stationary, so that the variables are said to be co-integrated.

As formally defined by Granger (1986) and Engle and Granger (1987), the components of a vector $x_t = (x_{1t}, x_{2t}, \ldots, x_{nt})'$ are said to be co-integrated if all components of the x_t vector are integrated of order d and there is a coefficient array $\beta = (\beta_1, \beta_2, \ldots, \beta_n)$ so that

$$\beta' x_t = \beta_1 x_{1t} + \beta_2 x_{2t} + \ldots + \beta_n x_{nt}$$

is integrated of order $(d - b)$, where $d \geq b > 0$ and β is said to be a cointegration vector. Cointegration means that, although other mechanisms cause permanent changes in the individual elements of x_t, there is some long-run equilibrium relationship by tying individual components of the series, represented by the linear combination $\beta' x_t$. The β cointegration vector, however, is not unique: if β is a cointegration vector, then, for every $a \in \mathbb{R}^*$, $a\beta$ will also be a cointegration vector. An arbitrary normalization of matching the

first element of β to one is usually done to solve this problem.

The error correction vector (VEC) is, then, an adaptation of the VAR method for when the series analyzed are not stationary in level (but are in first difference) and a cointegration relationship can be established between them. Although the VAR in differences is not consistent in cointegrated series, its version in level can be, resulting in a vector of error correction. Suppose that two variables Y_t and X_t are I (1) and cointegrated. Normalizing the coefficient referring to Y_t to 1, we have that the error correction vector can be written as:

$$e_t = Y_t - \alpha_0 - \alpha_1 X_t$$

and it is stationary - I (0) -, by the definition of cointegration. The deviations from this equilibrium relationship between Y_t and X_t are ,then, represented exactly by the error correction vector e_t. After estimating this vector $\widehat{e}_t$, we can insert it in the usual difference VAR equation, in which the coefficients related to the differentiated variables are understood as short-term effects, while the vector of correction of errors symbolizes the long-term relationship between them.

Following these procedures, two exercises were carried out to study the relationship between FDI and economic growth for the Brazilian economy, trying to identify the operation of several of the channels pointed out in the literature and widely analyzed in this master's thesis. First, we look to an econometric exercise focused on the operation of such channels with monthly data.

3.3 A monthly data analysis

The initial focus of this section will be on specifying the data to be used, as well as its limitations and the possible scope of this short-run analysis. At the outset, it is worth reiterating that the analytical review of the theoretical literature regarding the channels through which FDI can affect economic growth in underdeveloped countries pointed to some possible relations of interest to be dealt with empirically. In particular, we would like to address variables related to the following channels: i) balance of payments components, mainly the trade and services balance; ii) technological change; iii) capital accumulation; iv) sectoral composition of output and employment (income distribution); v) market structure and, of course, the aggregate result on the economic development measured by the GDP.

With this interest in mind, the effort here aims at building a database with variables that could capture the proposed relationships, always bearing in mind the serious restriction of observations for the Brazilian case. Aiming at an analysis with statistically robust results, the option for data with monthly frequency for this short-run econometric exercise seemed the best choice given the relatively short period of data availability. Therefore, for all

series of interest, the treatment will be for the period between January 2005 and March 2020. In practical terms, we will work with 183 observations for each variable. Within these specifications, unfortunately, it was not possible to build any variable directly related to the market structure channel, that is, competition (concentration) in the sectors that received FDI flows.

The variables that compose our database for this short-run econometric exercise are presented in Appendix C, with a list of variables describing names, definitions, and the sources of each time series.[5]

The first step of this exercise is to analyze the behavior of the time series regarding their stationarity. This step is related to the execution of unit root tests in all the economic series covered. In more detail, we perform two types of tests for each of the variables: the ADF test (Augmented Dickey-Fuller test, following Dickey and Fuller (1979) and Dickey and Fuller (1981)), with the null hypothesis of the existence of a unit root in the series, and the KPSS test (developed by Kwiatkowski et al. (1992)), which has a null hypothesis of stationarity of the series. The choice of this combination of tests was due to the scope of the treatment of two different null hypotheses (different perspectives), which potentially guarantees greater safety and robustness in the analysis of the results.

The results of the unit root tests are presented in Appendix C. The analysis of unit root tests indicated, in general, that the variables treated in this exercise seem to present a stochastic tendency in level but seem to be weakly stationary in their first difference. Thus, in summary, we can consider that all variables in our analysis are integrated of first degree, that is, I(1).[6]

It is worth remembering that our interest, in this econometric exercise, is to capture relationships among the variables of interest, always bearing in mind the possible mechanisms or channels through which the FDI can affect the economic growth of the Brazilian economy. Therefore, the first modeling attempt would be to analyze the variables together in the context of a VAR model. Nevertheless, in this type of model, an important hypothesis that should be tested, especially given our interest, is the existence of a long-term relationship between the variables treated - that is, cointegration relations. To test the existence of this or these cointegration vectors, the next step that we will follow in this exercise is to estimate several VARs for the levels of the variables in our database. The endogenous variables are represented by a vector Y_t and, thus, the model VAR(p) to

[5] See Table 45. Data from the Central Bank of Brazil (BCB) was obtained from the Time Series Management System (SGS-BCB) and data from the Institute for Applied Economic Research (IPEA) was obtained from IPEA Data.

[6] Although the ADF test has suggested the rejection of the null hypothesis for some of the series analyzed (in level), the KPSS test did not allow us to draw similar conclusions. Thus, we consider the indication that all the economic series in this exercise seem to have a stochastic tendency in level.

be estimated is (where p is the number of lags included):

$$Y_t = A_1 Y_{t-1} + A_2 Y_{t-2} + \ldots + A_p Y_{t-p} + \delta Z_t + \varepsilon_t \tag{3.1}$$

where A_i, $i \in \{1, \ldots, p\}$, are vectors of coefficients (dimension $K \times K$, where K is the number of endogenous variables), δ is a $M \times M$ (where M is the number of exogenous variables) vector of parameters, Z_t is a vector of exogenous control variables and ε_t is a K-dimensional stochastic process with $E[\varepsilon_{t-j}] = 0$, $\forall j \in T$, and positive definite and time-invariant covariance matrix $E[\varepsilon_{t-j}\varepsilon'_{t-j}] = \Sigma_t$ (that is, ε_t is a white noise process) (LÜTKEPOHL, 2005).

With the estimation of the VAR models for the variables' level, adding the lag terms indicated by the information criteria, we can then proceed to the cointegration tests. Even so, it is also worth pointing out that the estimated VAR models also include some exogenous variables: one constant, eleven monthly "dummies" (the month of December was excluded) to deal with seasonality, the growth rates of the real exchange rate and the commodities index. The last two variables were introduced as control for some of the phenomena observed in the Brazilian economy in the last two decades and that could had interfere in a better understanding of the effects of FDI, through their respective channels of operation, on the economy. Once the estimated models are explained, we then proceed to the cointegration tests (trace and maximum eigenvalue), following the specifications of Johansen (1991) and looking at all possible models.[7]

Thus, depending on the result of the cointegration test, we will estimate a VEC model (taking into account the presence of long-term relationships between the variables) or a VAR model for the first difference of the variables. The VEC model and the VAR model for the first difference can be represented, respectively, by Equations 3.2 and 3.3 (LÜTKEPOHL; KRÄTZIG; PHILLIPS, 2004; LÜTKEPOHL, 2005).

$$\Delta Y_t = \alpha\beta' Y_{t-1} + A_1 \Delta Y_{t-1} + A_2 \Delta Y_{t-2} + \ldots + A_p \Delta Y_{t-p} + \delta Z_t + \varepsilon_t \tag{3.2}$$

where ΔY_t represents the first difference of Y_t, α is the short-run adjustment vector and β is the cointegration vector (long-term relationships).

$$\Delta Y_t = A_1 \Delta Y_{t-1} + A_2 \Delta Y_{t-2} + \ldots + A_p \Delta Y_{t-p} + \delta Z_t + \varepsilon_t \tag{3.3}$$

For the first case, we will focus our analysis on the cointegration relationship, the Granger causality test and, especially, on the impulse response functions (henceforth, IRF). In

[7] The outputs of the Johansen's cointegration tests present the results for five possible models. Model 1 includes no intercept or trend in the cointegration vector and in VAR. Model 2 includes an intercept term in the cointegration vector but no intercept in VAR. Model 3 includes intercepts in the cointegration vector and in the VAR. Model 4 includes intercept and trend in the cointegration vector and no intercept in the VAR. Model 5 includes intercepts in the cointegration vector and in the VAR, and a trend term in the cointegration vector. The number of cointegration vectors by Model is selected at 0.05 level of significance.

the case of the VAR models, we examine the Granger causality tests to try to capture relations of temporal precedence between the variables of interest, and we will also look at the impulse response functions.[8]

Seeking to understand the relationships between the FDI and the several variables that relate to the channels highlighted in the literature, the analysis of this section (using the methodology already discussed) will be divided into some subsections in which we will make estimates for relationships between two or three variables as we will discuss the results. So let's move on to the relationship between FDI and trade balance.

3.3.1 FDI and trade balance

In the balance-of-payments components channel, a possibility pointed out in the literature is a decrease in imports coming from domestic production of final and intermediate goods by foreign companies in the country and an increase in exports due to the expansion of trade relations with the countries of origin of capital flows (market opening argument). As pointed out by Duttaray, Dutt and Mukhopadhyay (2008), these results could then increase the long-run equilibrium growth rate determined by the external constraint (or the balance-of-payments constraint). On the other hand, another possible effect of the entry of foreign firms is that of increased imports of capital and intermediate goods (if the domestic market is not competitive or does not exist in these sectors) which, coupled with a delay in significantly improving exports (due to the existence of institutional constraints) may actually lead to a negative aggregate balance-of-payments result and thus intensify the external constraint of developing economies (JENKINS, 2013).

Faced with these arguments, an interesting empirical question emerges: what, in fact, is the relationship between FDI and the trade balance in the Brazilian economy? In this point, as discussed earlier in this essay, Laplane and Sarti (1999) and Sarti and Laplane (2002) indicate a negative macroeconomic result of FDI flows with the worsening of the trade balance (increase in import needs without the counterpart of exports by foreign firms) for the Brazilian case.

With that in mind, let us look at the monthly data regarding these two variables to address the question. Table 10 presents the results for the Johansen's cointegration test. Note that the number of lags described are the ones selected for the estimation of the VAR model for the variables' levels. For the first two VARs estimated, for FDI (equity) and trade balance and, FDI (equity) and trade and services balance, the general evidence is that there are not cointegration relations between the variables. Thus, in those cases, we proceed to the estimation of VAR models for the first difference of the variables (including 5 lags and the exogenous variables). Nevertheless, for the third specification

[8] It is worth saying that all the models estimated in this econometric exercise using monthly data are stable, that is, the inverse roots of the autoregressive characteristic polynomial lie inside the unit circle.

examined, with FDI (equity), exports, and imports, there is evidence of the existence of one cointegration relation. Therefore, we estimate a VEC model for this case (including 3 lags and the exogenous variables).

Variables Selected lags (VAR)	Test type	Number of cointegration relations				
		Model	1	2	3	4	5
FDI and trade balance	Trace		0	1	0	0	0
6 lags	Max-Eig		0	1	0	0	0
FDI and trade and services balance	Trace		0	0	0	0	0
6 lags	Max-Eig		0	1	0	0	0
FDI, exports and imports	Trace		1	2	1	1	1
4 lags	Max-Eig		1	2	1	1	1

Table 10 – Cointegration relations - FDI (capital participation) and trade balance

It is worth indicating that we present the tests regarding the behavior of the residuals of each estimation in the Appendix C. In summary, the residuals of the three estimations examined in this section do not present autocorrelation problems. Nevertheless, regarding the Jarque-Bera normality test, although the residuals associated with the first difference of the trade balance, trade and services balance, and, imports and exports have a distribution similar to a normal, the same cannot be said about the residuals of FDI flows variations. Therefore, we will continue our analysis in this subsection keeping in mind that the residuals associated with one of the variables of interest in our estimates do not present third and fourth moments close to the normal distribution.

First, let us examine the estimation of the VAR (5) model with FDI and trade balance as endogenous variables. Table 11 presents the Granger-causality test for this specification. The results indicate that neither the variations of FDI nor the variations of trade balance "Granger-cause" each other, that is, there is not a temporal precedence relation between the two variables.

Second, regarding the impulse response functions, we analyze the results for two different orderings for the shocks (following a Cholesky decomposition). First, Figures 16 and 17 presents, respectively, the IRF and the accumulated IRF for the ordering in which the variations of FDI are affected only by their own shocks in the first period, whilst trade balance variations are affected by FDI shocks as well as their own shocks (that is, $D(IDPPC) \longrightarrow D(BC)$).[9] [10]

[9] It is important to say that we omitted the responses of the variables for their own shocks to make the analysis cleaner.

[10] For all IRFs presented in this essay, we consider shocks of two standard deviations of magnitude.

Dependent variable: D(IDPPC)			
Excluded	Chi-sq	df	Prob.
D(BC)	4.836495	5	0.4362
All	4.836495	5	0.4362

Dependent variable: D(BC)			
Excluded	Chi-sq	df	Prob.
D(IDPPC)	3.387229	5	0.6405
All	3.387229	5	0.6405

Table 11 – Granger causality test - FDI and trade balance

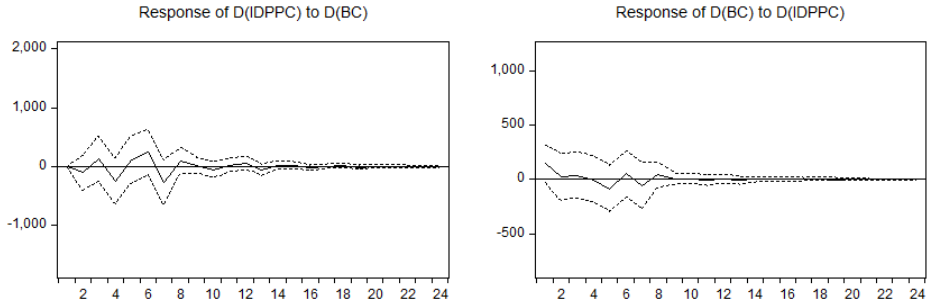

Figure 16 – Impulse-response functions - FDI and trade balance - First ordering

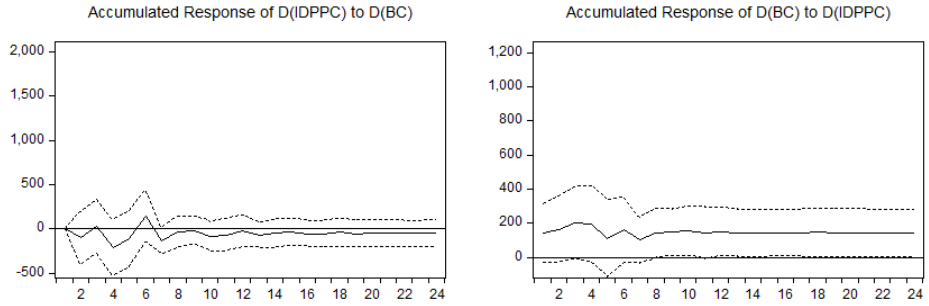

Figure 17 – Accumulated impulse-response functions - FDI and trade balance - First ordering

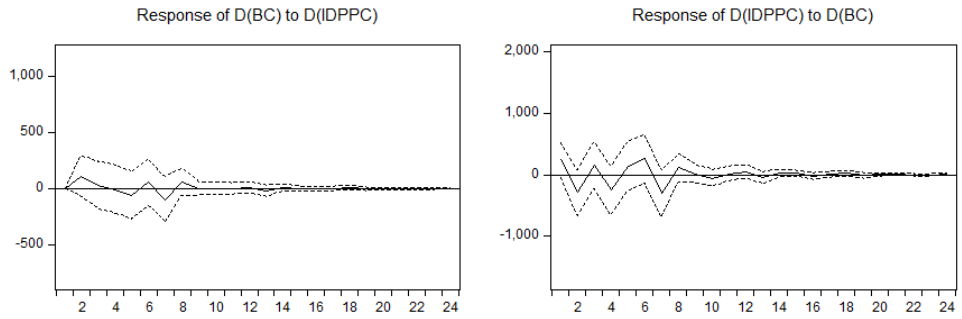

Figure 18 – Impulse-response functions - FDI and trade balance - Second ordering

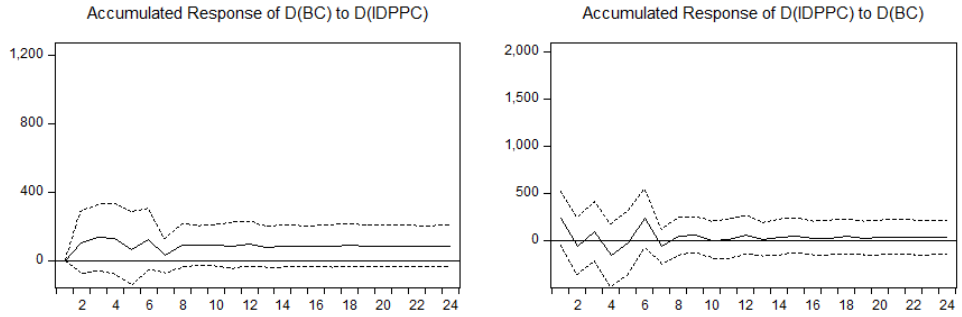

Figure 19 – Accumulated impulse-response functions - FDI and trade balance - Second estimation

The results indicate that shocks in trade balance variations do not affect FDI variations. On the other hand, it is clear from the IRFs that shocks in FDI variations have a positive effect (although might be small) on trade balance variation between the 8th and 14th month after the shock. This means that, at least regarding exports and imports of goods, increases in FDI flows seem to have a positive effect on variations of the Brazilian trade balance for a certain period.

On the other hand, Figures 18 and 19 presents, respectively, the IRF and the accumulated IRF for the ordering in which the variations of trade balance are affected only by their own shocks in the first period, whilst FDI variations are affected by trade balance shocks as well as their own shocks (that is, $D(BC) \longrightarrow D(IDPPC)$).

The results corroborate the earlier findings, indicating that shocks in trade balance variations do not affect FDI variations. However, shocks in FDI variations have no effect on trade balance variations as well. Thus, it is clear that the result found for the first ordering does not appear in this second specification, which indicates that the result is not quite robust (at least for variations in the Choleksly decomposition).

Going further, let us examine the estimation of the VAR (5) model with FDI and trade and services balance as endogenous variables. Table 12 shows the Granger-causality

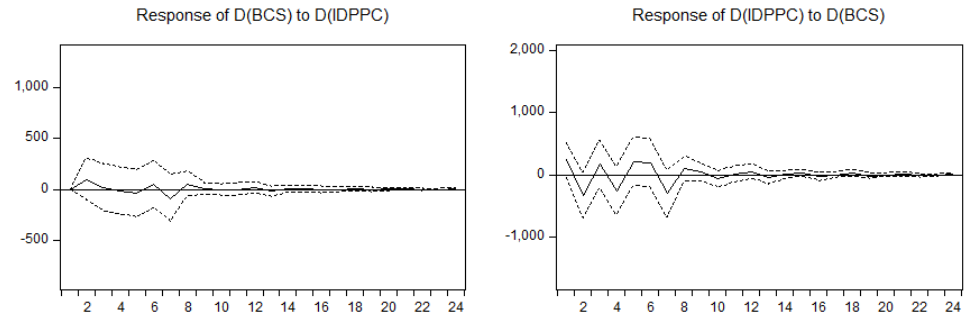

Figure 20 – Impulse-response functions - FDI and trade and services balance - First ordering

test for this specification. Again, the results indicate that neither the variations of FDI nor the variations of trade and services balance “Granger-cause" each other, that is, there is not a precedence relation between the two variables.

Dependent variable: D(BCS)

Excluded	Chi-sq	df	Prob.
D(IDPPC)	2.058569	5	0.8410
All	2.058569	5	0.8410

Dependent variable: D(IDPPC)

Excluded	Chi-sq	df	Prob.
D(BCS)	5.310237	5	0.3792
All	5.310237	5	0.3792

Table 12 – Granger causality test - FDI and trade and services balance

In this case, we analyze the results of impulse response functions for two different orderings for the shocks. First, Figures 20 and 21 presents, respectively, the IRF and the accumulated IRF for the ordering in which the variations of trade and services balance are affected only by their own shocks in the first period, whilst FDI variations are affected by trade balance shocks as well as their own shocks (that is, $D(BCS) \longrightarrow D(IDPPC)$).

Our findings suggest that shocks in trade and services balance variations do not affect FDI variations and shocks in FDI variations have no effect on trade and services

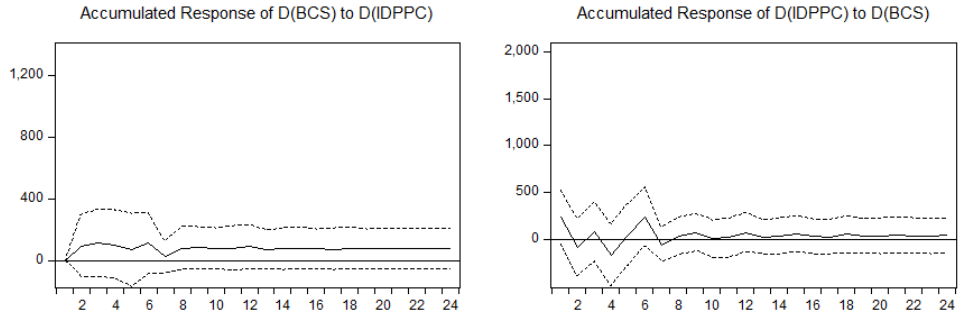

Figure 21 – Accumulated impulse-response functions - FDI and trade and services balance - First ordering

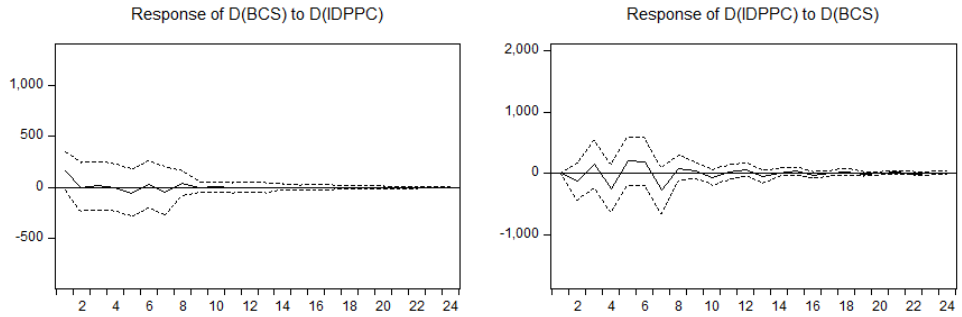

Figure 22 – Impulse-response functions - FDI and trade and services balance - Second ordering

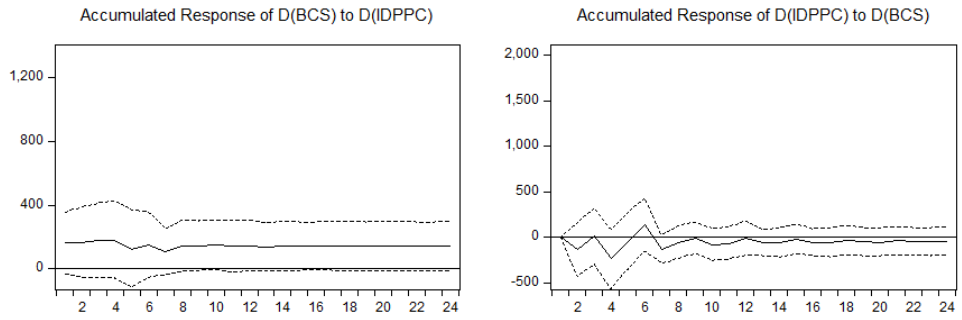

Figure 23 – Accumulated impulse-response functions - FDI and trade and services balance - Second estimation

balance variations as well.

On the other hand, Figures 22 and 23 presents, respectively, the IRF and the accumulated IRF for the ordering in which the variations of FDI are affected only by their own shocks in the first period, whilst trade and services balance variations are affected by trade balance shocks as well as their own shocks (that is, $D(IDPPC) \longrightarrow D(BCS)$).

For this second ordering of the shocks, the results are similar to the previous case. Thus, the general evidence here is that it does not seem to exist a relationship between

FDI flows variations and trade and services balance in the short run for the Brazilian economy.

Looking now at the specification with exports and imports as separate components, first, it is important to remember that, in this case, we are considering a VEC model, since we found a cointegration relation between the variables. Therefore, we first examine the estimation of the VEC model to analyze the long-term relationship between the variables. Table 13 presents the output of this estimation.

Qualitatively, the most relevant results from the previous estimation are related to long-term relationships, that is, the coefficients within the cointegration vector. It is direct to see that, with the normalization proposed (for IDPPC), the coefficients indicate that exports are positively related to FDI flows in the long run, and imports are negatively related to these capital flows. In the VEC, the adjustment coefficients, α (represented by "CointEq1" in the output), associated with the short-term relationships present the expected signs (the "inverse" of the signs of the cointegration vector) and are statistically significant for FDI variations and the growth rate of exports. Moreover, although the sign of the coefficient associated with the growth rate of imports is not the expected, it is not statistically significant.

Beyond that, Table 14 presents the Granger-causality test for this specification. The results show that the growth rate of imports and the variations of FDI flows are not "Granger-caused" by any other variables. However, there is evidence that the growth rate of exports might be preceded by the growth rate of imports and FDI flows variations (at least at 0.10 level of significance).

Moreover, Figures 24 and 25 presents, respectively, the IRF and the accumulated IRF for the ordering of the shocks in which the variations of FDI flows are affected only by their own shocks in the first period, whilst the growth rate of imports is affected by FDI variations shocks, as well as its own shocks and the growth rate of exports, is affected by all shocks in the first period (that is, $D(IDPPC) \longrightarrow D(LM) \longrightarrow D(LX)$).[11]

The results indicate that shocks in the growth rate of imports and exports do not impact the variations of FDI flows for the periods analyzed and FDI variations shocks do not impact the growth rate of imports. Nevertheless, we find evidence that the growth rate of exports has a positive response for FDI flows variations in (and only in) the first period.

Figures 26 and 27 present, respectively, the IRF and the accumulated IRF for the second ordering, in which the growth rate of imports is affected only by its own shocks in the first period, whilst the growth rate of exports are affected by trade balance shocks as well as its own shocks and the variations of FDI flows are affected by all shocks in the first

[11] Again, we omitted the responses of variables to their own shocks as well as the interactions between exports and imports. The reason for such omission is only to simplify our analysis.

Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1		
IDPPC(-1)	1.000000		
LX(-1)	−18072.01 (3681.38) [-4.90904]		
LM(-1)	7454.559 (2481.87) [3.00360]		
C	100418.3		
Error Correction:	**D(IDPPC)**	**D(LX)**	**D(LM)**
CointEq1	−0.238444 (0.11578) [-2.05942]	$1.29E-05$ $(4.7E-06)$ [2.75874]	$6.72E-08$ $(5.2E-06)$ [0.01289]
D(IDPPC(-1))	−0.569075 (0.12111) [-4.69900]	$-9.35E-06$ $(4.9E-06)$ [-1.91555]	$-2.96E-06$ $(5.5E-06)$ [-0.54272]
D(IDPPC(-2))	−0.337479 (0.11297) [-2.98732]	$-2.61E-06$ $(4.6E-06)$ [-0.57259]	$3.61E-07$ $(5.1E-06)$ [0.07092]
D(IDPPC(-3))	−0.168358 (0.08637) [-1.94928]	$-3.88E-06$ $(3.5E-06)$ [-1.11652]	$-4.69E-06$ $(3.9E-06)$ [-1.20562]
D(LX(-1))	−3089.461 (2728.86) [-1.13214]	−0.222670 (0.10993) [-2.02551]	0.271586 (0.12290) [2.20988]
D(LX(-2))	−659.9825 (2793.75) [-0.23624]	−0.066230 (0.11255) [-0.58846]	0.043431 (0.12582) [0.34519]
D(LX(-3))	−2592.593 (2504.33) [-1.03525]	0.056723 (0.10089) [0.56224]	0.061611 (0.11278) [0.54627]
D(LM(-1))	3149.223 (2201.45) [1.43052]	−0.040010 (0.08869) [-0.45114]	−0.536683 (0.09914) [-5.41317]
D(LM(-2))	348.2136 (2473.75) [0.14076]	−0.059488 (0.09966) [-0.59693]	−0.205881 (0.11141) [-1.84800]
D(LM(-3))	2055.169 (2230.45) [0.92142]	0.186310 (0.08985) [2.07347]	0.206203 (0.10045) [2.05279]
C	890.9979 (539.621) [1.65115]	0.029158 (0.02174) [1.34128]	−0.083683 (0.02430) [-3.44342]
@MONTH=1	−1226.511 (802.166) [-1.52900]	−0.242730 (0.03232) [-7.51125]	0.052434 (0.03613) [1.45140]
@MONTH=2	−2446.364 (867.582) [-2.81975]	−0.110138 (0.03495) [-3.15123]	0.056139 (0.03907) [1.43680]
@MONTH=3	52.10377 (886.416) [0.05878]	0.138010 (0.03571) [3.86479]	0.201678 (0.03992) [5.05200]
@MONTH=4	−1049.924 (1012.29) [-1.03718]	0.004836 (0.04078) [0.11859]	0.038650 (0.04559) [0.84780]
@MONTH=5	−943.1355 (903.180) [-1.04424]	0.099671 (0.03638) [2.73935]	0.168500 (0.04068) [4.14255]
@MONTH=6	−155.6359 (935.455) [-0.16637]	−0.018687 (0.03769) [-0.49587]	0.046877 (0.04213) [1.11271]
@MONTH=7	−960.9866 (792.482) [-1.21263]	0.050175 (0.03193) [1.57162]	0.189146 (0.03569) [5.29968]
@MONTH=8	−1236.935 (827.644) [-1.49452]	−0.012718 (0.03334) [-0.38143]	0.118159 (0.03727) [3.17004]
@MONTH=9	−903.5247 (754.793) [-1.19705]	−0.038457 (0.03041) [-1.26473]	0.074900 (0.03399) [2.20340]
@MONTH=10	−808.5583 (753.399) [-1.07321]	−0.054010 (0.03035) [-1.77951]	0.091188 (0.03393) [2.68753]
@MONTH=11	−1338.658 (729.937) [-1.83394]	−0.104496 (0.02941) [-3.55361]	0.051058 (0.03287) [1.55317]
GRER	−4235.441 (4998.86) [-0.84728]	−0.255200 (0.20138) [-1.26725]	−0.473269 (0.22513) [-2.10222]
GRCOM	10023.35 (5478.40) [1.82961]	−0.052917 (0.22070) [-0.23977]	0.095589 (0.24672) [0.38743]

Table 13 – Estimation output - Cointegration: FDI, exports and imports

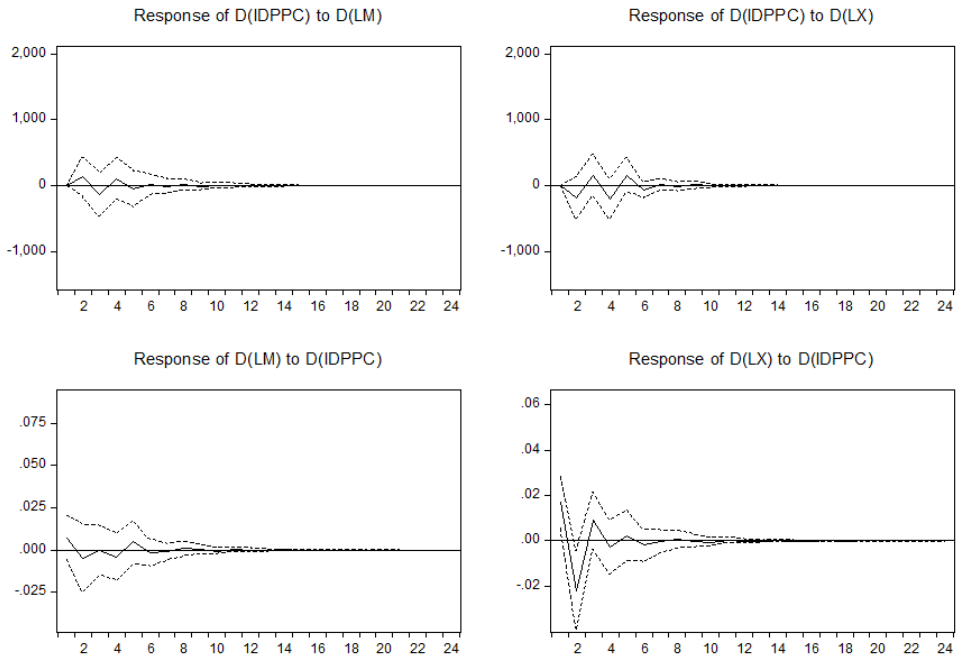

Figure 24 – Impulse-response functions - FDI, exports and imports - First ordering

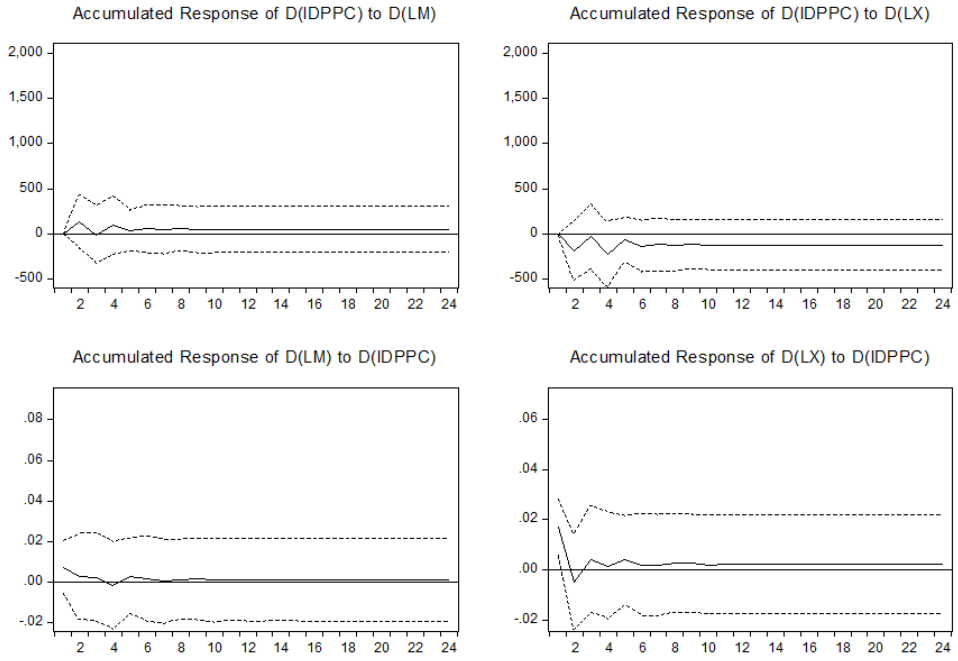

Figure 25 – Accumulated impulse-response functions - FDI, exports and imports - First ordering

Dependent variable: D(IDPPC)

Excluded	Chi-sq	df	Prob.
D(LX)	2.671787	3	0.4450
D(LM)	3.739227	3	0.2910
All	4.455681	6	0.6153

Dependent variable: D(LX)

Excluded	Chi-sq	df	Prob.
D(IDPPC)	6.561300	3	0.0873
D(LM)	7.710081	3	0.0524
All	16.08667	6	0.0133

Dependent variable: D(LM)

Excluded	Chi-sq	df	Prob.
D(IDPPC)	3.806992	3	0.2831
D(LX)	6.022642	3	0.1105
All	9.122595	6	0.1668

Table 14 – Granger causality test - FDI, exports and imports

period (that is, $D(LM) \longrightarrow D(LX) \longrightarrow D(IDPPC)$).

Our findings for this second ordering suggest that shocks in the growth rate of imports do not impact the variations of FDI flows for the periods analyzed, although shocks in exports growth rate does have a positive impact. Also, FDI variations shocks do not impact the growth rate of imports. Nevertheless, we find evidence that the growth rate of exports has a negative response to shocks of FDI variations in the second period analyzed. Thus, we find conflicting evidence of the impacts of shocks of FDI variations in the growth rate of exports for different orderings.

After presenting the empirical results for this first econometric exercise, let us now briefly review our findings in comparison with the literature. Succinctly, we find that FDI flows variations do not seem to impact the Brazilian trade (and services) balance in an aggregate way in the short-run. However, looking to the components of the trade balance,

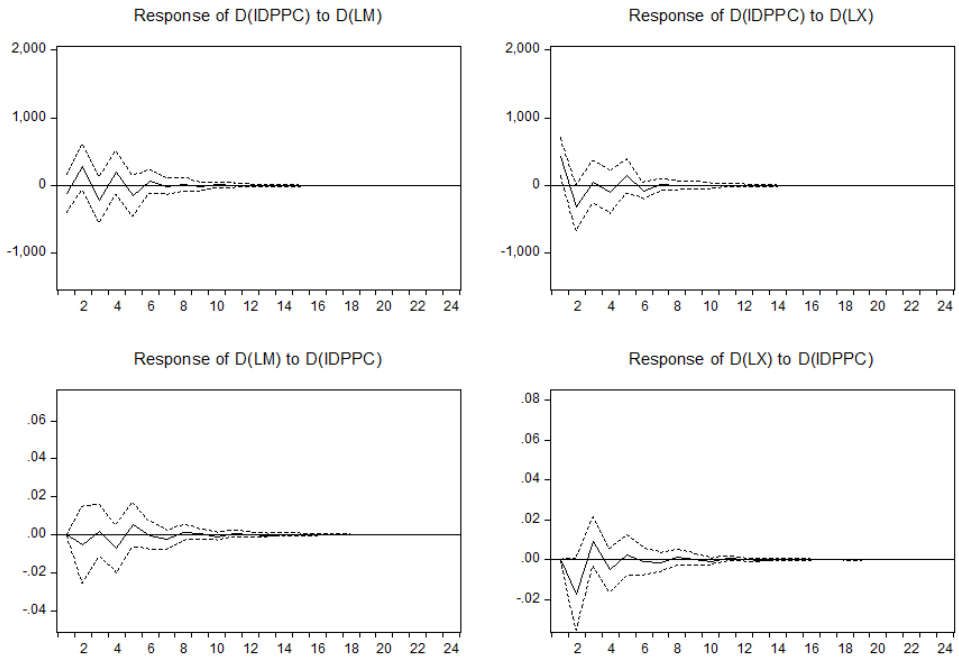

Figure 26 – Impulse-response functions - FDI, exports and imports - Second ordering

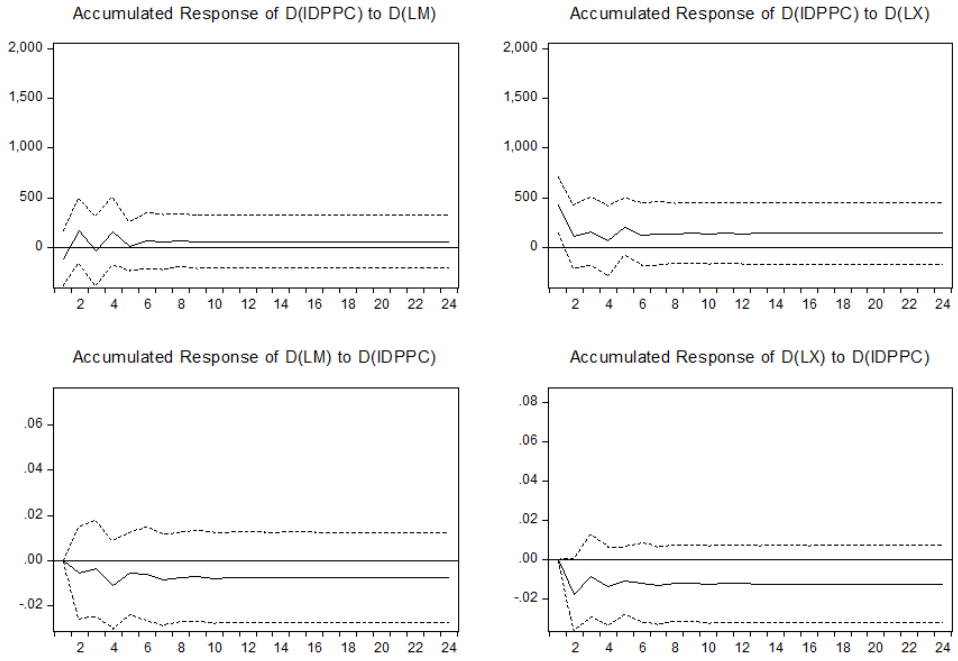

Figure 27 – Accumulated impulse-response functions - FDI, exports and imports - Second ordering

our cointegration results suggest that there is a stable relationship between FDI, exports, and imports - in special, exports are positively related to FDI and imports are negatively related to these capital flows. Therefore, our findings are different from earlier studies for the Brazilian economy, such as Laplane and Sarti (1999) and De Negri (2003), since we find, in this short-run analysis, that FDI flows might be related to a certain alleviation in the external constraint. On the other hand, these findings are partially in line with Calegário, Bruhn and Pereira (2014), as we also find a positive relationship between FDI and exports but a negative one with imports. Besides, in terms of the balance-of-payments equilibrium growth rate, our results, although far from being conclusive and, so far, focused in the short term, are suggestive that this connection between FDI flows and the components of the trade balance might indicate different possibilities of economic growth for the Brazilian economy.[12] Nevertheless, it remains to be seen whether these results persist in our long-run analysis.

3.3.2 FDI and unit labor costs

Furthermore, it is interesting to analyze how FDI flows can impact the international competitiveness of the recipient country. This effect is related to two of the channels analyzed earlier in this essay: the balance-of-payments components and the technological change channels.[13]

Regarding the balance-of-payments channel, it is important to highlight that the mechanisms through which this channel works, in the long run, might be directly related to the impacts of FDI on income elasticities of trade, an extremely relevant issue that was addressed in the previous essays on this thesis. The aggregate result on the balance-of-payments may, then, depend on the impacts of FDI inflows on the recipient country's productive structure (structural competitiveness), especially if it significantly alters the composition of imports and exports.[14]

Moreover, the technological change channel is directly related to the possibility of technological transfers from developed to developing countries, either directly or indirectly. Directly, capital flows from a developed country, theoretically a technology developer and with high R&D investment, would tend to increase the average productivity of the sector in which it operates in the South. In this same context, but indirectly, the literature points

[12] In this point, our evidence might be related, as discussed in the first essay of this thesis, to a different pattern of relative development between developed and underdeveloped regions that, in the limit, can represent an overcome of uneven development trajectories.

[13] However, as we use the unit labor cost as a measure of international competitiveness of the country, it is important to note that this variable keeps a certain relation with the functional distribution of income and, therefore, the evidence here might also be indirectly interpreted in the context of the income distribution channel.

[14] This discussion is largely based on Thirlwall (1979) and the vast subsequent literature on balance-of-payments constrained growth. For surveys on this literature see, for instance, Thirlwall (2012) and Setterfield (2012).

to several possibilities of spillover effects, cases of positive externalities derived from the establishment of foreign firms in the receiving country. These effects can, thus, alter the international competitiveness of the goods produced in the recipient country.

Seeking to analyze if FDI flows are related to the international competitiveness of the Brazilian goods, we will look at the relationship between FDI and unit labor costs (henceforth, ULC).[15] Table 15 presents the results for the Johansen's cointegration test. Although there is evidence of one cointegration vector for Model 2, the data for both variables present a certain trend that should be considered. Thus, we will consider (following Models 3 and 4) that the variables do not present a long-run relation. Therefore, we estimate a VAR model for the first difference of the variables, taking into consideration 6 lags of the endogenous variables and the usual control variables (seasonality dummies, the growth rates of the real exchange rate, and of commodities index).

Variables Selected lags (VAR)	Test type	Number of cointegration relations					
		Model	1	2	3	4	5
FDI and unit labor cost	Trace		2	1	0	0	0
7 lags	Max-Eig		2	1	0	0	0

Table 15 – Cointegration relations - FDI (capital participation) and unit labor cost

Again, it is necessary to analyze the behavior of the residuals of the estimation. Similar to the results of the previous subsection, the residuals of this estimation also do not present autocorrelation problems, although the residual associated with FDI flows variations do not seem to be normally distributed (however, the other component seems to be).

Table 16, in turn, shows the result for the Granger-causality test. In brief, the evidence suggests that the growth rate of unit labor costs "Granger-causes" FDI flows variations (at least for 0.10 level of significance) and that the opposite is not observed, thus ruling out the possibility of double (two-way) causality between the variables.

Besides, the impulse response functions for this estimation are presented in Figures 28 and 29. From the evidence of the Granger-causality test, we chose the ordering in which the growth rate of ULC is affected only by its own shocks in the first period, whilst FDI variations are affected by their own shocks and by ULC shocks (that is, $D(LULC) \longrightarrow D(IDPPC)$).

The results associated with these IRFs can be summarized as follows: shocks in

[15] At this point, it is important to highlight that the unit labor cost is one possible measure of the international competitiveness of the economy. See, for instance, Blecker (2002) and Blecker, Cauvel and Kim (2020) for examples of another measures of such competitiveness.

Dependent variable: D(IDPPC)			
Excluded	Chi-sq	df	Prob.
D(LULC)	11.90204	6	0.0642
All	11.90204	6	0.0642

Dependent variable: D(LULC)			
Excluded	Chi-sq	df	Prob.
D(IDPPC)	6.005354	6	0.4226
All	6.005354	6	0.4226

Table 16 – Granger causality test - FDI and unit labor costs

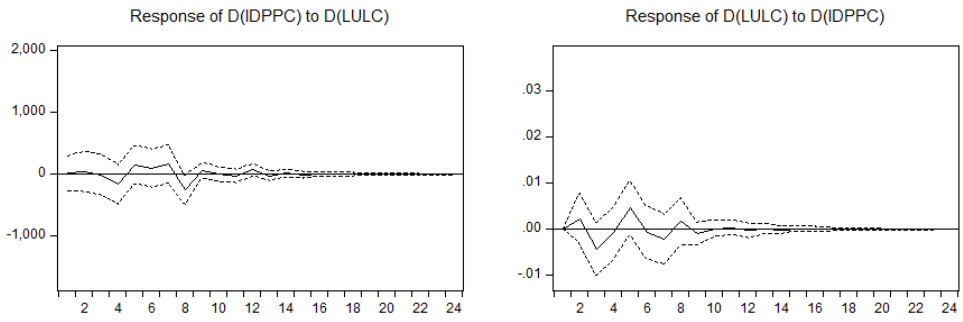

Figure 28 – Impulse-response functions - FDI and labor unit costs

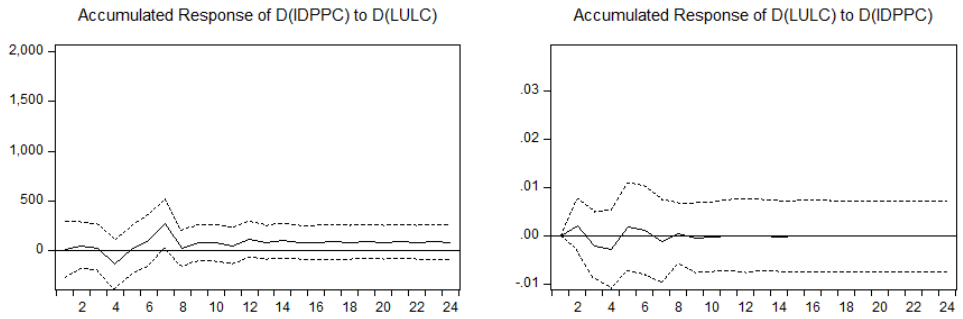

Figure 29 – Accumulated impulse-response functions - FDI and labor unit costs

FDI variations do not impact the growth rate of ULC but, on the other hand, shocks in the growth rate of ULC have a positive impact (although only in one period) on FDI flows variations. Coupled with the evidence concerning Granger-causality, we find that FDI flows might be related to (and preceded by) unit labor costs in a positive way in the Brazilian economy - that is, increasing unit labor costs and, therefore, decreasing international competitiveness are related to increasing FDI flows. Therefore, our findings complement the suggestions of Bonelli (1999) and, beyond that, indicate a clearer connection - even though there might be a positive relation between FDI flows and growing companies for some industries, the empirical evidence is suggestive of an aggregate result that is, in fact, negative.

Before moving on to the next econometric exercise, it is worth pointing out some possible interpretations of such results in the light of economic theory. Silva Filho (2015), when indicating a concentration of FDI flows to sectors focused on domestic consumption and commodity production[16], argues that this characteristic of these capital flows to Brazil would denote a specific pattern of international insertion of the country - one that keeps the Brazilian economy at the margin of global value chains. Within this perspective, we can understand our results as an in-depth suggestion that FDI flows, in addition to not altering the international insertion of the Brazilian economy, can undermine the possibilities of upgrading the national productive structure given the connection of these capital flows to a deterioration of the international competitiveness of the economy.

3.3.3 FDI, trade balance and unit labor costs

After presenting the analyses for the relations between FDI and trade balance and FDI and unit labor cost, it seems interesting to analyze the result for these variables together. Thus, we proceed to examine the relationships between these three variables. Table 17 presents the result for the Johansen's cointegration test. Again, as those variables present a certain trend in the period analyzed, we will consider both Models 3 and 4 and, thus, we conclude that there are not cointegration relations in both VAR models estimated. Therefore, we estimate two VARs for the first difference of the variables, including 11 lags and the usual control variables.

Regarding the behavior of the residuals of the estimations, similarly to the results of the previous subsections the residuals of both estimations also do not present auto-correlation problems, although the residuals associated with FDI flows variations do not seem to be normally distributed in both cases (although the residuals associated with

[16] Concerning this point, Angelo, Eunni and Fouto (2010) indicate that the domestic market growth was a significant determinant of FDI to Brazil. Moreover, Hiratuka and Sarti (2016) argue, studying the bilateral direct investment between Brazil and China, that those capital flows to the Brazilian economy tend to reinforce the role of the country as a commodity exporter.

Variables Selected lags (VAR)	Test type	Number of cointegration relations					
		Model	1	2	3	4	5
FDI, trade balance and unit labor cost	Trace		1	1	0	0	0
12 lags	Max-Eig		1	1	0	0	0
FDI, trade and services balance and unit labor cost	Trace		1	1	0	0	0
12 lags	Max-Eig		1	0	0	0	0

Table 17 – Cointegration relations - FDI (capital participation), trade balance and ULC

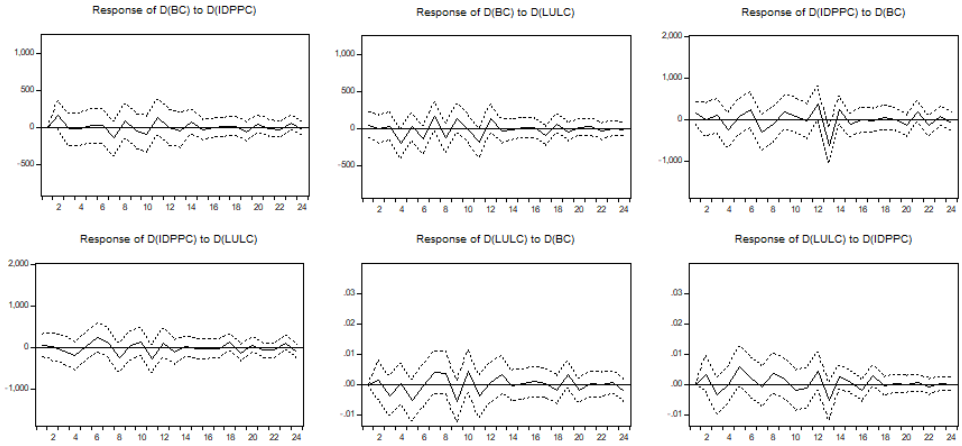

Figure 30 – Impulse-response functions - FDI, trade balance and ULC

trade balance and unit labor costs have similar third and fourth moments compared to the normal distribution).

First, let us examine the specification using the trade balance (goods). Table 41 shows the results for the Granger-causality test. In brief, the growth rate of ULC "Granger-causes" both FDI flows and trade balance variations. Besides, we also have evidence that variations in trade balance "Granger-causes" variations in FDI flows. Therefore, these results indicate that, considering the relationship between the three variables, the growth rate of ULC precedes variations in trade balance that, in turn, precede FDI flows variations.

Similarly to the previous section, we analyze the results of the impulse response functions for the ordering that follow the result of the Granger-causality test (that is, $D(LULC) \longrightarrow D(BC) \longrightarrow D(IDPPC)$). Figures 30 and 31 present these results.

It is possible to summarize the results of the IRFs as follows: shocks of FDI variations do not impact neither the trade balance variations nor the growth rate of ULC. Besides, shocks of trade balance variations do not impact the growth rate of ULC but do positively impact FDI flows variations. Thus, it seems that shocks in the trade balance have a positive impact on FDI flows for the Brazilian case. Moreover, shocks in the growth

Dependent variable: D(BC)

Excluded	Chi-sq	df	Prob.
D(IDPPC)	6.472782	11	0.8400
D(LULC)	20.23198	11	0.0423
All	26.30617	22	0.2388

Dependent variable: D(IDPPC)

Excluded	Chi-sq	df	Prob.
D(BC)	22.64305	11	0.0198
D(LULC)	19.33620	11	0.0553
All	37.28937	22	0.0220

Dependent variable: D(LULC)

Excluded	Chi-sq	df	Prob.
D(BC)	11.65376	11	0.3902
D(IDPPC)	14.26821	11	0.2185
All	27.24224	22	0.2022

Table 18 – Granger-causality test - FDI, trade balance and ULC

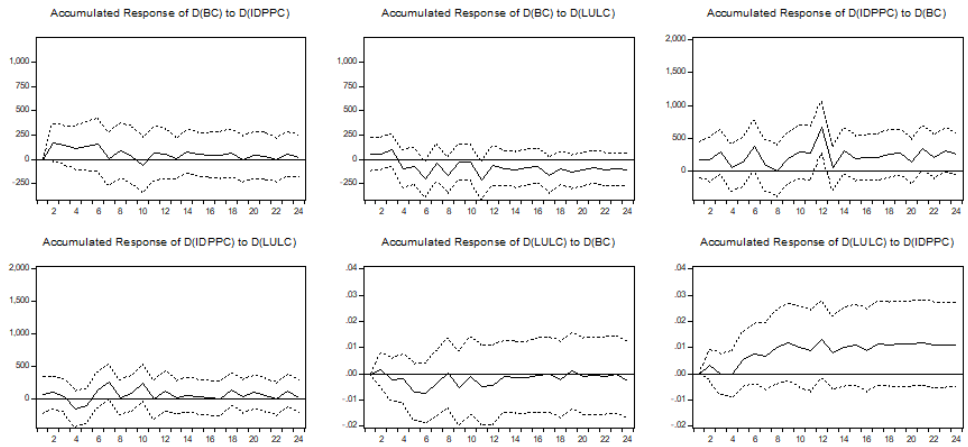

Figure 31 – Accumulated impulse-response functions - FDI, trade balance and ULC

rate of ULC do not impact FDI flows variations but do negatively impact trade balance variations, as expected - increases in ULC, *ceteris paribus*, are related to decreases in the international competitiveness of the domestic goods and, therefore, negatively related to the trade balance.

Before presenting a detailed analysis of the results, let us now examine the specification using the trade and services balance. Table 43 presents the results for the Granger-causality test. It is clear to see that the growth rate of ULC "Granger-causes" both FDI flows (at 0.07 level of significance) and trade and services balance variations. We also have evidence that variations in trade and services balance "Granger-causes" variations in FDI flows. Therefore, similarly to the previous estimation, these results indicate that, considering the relationship between the three variables, the growth rate of ULC precedes variations in trade and services balance that, in turn, precede FDI flows variations.

Dependent variable: D(BCS)

Excluded	Chi-sq	df	Prob.
D(IDPPC)	5.280056	11	0.9168
D(LULC)	23.21617	11	0.0165
All	28.46382	22	0.1608

Dependent variable: D(IDPPC)

Excluded	Chi-sq	df	Prob.
D(BCS)	19.53372	11	0.0522
D(LULC)	18.62908	11	0.0681
All	33.86949	22	0.0506

Dependent variable: D(LULC)

Excluded	Chi-sq	df	Prob.
D(BCS)	15.22745	11	0.1723
D(IDPPC)	14.72361	11	0.1955
All	31.22659	22	0.0916

Table 19 – Granger-causality test - FDI, trade and services balance and ULC

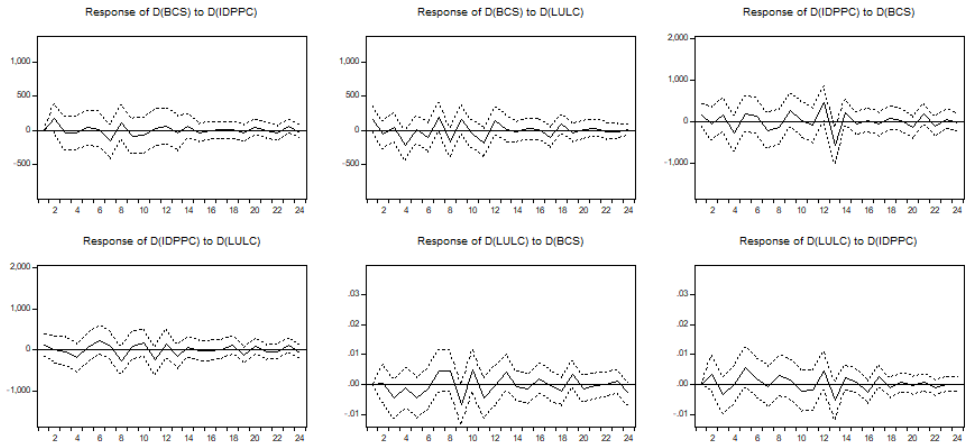

Figure 32 – Impulse-response functions - FDI, trade and services balance and ULC

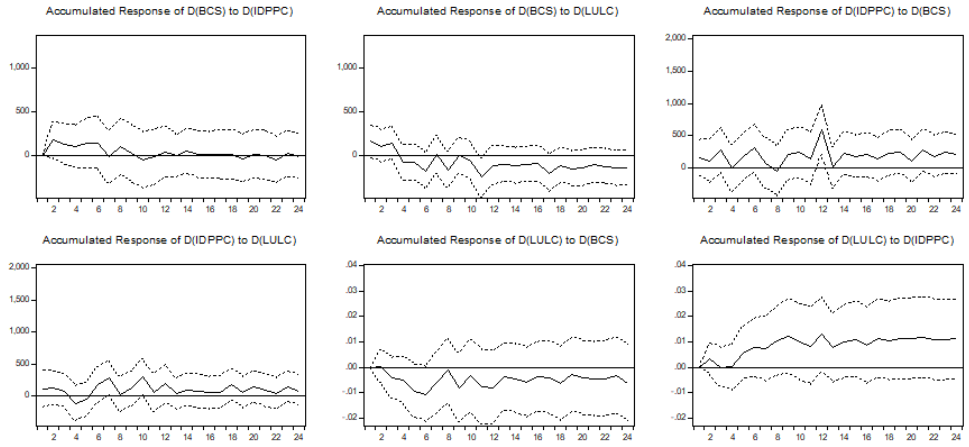

Figure 33 – Accumulated impulse-response functions - FDI, trade and services balance and ULC

Again, we analyze the results of the IRFs for the ordering that follow the result of the Granger-causality test (that is, $D(LULC) \longrightarrow D(BCS) \longrightarrow D(IDPPC)$). Figures 32 and 33 presents, respectively, the IRF and the accumulated IRF for such Cholesky decomposition.

Similarly to the previous specification, the results show that shocks of FDI variations do not impact the other variables of the model whilst shocks in trade and services balance variations do not impact the growth rate of ULC but do positively impact FDI flows variations, and, shocks in the growth rate of ULC positively impact FDI flows variations and negatively impact trade balance variations.

In summary, the results presented in this subsection indicate that there is an interesting precedence between FDI flows, unit labor costs and trade (and services) balance in the Brazilian economy: the growth rate of ULC not only "Granger-causes" variations in the trade balance but also in FDI flows. Furthermore, corroborating the

evidence presented in the previous subsection, we find that, at least for the trade and services balance specification, shocks in the growth rate of ULC have a positive effect on FDI flows variations. Moreover, trade balance variations also "Granger-cause" FDI flows variations and we find evidence that shocks in trade and services balance variations have a positive impact on FDI variations. Therefore, it seems like the Brazilian economy presented a certain behavior regarding FDI inflows in the last decades: when considering the mutual determination of unit labor costs, it seems that FDI flows were preceded by trade and services balance variations and unit labor costs variations and not the contrary. Furthermore, shocks in both trade balance variations and the ULC growth rate have a positive impact on FDI flows variations.

Thus, our results are suggestive of a further step than that highlighted in the last subsection. When we also take into consideration the trade balance, the indication that these trade flows have positive effects on FDI and, given that the opposite direction is not observed, the results suggest that these capital flows might, in fact, present a relation with an exporting behavior (concentrated in commodities and low value-added final goods) that does not bring significant improvements in terms of the international competitiveness of the Brazilian economy. Furthermore, it is important to highlight that this pattern of international insertion of the country might be related to a certain ratio of income elasticities of trade and, therefore, as discussed in several passages of this thesis, to the economic growth rate associated with the equilibrium of the balance-of-payments and to patterns of relative development between regions. That is, as much as FDI flows may be associated with a growth in exports compared to imports in the short run, the particular characteristics of this direct investment for the Brazilian economy do not seem to indicate an improvement in terms of the income elasticities of trade (at least for the case of exports) and, therefore, may suggest the unsustainability of economic growth in the long run (due to the balance-of-payments constraint).

3.3.4 FDI and gross fixed capital formation

In the capital accumulation channel, the mechanisms concern the role of FDI inflows in increasing savings and aggregate investment in the host country, with a major effect on low domestic savings economies with a lack of governmental action to promote domestic investment (the general case of the less developed and developing economies, although with exemptions in the latter.). Theoretically, these investments would also be less volatile (in comparison with other capital flows), which would serve to stabilize higher long-term savings and investment rates (DE MELLO, 1997; NAIR-REICHERT; WEINHOLD, 2001). On the other hand, foreign capital inflows can have long-term negative effects on developing countries' savings and investment, either because profit remittances are consistently higher

than new FDI inflows (so it may decrease aggregate savings)[17] or because a crowding-out effect of domestic investment may occur with the entry of multinational firms. On this point, Agosin and Machado (2005) - using panel data covering the period 1971-2000 for 36 developing countries - find evidence that FDI has crowded out domestic investment in Latin American countries, although the effects of FDI are not statistically significant for economies in Africa and Asia. Furthermore, Wang (2010), using a large panel consisting of 50 developed and developing countries, present evidence that the effect of FDI on the domestic investment of the recipient country differs between developed and less developed economies, as it is, in the long run, neutral for richer countries and positive for the poorer ones (and negative and neutral, respectively, in the short run). Ashraf and Herzer (2014), in turn, examine the effects of greenfield investment and M&As on domestic investment using panel data for 100 developing countries for the period 2003 to 2011, and find that while cross-border M&As do not have a significant effect on domestic investment, greenfield FDI has a large crowding-out effect. Moreover, Kamaly (2014) indicates that, in general, the effect of FDI on domestic investment is country-specific. Using data on 16 emerging countries over 30 years, the author finds that for most countries included in the sample, FDI has a neutral long-term effect on domestic investment.

Seeking to analyze the relationship between FDI and the capital accumulation channel for the Brazilian economy, we focus our attention on the short-run effects on the investment level in Brazil. For that, we use an index of gross fixed capital formation (henceforth, GFCF) as a measure of the investment in the country. Table 20 shows the results for the cointegration test. For all models considered, there is evidence of one cointegration relation between the variables. Thus, we proceed with the estimation of a VEC model with the inclusion of a constant and a trend term in the cointegration vector and a constant in the VEC (Model 4), 1 lag for the endogenous variables, and the usual control variables. Table 21 presents the output of this estimation. Moreover, concerning the behavior of the residuals of this estimation, in a similar way to the previous exercises, they also do not present autocorrelation problems, although the residuals do not seem to be normally distributed.

Variables Selected lags (VAR)	Test type	Number of cointegration relations					
		Model	1	2	3	4	5
FDI and GFCF index	Trace		1	1	1	1	1
2 lags	Max-Eig		1	1	1	1	1

Table 20 – Cointegration relations - FDI (capital participation) and GFCF index

[17] For a detailed discussion of this possibility and the operation of this channel, see the first essay of this thesis (in special, see Section 1.1).

Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1	
IDPPC(-1)	1.000000	
LFBKF(-1)	−4745.985 (1869.20) [-2.53904]	
@TREND(05M01)	−16.14753 (6.00145) [-2.69061]	
C	21443.99	
Error Correction:	**D(IDPPC)**	**D(LFBKF)**
CointEq1	−0.470418 (0.08732) [-5.38709]	$1.29E-06$ $(1.6E-06)$ [0.82954]
D(IDPPC(-1))	−0.294875 (0.07488) [-3.93821]	$7.55E-09$ $(1.3E-06)$ [0.00567]
D(LFBKF(-1))	−4409.096 (4266.65) [-1.03339]	−0.277573 (0.07590) [-3.65697]
C	880.8707 (496.020) [1.77588]	−0.012486 (0.00882) [-1.41501]
@MONTH=1	−1297.814 (703.762) [-1.84411]	0.020961 (0.01252) [1.67424]
@MONTH=2	−2338.072 (702.880) [-3.32642]	0.012533 (0.01250) [1.00234]
@MONTH=3	−819.1879 (696.109) [-1.17681]	0.015870 (0.01238) [1.28150]
@MONTH=4	−246.9996 (714.343) [-0.34577]	0.018066 (0.01271) [1.42164]
@MONTH=5	−1496.780 (699.582) [-2.13954]	0.007504 (0.01245) [0.60297]
@MONTH=6	−415.1210 (700.640) [-0.59249]	0.037665 (0.01246) [3.02189]
@MONTH=7	−723.0861 (715.140) [-1.01111]	0.004871 (0.01272) [0.38289]
@MONTH=8	−1041.971 (696.965) [-1.49501]	0.012127 (0.01240) [0.97809]
@MONTH=9	−582.6650 (694.928) [-0.83845]	0.018318 (0.01236) [1.48170]
@MONTH=10	−530.3816 (698.136) [-0.75971]	0.014636 (0.01242) [1.17844]
@MONTH=11	−1114.219 (693.365) [-1.60697]	0.007477 (0.01233) [0.60620]
GRER	−5188.463 (4769.77) [-1.08778]	−0.203237 (0.08485) [-2.39518]
GRCOM	7807.458 (5245.65) [1.48837]	0.110174 (0.09332) [1.18062]

Table 21 – Estimation output - Cointegration: FDI and GFCF index

Focusing our attention to the long-term relationships presented in our estimation - that is, the coefficients within the cointegration vector - it is direct to see that, with the normalization proposed (for IDPPC), the coefficients indicate that the GFCF index is positively related to FDI flows (statistically significant) in the long run. In the VEC, the adjustment coefficients, α (represented, again, by "CointEq1" in Table 21), associated with the short-term relationships present the expected signs and is statistically significant for FDI variations but not significant for the growth rate of GFCF index. Furthermore, Table 22 presents the Granger-causality test for this specification. The results show that neither of the variables "Granger-cause" the other one.

Dependent variable: D(IDPPC)

Excluded	Chi-sq	df	Prob.
D(LFBKF)	1.067885	1	0.3014
All	1.067885	1	0.3014

Dependent variable: D(LFBKF)

Excluded	Chi-sq	df	Prob.
D(IDPPC)	$3.21E-05$	1	0.9955
All	$3.21E-05$	1	0.9955

Table 22 – Granger causality test - FDI and GFCF index

Moreover, Figures 34 and 35 presents the IRFs for the ordering in which FDI variations are affected only by their own shocks in the first period, whilst the growth rate of GFCF index is affected by its own shocks and by FDI variations shocks (that is, $D(IDPPC) \longrightarrow D(LFBKF)$).[18]

The results of the IRFs show that both FDI variations shocks and GFCF index growth rate shocks do not impact the other variable. Nevertheless, it is important to highlight that we find evidence of a positive relationship between those variables in the cointegration vector, indicating that, for the Brazilian case, it seems that FDI is positively related to investment and, thus, to capital accumulation. Therefore, our findings are in line with the results presented in Wang (2010), as for the Brazilian case, a developing economy, we find a positive relationship between FDI and aggregate investment. Although we cannot

[18] We chose to present only this ordering for the shocks in the Cholesky decomposition mainly because the results are the same for the other possible arrangement.

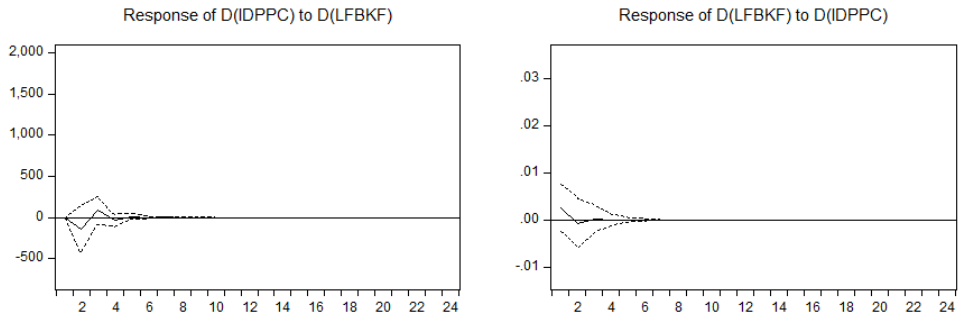

Figure 34 – Impulse-response functions - FDI and GFCF

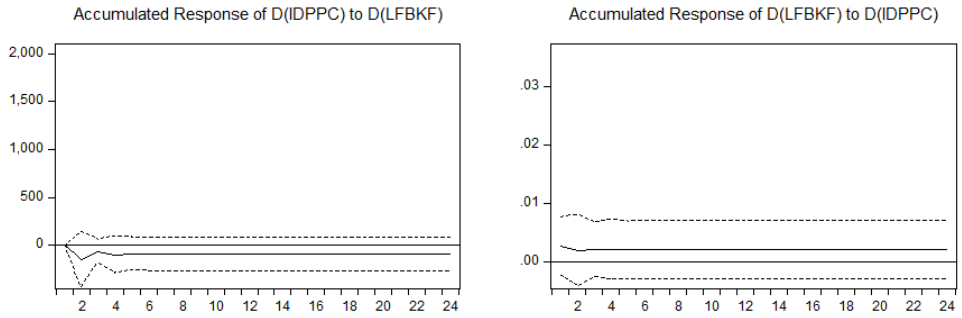

Figure 35 – Accumulated impulse-response functions - FDI and GFCF

conclude about the possible crowding-in and crowding-out effects on the Brazilian domestic investment, our results are suggestive of a net positive effect of FDI on investment in the short run, possibly indicating that the empirical evidence of Agosin and Machado (2005) and, more recently, Kamaly (2014), do not seem to be the case of Brazil, at least in this short term analysis.

3.3.5 FDI and gross domestic product

After presenting an econometric analysis for some of the channels through which FDI can impact the economic growth of the Brazilian economy, we now turn our attention to the aggregate effect of FDI flows on the Brazilian GDP. For that, we use an index of monthly economic activity (IBC-BR) as a measure of the real GDP to better deal with the strong seasonality present in the monthly data for the national production. Table 23 presents the results for the cointegration test. For all models considered, there is evidence of one cointegration relation between the variables. Thus, we proceed with the estimation of a VEC model with the inclusion of a constant term in the cointegration vector and a constant in the VEC (Model 3), 2 lags for the endogenous variables, and the usual control variables. Table 24 presents the output of this estimation. Similar to the results of the previous subsections, the residuals of this estimation also do not present autocorrelation problems. However, the residuals do not seem to present third and fourth moments similar

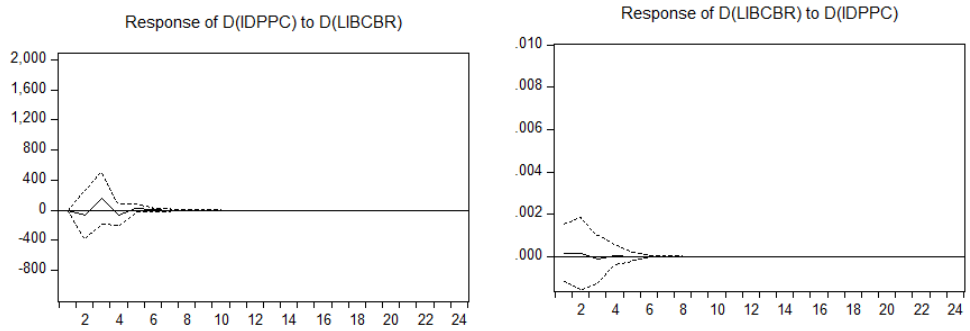

Figure 36 – Impulse-response functions - FDI and IBC-BR

to those of the normal distribution.

Variables Selected lags (VAR)	Test type	Number of cointegration relations					
		Model	1	2	3	4	5
FDI and IBC-BR	Trace		1	1	1	1	1
3 lags	Max-Eig		1	1	1	1	1

Table 23 – Cointegration relations - FDI (capital participation) and IBC-BR

The most relevant results from the previous output are related to the coefficients within the cointegration vector, that represent the stable relationship between the endogenous variables. Following the usual normalization, we can see from Table 24 that these coefficients indicate that the economic activity index is positively related to FDI flows (statistically significant) in the long run. In the VEC, the adjustment coefficients, α (once again represented by "CointEq1" in Table 24), associated with the short-term relationships present the expected signs and is statistically significant for FDI variations but not significant for the growth rate of IBC-BR. Besides, Table 25 shows the results of the Granger-causality test for this specification, indicating that neither of the variables "Granger-cause" the other one.

Furthermore, Figures 36 and 37 presents, respectively, the IRF and the accumulated IRF for the ordering in which FDI variations are affected only by their own shocks in the first period, whilst the growth rate of IBC-BR is affected by its own shocks and by FDI variations shocks (that is, $D(IDPPC) \longrightarrow D(LIBCBR)$).

The evidence from Figures 36 and 37 shows that both FDI variations shocks and IBC-BR growth rate shocks do not impact the other variable. Nevertheless, again, it is important to highlight that we find evidence of a positive relationship between those variables in the cointegration vector, indicating that, for the Brazilian case, it seems that FDI is positively related to economic activity. This way, although so far our analysis has

Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1	
IDPPC(-1)	1.000000	
LIBCBR(-1)	−16221.91 (4733.40) [-3.42711]	
C	75497.47	
Error Correction:	**D(IDPPC)**	**D(LIBCBR)**
CointEq1	−0.375921 (0.09314) [-4.03624]	$4.68E-07$ $(4.5E-07)$ [1.04340]
D(IDPPC(-1))	−0.438118 (0.09519) [-4.60251]	$8.02E-08$ $(4.6E-07)$ [0.17485]
D(IDPPC(-2))	−0.176650 (0.07783) [-2.26962]	$-5.06E-08$ $(3.7E-07)$ [-0.13510]
D(LIBCBR(-1))	−7107.167 (17219.1) [-0.41275]	0.028435 (0.08294) [0.34283]
D(LIBCBR(-2))	14937.38 (17240.3) [0.86642]	0.138355 (0.08304) [1.66603]
C	849.1808 (492.972) [1.72257]	−0.002355 (0.00237) [-0.99181]
GRER	−3687.924 (4818.34) [-0.76539]	−0.106119 (0.02321) [-4.57225]
GRCOM	7616.420 (5349.27) [1.42382]	0.070212 (0.02577) [2.72491]
@MONTH=1	−1242.300 (699.423) [-1.77618]	0.002180 (0.00337) [0.64716]
@MONTH=2	−2268.461 (695.902) [-3.25974]	0.004073 (0.00335) [1.21505]
@MONTH=3	−1032.433 (715.546) [-1.44286]	0.000621 (0.00345) [0.18017]
@MONTH=4	−285.1185 (709.576) [-0.40182]	0.004698 (0.00342) [1.37459]
@MONTH=5	−1279.076 (704.207) [-1.81634]	0.002560 (0.00339) [0.75479]
@MONTH=6	−406.2770 (699.210) [-0.58105]	0.005613 (0.00337) [1.66647]
@MONTH=7	−767.7330 (701.711) [-1.09409]	0.003944 (0.00338) [1.16696]
@MONTH=8	−865.4619 (700.392) [-1.23568]	0.005465 (0.00337) [1.61977]
@MONTH=9	−673.1907 (692.911) [-0.97154]	0.003173 (0.00334) [0.95061]
@MONTH=10	−515.7300 (694.396) [-0.74270]	0.000920 (0.00334) [0.27498]
@MONTH=11	−1061.937 (689.447) [-1.54027]	0.001745 (0.00332) [0.52552]

Table 24 – Estimation output - Cointegration: FDI and IBC-BR

Dependent variable: D(IDPPC)			
Excluded	Chi-sq	df	Prob.
D(LIBCBR)	0.872147	2	0.6466
All	0.872147	2	0.6466

Dependent variable: D(LIBCBR)			
Excluded	Chi-sq	df	Prob.
D(IDPPC)	0.128752	2	0.9377
All	0.128752	2	0.9377

Table 25 – Granger causality test - FDI and IBC-BR

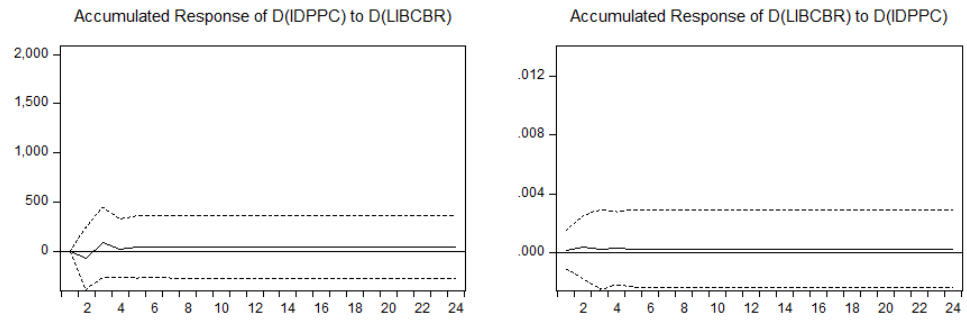

Figure 37 – Accumulated impulse-response functions - FDI and IBC-BR

been focused on short-run relationships between the variables, we have already found suggesting evidence that FDI flows are positively related to the economic activity in Brazil.

By way of conclusion, it is worth presenting a brief review of the results found in this short-term analysis before moving to the next econometric exercise. Although some of the evidence is sensitive to different orderings in the Cholesky decomposition or slightly different specifications, in general, the results obtained allow us to suggest that FDI flows are positively related to the Brazilian exports and negatively related to imports. Moreover, we also find evidence of a positive relationship between FDI and investment (measured by a GFCF index) and between these capital flows and the Brazilian economic activity as a whole. Nevertheless, the results regarding the unit labor costs and, therefore, a measure of the international competitiveness of Brazilian production, seem to indicate that FDI flows are negatively related to such competitiveness, which can undermine the positive effects on the trade balance in the medium and the long term. In summary, our results are suggestive

of a connection between the characteristics of FDI flows to the Brazilian economy and a specific pattern of international insertion of the Brazilian economy that keeps it at the margin of global value chains. In the context of balance-of-payments constrained growth, the suggestion of undermined possibilities of upgrading the national productive structure might indicate impossibilities of improving the income elasticity of exports and, consequently, limited economic growth trends in the long run.

3.4 An annual data analysis

Having done the first econometric exercise of this essay, focused on the operation of some of the channels through which FDI can affect the economic growth of the Brazilian economy using monthly data, let us now move on to the second empirical exercise of this work: the attempt to better understand the operation of some the channels identified in the literature - which, from the beginning, guide the developments of this thesis - in an annual context.

With this interest in mind, aiming at an analysis with statistically robust results and that could eventually capture the long-run relationships that interest us, we use annual data for a relatively long period. Similar to the previous section, a list of variables indicating the names, definitions, and the sources of such data is presented in Appendix C.[19] For almost all series of interest we analyze the period between 1970 and 2014, that is, in practical terms, we will work with 44 observations for each variable. However, for the estimations that include the GINI coefficient, we restrict our sample to the period between 1976 and 2014. Within these specifications, we obtained representative variables for most of the channels through which FDI can affect the development of the Brazilian economy, but, again, we were unable to address the channel of the market structure.[20] The results of the unit root tests are also presented in Appendix C. The analysis of unit root tests indicated, in general, that the variables treated in this exercise seem to present a stochastic tendency in level but seem to be weakly stationary in their first difference. Thus, in summary, we can consider that all variables in our analysis are integrated of first degree, that is, I(1). The only variable that is already stationary is the real GDP growth. Moreover, for all the estimations examined in this section, we include the terms of trade as a control variable, in order to capture the possible effects of an important variable that might be related to many of the series used in this exercise.

[19] For this exercise, see Table 46. We like to thank Professor Adalmir Marquetti for kindly providing data for the wage share in Brazil for the period between 1970 and 2000 (for the remaining periods, we calculate the variable using national accounts data from IBGE. For a detailed analysis of the profit rate in Brazil, see Marquetti, Filho and Lautert (2010).

[20] The closest measure we have found to possibly identify the operation of this channel is a simple Hirschman-Herfindahl index of market concentration. Nevertheless, the annual observations available in the World Bank database only cover the period from 1989 to 2015.

Before moving to the analysis of the estimations, it is worth discussing some points related to the development of this section. First, as we did earlier, we divide this exercise into several subsections that, in turn, seek to analyze separately the operation of a certain channel or a combination of channels. Furthermore, we follow the methodology exposed earlier in this essay (in Section 3.2 and 3.3) and largely applied in the previous section. That said, we now advance to the estimation of a relationship presented in the balance-of-payments component channel.

3.4.1 FDI and trade balance

In our short-run analysis, the results presented in this subsection indicate that FDI might, in fact, impact the Brazilian trade balance. In brief, our short-term results suggest that there is a stable relationship between FDI, exports, and imports, and, in special, exports are positively related to FDI flows, and imports are negatively related to these capital flows. Nevertheless, to properly address the empirical question posed in the previous section (see Section 3.3.1), it is important to take into consideration the long-run effects of FDI on the trade balance (and its components) of Brazil. This is exactly the objective of this subsection.

Following the steps postulated in our previous econometric exercise, Table 26 presents the results for the Johansen's cointegration tests. For the first VAR model estimated, with FDI and trade balance as endogenous variables, there is not evidence of a cointegration relation between the variables. Thus, we proceed to the estimation of a VAR (2) for the first difference of the variables. On the other hand, for the disaggregated specification, there is evidence of one cointegration vector. In this case, we estimate a VEC model.[21]

Variables Selected lags (VAR)	Test type	Number of cointegration relations					
		Model	1	2	3	4	5
FDI and trade balance	Trace		1	0	0	0	0
3 lags	Max-Eig		0	0	0	0	0
FDI, exports and imports	Trace		2	2	1	1	1
5 lags	Max-Eig		2	1	1	1	1

Table 26 – Cointegration relations - Annual data - FDI and trade balance

As we did in the previous section of this essay, the tests regarding the behavior of the residuals of each estimation are presented in Appendix C. In summary, the residuals

[21] It is worth saying that all the models estimated in this econometric exercise using annual data are stable, that is, the inverse roots of the autoregressive characteristic polynomial lie inside the unit circle.

of both the estimations examined in this section do not present autocorrelation problems and, moreover, majorly seem to be normally distributed (only the residuals associated with the growth rate of exports in the second specification do not appears to be normally distributed).

First, looking at the VAR model for the growth rate of FDI flows and trade balance variations, the results for the Granger-causality test are explicit in Table 27. The evidence suggests that the growth rate of FDI flows do not "Granger-cause" trade balance variations, but trade balance variations might "Granger-cause" the growth rate of FDI flows if we consider a 0.10 level of significance.

Dependent variable: D(LIDPPC)

Excluded	Chi-sq	df	Prob.
D(BC)	4.892658	2	0.0866
All	4.892658	2	0.0866

Dependent variable: D(BC)

Excluded	Chi-sq	df	Prob.
D(LIDPPC)	2.374074	2	0.3051
All	2.374074	2	0.3051

Table 27 – Granger-causality test (annual data) - FDI and trade balance

Moreover, regarding the impulse response functions, we analyze the results for two different orderings of the shocks for the Cholesky decomposition. Figures 38 and 39 presents, respectively, the IRF and the accumulated IRF for the ordering in which FDI flows growth rate is affected only by its own shocks in the first period, whilst the trade balance variations are affected by their own shocks and by FDI flows growth rate shocks (that is, $D(LIDPPC) \longrightarrow D(BC)$). Briefly, the results for the IRFs show that both FDI flows growth rate shocks and trade balance variations shocks do not impact the other variable. In addition, we find similar evidence for the second ordering of the shocks (that is, $D(BC) \longrightarrow D(LIDPPC)$). These results are presented in Figures 40 and 41.

Looking now at the specification with exports and imports as separate components, we analyze a VEC model since the evidence indicated the existence of a cointegration

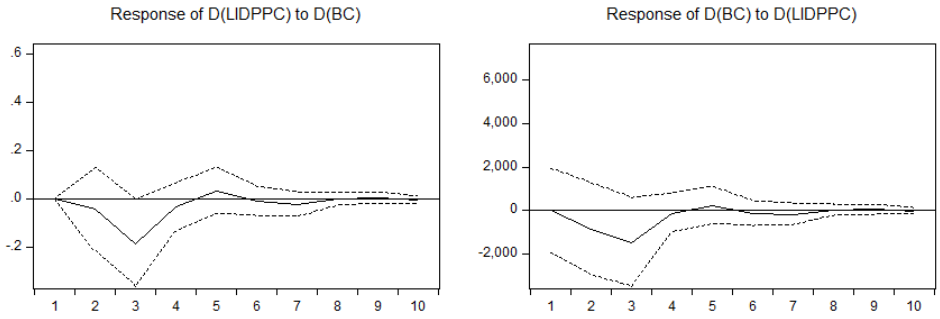

Figure 38 – Impulse-response functions (annual) - FDI and trade balance - First ordering

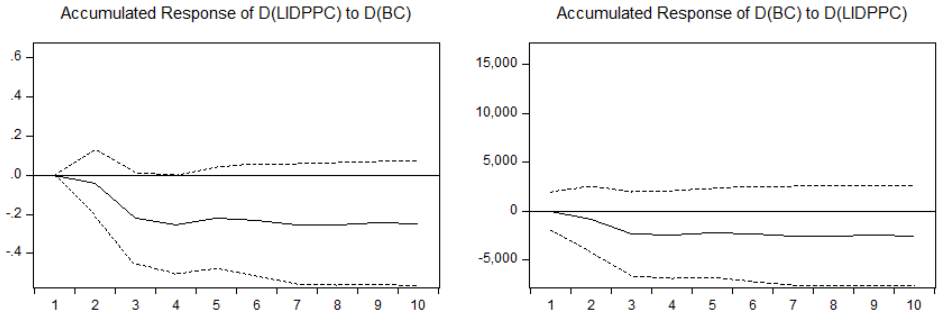

Figure 39 – Accumulated impulse-response functions (annual) - FDI and trade balance - First ordering

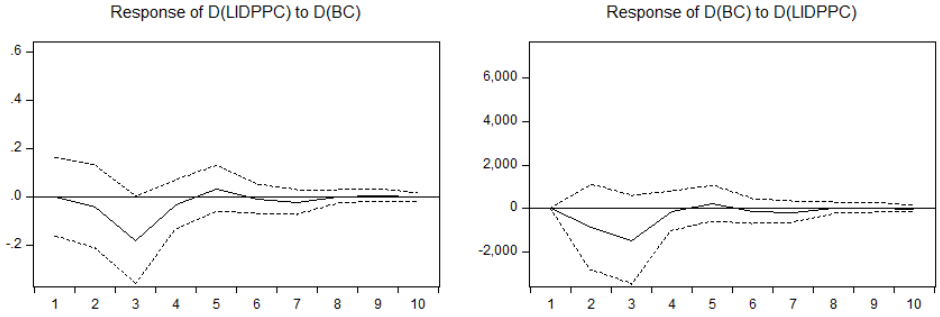

Figure 40 – Impulse-response functions - FDI and trade balance - Second ordering

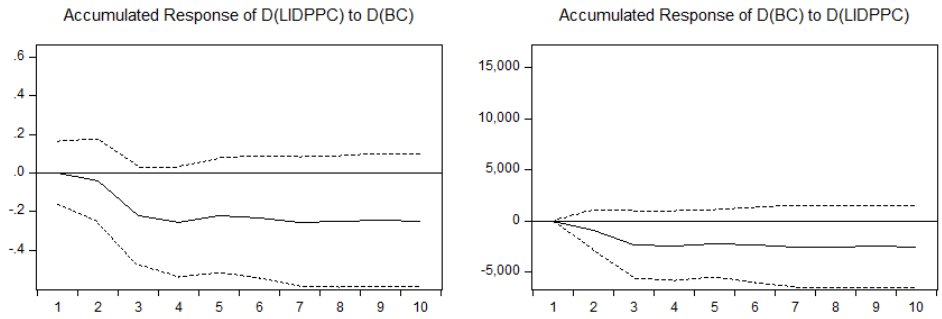

Figure 41 – Accumulated impulse-response functions - FDI and trade balance - Second ordering

relation between the endogenous variables. Table 28 presents the output of this estimation.

Following, again, a normalization for FDI flows, the coefficients within the cointegration vector indicate that both exports and imports are positively related to FDI flows in the long run, although the coefficient is statistically significant only for the exports. In the VEC, the adjustment coefficients, α ("CointEq1" in Table 28), associated with the short-term relationships present the expected signs for the growth rate of FDI flows and exports variations (although not statistically significant). Moreover, the sign of the coefficient associated with the growth rate of imports is not expected. Besides, Table 29 presents the Granger-causality test for this specification. The results show that neither of the variables considered in the estimation "Granger-causes" the other ones.

Regarding the impulse response functions, we analyze the results for two different orderings for the shocks. First, Figures 42 and 43 the IRFs for the ordering in which the growth rate of FDI flows is affected only by its own shocks in the first period, whilst the growth rate of exports is affected by shocks of FDI flows growth rate as well as its own shocks and the growth rate of imports is affected by all shocks in the first period $(D(LIDPPC) \longrightarrow D(LX) \longrightarrow D(LM))$.[22]

The results presented in Figures 42 and 43 indicate that shocks of FDI flows growth rate positively impact the growth rate of exports and imports, at least for the first periods after the innovations. Nevertheless, exports and imports growth rates shocks do not impact the growth rate of FDI flows. Therefore, this analysis present evidence that increasing FDI flows are related both to increasing exports and imports in the Brazilian economy.

In turn, Figures 44 and 45 present the IRFs for the second proposed ordering for the shocks $(D(LX) \longrightarrow D(LM) \longrightarrow D(LIDPPC))$. In this case, the results are less clear: shocks in FDI flows growth rate do not impact neither imports nor exports growth

[22] Again, we omitted the responses of variables to their own shocks as well as the interactions between exports and imports. The reason for such omission is only to simplify our analysis.

Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1		
LIDPPC(-1)	1.000000		
LX(-1)	−1.466931 (0.49386) [-2.97035]		
LM(-1)	−0.103030 (0.50976) [-0.20212]		
C	8.229611		
Error Correction:	**D(LIDPPC)**	**D(LX)**	**D(LM)**
CointEq1	−0.094459 (0.15445) [-0.61160]	0.058752 (0.03659) [1.60567]	−0.103491 (0.04847) [-2.13525]
D(LIDPPC(-1))	−0.196736 (0.23648) [-0.83193]	−0.041587 (0.05603) [-0.74228]	0.129684 (0.07421) [1.74747]
D(LIDPPC(-2))	−0.170688 (0.25528) [-0.66862]	−0.067956 (0.06048) [-1.12361]	0.072384 (0.08011) [0.90352]
D(LIDPPC(-3))	0.128492 (0.22131) [0.58061]	−0.072434 (0.05243) [-1.38152]	0.021630 (0.06945) [0.31144]
D(LIDPPC(-4))	−0.087924 (0.20859) [-0.42152]	−0.091694 (0.04942) [-1.85550]	−0.015341 (0.06546) [-0.23436]
D(LX(-1))	−1.232639 (1.14583) [-1.07576]	−0.127771 (0.27146) [-0.47067]	−0.035456 (0.35959) [-0.09860]
D(LX(-2))	−1.093525 (1.01098) [-1.08165]	−0.429479 (0.23952) [-1.79311]	−0.033864 (0.31727) [-0.10674]
D(LX(-3))	−1.341414 (1.07508) [-1.24773]	0.069944 (0.25470) [0.27461]	0.356803 (0.33738) [1.05756]
D(LX(-4))	1.128877 (1.07938) [1.04586]	0.182506 (0.25572) [0.71369]	−0.219966 (0.33873) [-0.64938]
D(LM(-1))	1.145759 (0.70458) [1.62617]	0.075285 (0.16692) [0.45101]	−0.125130 (0.22111) [-0.56591]
D(LM(-2))	0.720738 (0.69003) [1.04451]	0.102893 (0.16348) [0.62940]	−0.188050 (0.21655) [-0.86841]
D(LM(-3))	0.681881 (0.67566) [1.00921]	0.029728 (0.16007) [0.18571]	−0.272024 (0.21204) [-1.28292]
D(LM(-4))	−0.146197 (0.64536) [-0.22654]	−0.113525 (0.15290) [-0.74250]	−0.043785 (0.20253) [-0.21620]
C	0.143771 (0.19336) [0.74356]	0.133843 (0.04581) [2.92177]	0.102087 (0.06068) [1.68240]
LPXM	0.450708 (1.07672) [0.41859]	0.300201 (0.25509) [1.17684]	0.946394 (0.33790) [2.80084]

Table 28 – Estimation output - Cointegration: FDI, exports and imports (annual)

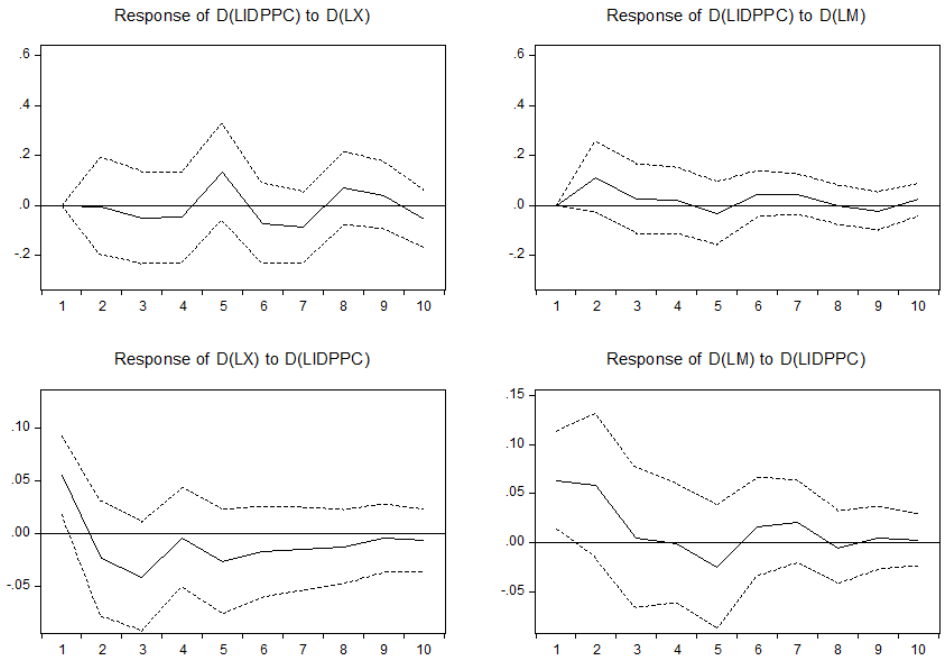

Figure 42 – Impulse-response functions (annual) - FDI, exports and imports - First ordering

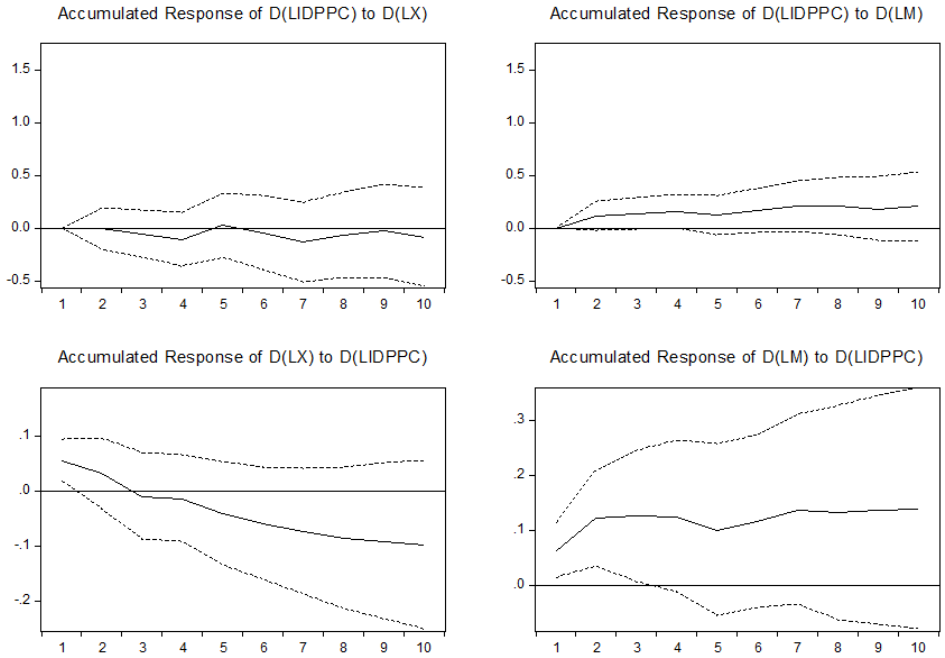

Figure 43 – Accumulated impulse-response functions (annual) - FDI, exports and imports - First ordering

Dependent variable: D(LIDPPC)

Excluded	Chi-sq	df	Prob.
D(LX)	1.318482	4	0.8582
D(LM)	1.868951	4	0.7598
All	6.507420	8	0.5906

Dependent variable: D(LX)

Excluded	Chi-sq	df	Prob.
D(LIDPPC)	3.886988	4	0.4215
D(LM)	1.517716	4	0.8235
All	6.474719	8	0.5942

Dependent variable: D(LM)

Excluded	Chi-sq	df	Prob.
D(LIDPPC)	6.058975	4	0.1948
D(LX)	4.344540	4	0.3614
All	10.91640	8	0.2065

Table 29 – Granger-causality test (annual data) - FDI, exports and imports

rates, but shocks in the export growth rate have a positive impact on the growth rate of FDI flows. Thus, our findings from the impulse response functions are, again, sensitive to different orderings within the same model specification.

As a summary, it is worth comparing the results obtained in this long-term analysis with that made in the previous empirical exercise, looking at shorter-term effects. In both cases, despite the reservations regarding the sensitivity of the results to different Cholesky decomposition orderings, the general evidence is that there seems to be a positive relationship between FDI and exports, either through shocks of the two variables affecting the level of the other (evidence of IRFs) or the existence of cointegration relations between then. Concerning imports, the results are different for the two cases: while in the short term we find evidence that such trade flows were negatively related to the increase in FDI flows, in the long-run, there seems to be a positive relationship between the variables.

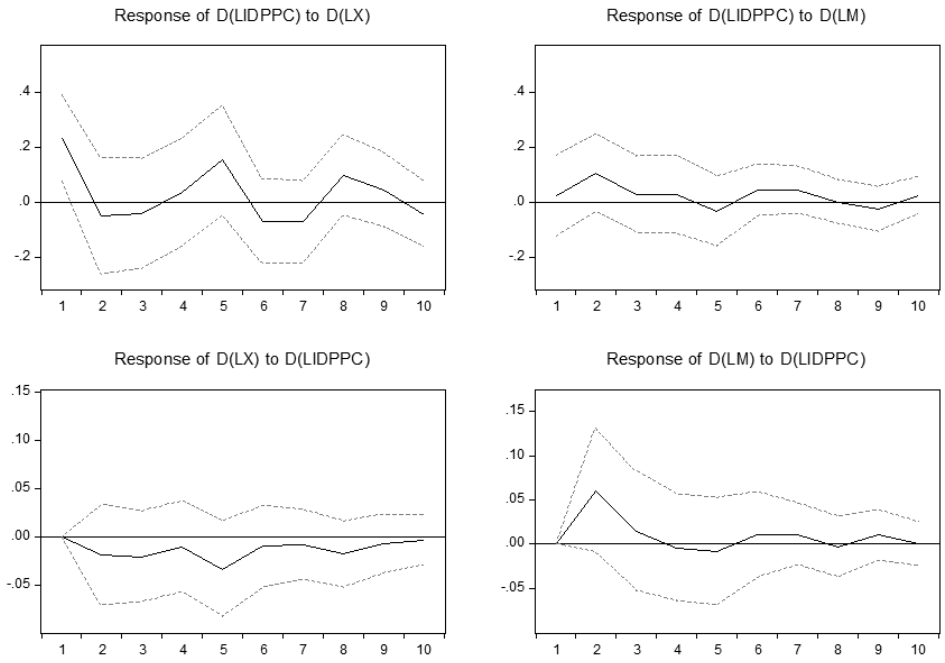

Figure 44 – Impulse-response functions - FDI, exports and imports - Second ordering

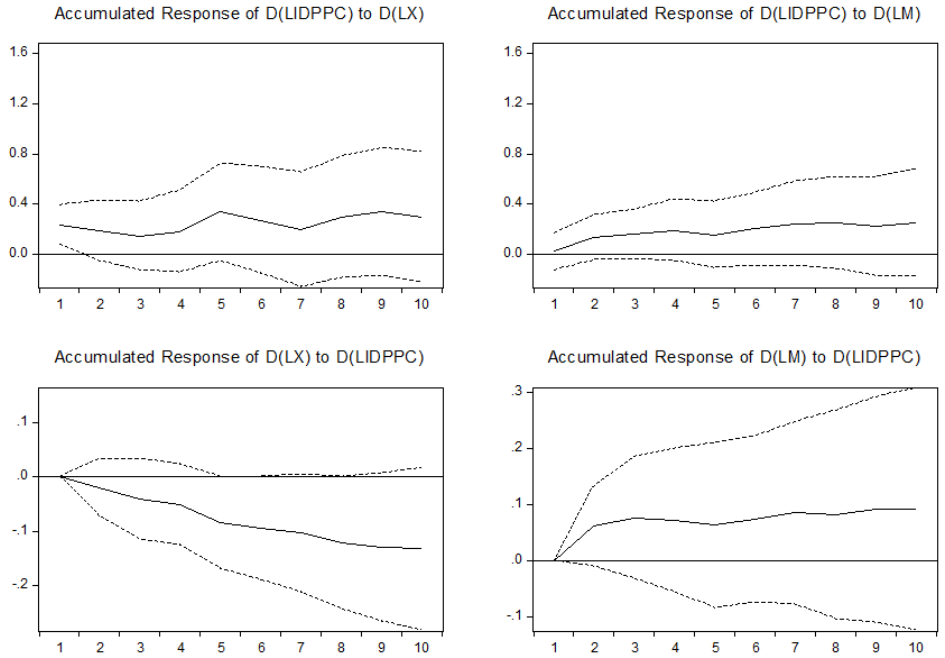

Figure 45 – Accumulated impulse-response functions - FDI, exports and imports - Second ordering

Therefore, the results of this long-run analysis regarding the aggregate effect FDI on the Brazilian trade balance are less clear than the earlier: as these capital flows are positively related to both exports and imports, the net effect depends on the magnitude of the impacts on each of its components. Nevertheless, even if we assume that the effect on exports is higher than in imports (and, thus, FDI is positively related to the trade balance), our long-run results are suggestive of a milder alleviation of the external constraint compared to the short run. Furthermore, if we also take into consideration the short-run evidence of harmful effects of FDI on the international competitiveness of the Brazilian economy, our results point to a further connection between FDI, the absence of improvements in the ratio of income elasticities of trade and, consequently, the limited long-run economic growth associated with balance-of-payments equilibrium for the Brazilian economy. Besides, in this long-run analysis, we find evidence that variations in trade balance precede the growth rate of FDI flows, a suggestion that these capital flows to Brazil might be boosted by the exporting behavior of the country and aimed to sectors that reinforce the role of the Brazilian economy as a commodity exporter.

3.4.2 FDI and technological change

In our short-run analysis, we deal with the technological change channel in a very indirect (and incomplete) manner, through the unit labor cost. Nevertheless, in this exercise with annual data, we will seek to deepen our analysis concerning this mechanism. As discussed earlier, the technological change channel is directly related to the possibility of technological transfers from developed to developing countries, either directly or indirectly. Besides, as negative effects analyzed in this channel, it is pointed out a possible transfer of obsolete technology to the South (keeping the technological difference between developed and developing economies); transfer of technologies that would be relatively inefficient in the recipient country (such as labor-saving technologies in economies with extensive labor supply, that is "industrial reserve army"); a structural deficit in the absorption of new technologies, as the observed transfer is that of technological development results and innovations from outside, with no long-run counterpart in technology development internally in the South, representing the maintenance of a lower technological level compared to the North (BERTELLA; LIMA, 2005; DUTTARAY; DUTT; MUKHOPADHYAY, 2008).[23]

Given the aggregate nature of this empirical exercise, it will not be possible to capture differences between the direct and indirect effects of a technological change arising from FDI flows. Nevertheless, we will seek to measure the effect as a whole on the aggregate productivity of the Brazilian economy. For that, we will use a simplified measure for this variable: the current total factor productivity (henceforth, TFP) level.[24]

[23] Again, see Section 1.1 for a detailed discussion of the mechanisms underlying the operation of this technological change channel.

[24] Although this variable is not the only one that can be used to capture such a relationship and, of

Table 30 presents the results for the cointegration tests. The evidence suggests that there is not a cointegration relation between the variables. Thus, we proceed to the estimation of a VAR(4) model for the first difference of the variables. It is important, once again, to indicate that we included the terms of trade as a control variable.

Variables Selected lags (VAR)	Test type	Number of cointegration relations					
		Model	1	2	3	4	5
FDI and current TFP level	Trace		0	0	0	0	2
5 lags	Max-Eig		0	0	0	0	0

Table 30 – Cointegration relations - Annual data - FDI and productivity

Analyzing the residuals of the estimation (again, the tests are presented in Appendix C), they do not present autocorrelation problems and, moreover, also seem to be normally distributed. Besides, regarding the Granger-causality test, the results in Table 31 show that neither of the variables "Granger-causes" the other one.

Dependent variable: D(LIDPPC)

Excluded	Chi-sq	df	Prob.
D(LTFPNA)	7.294102	5	0.1997
All	7.294102	5	0.1997

Dependent variable: D(LTFPNA)

Excluded	Chi-sq	df	Prob.
D(LIDPPC)	6.727367	5	0.2417
All	6.727367	5	0.2417

Table 31 – Granger-causality test (annual data) - FDI and TFP

Moreover, for the impulse response functions, we analyze the results for two different orderings for the shocks. First, Figures 46 and 47 presents the IRFs for the ordering in which the growth rate of FDI flows is affected only by its own shocks in the first period,

course, it may not be the best measure of productivity, we follow our analysis with this variable mainly because of data availability.

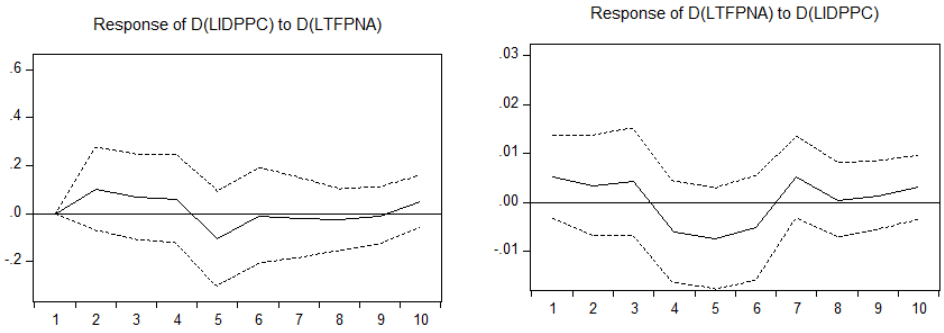

Figure 46 – Impulse-response functions - FDI and TFP - First ordering

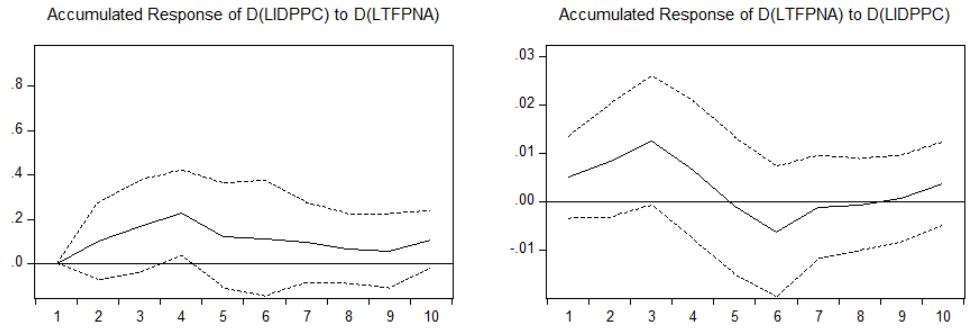

Figure 47 – Accumulated impulse-response functions - FDI and TFP - First ordering

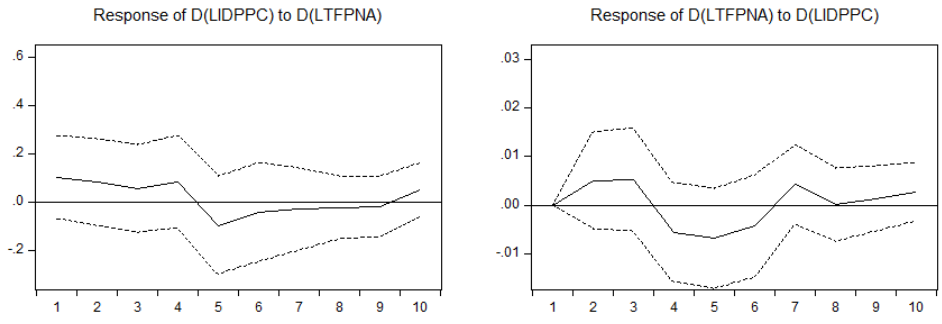

Figure 48 – Impulse-response functions - FDI and TFP - Second ordering

whilst the growth rate of TFP is affected by shocks of FDI flows growth rate as well as its own shocks in the first period (that is, $D(LIDPPC) \longrightarrow D(LTFPNA)$).

For this first case, the results suggest that although shocks in FDI flows growth rate does not impact the growth rate of TFP, shocks in the TFP growth rate positively impact the growth rate of FDI flows. Thus, we find evidence that increasing aggregate productivity is positively related to increasing FDI flows in the Brazilian economy. Furthermore, Figures 48 and 49 presents similar results for the second ordering ($D(LTFPNA) \longrightarrow D(LIDPPC)$, what indicates a certain robustness of our findings.

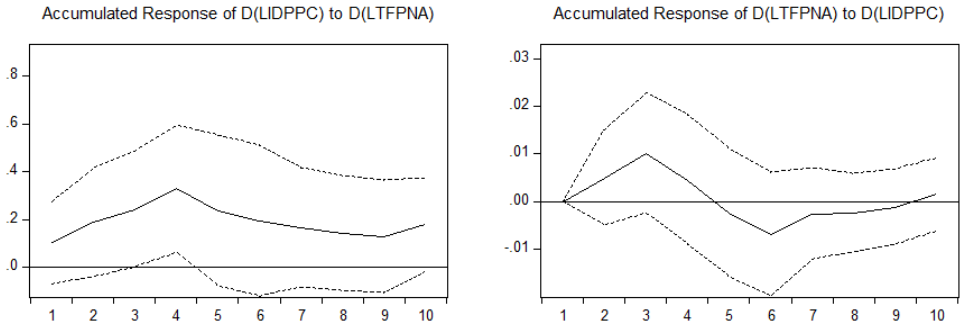

Figure 49 – Accumulated impulse-response functions - FDI and TFP - Second ordering

Therefore, in a long-run analysis, there appears to be a positive relationship between the growth rate of total factor productivity and the growth rate of FDI flows in the Brazilian economy. Thus, our aggregate results point to a different suggestion than Jorge and Dantas (2009) and Souza and Pinto (2015), as it seems that there is a positive relationship between productivity and FDI flows in the Brazilian economy, although the causation seems to be from increasing productivity to increasing FDI flows. A possible explanation for this specific connection is that increasing productivity might lead to higher profitability and, through this mechanism, increase the attractiveness of the Brazilian economy to direct investments. Also, a similar argument could be made in relation to a potential accelerator effect of GDP growth on FDI flows.[25]

3.4.3 FDI and income distribution

In the distribution channel, the arguments presented in the literature generally point to the higher wages paid by foreign firms in developing countries (given that their productivity tends to be higher). Nevertheless, the entry of foreign firms into emerging countries may diminish wages and prospects of low-skilled workers, although it pays well a small privileged share of highly skilled workers, representing an inequalizing process regarding wages (FEENSTRA; HANSON, 1997). Earlier in this thesis (see Section 1.1), we discussed the impact that these "islands" of high-wage workers and managers can generate regarding the consumer behavior, the productive structure, the employment composition and the pattern of income distribution of the country in the long-run. In addition, the theoretical arguments suggest that the relationship between FDI inflows and inequality is not linear and may change over time, given workers' learning and skills improvement in the transition to new technologies.

To analyze the operation of this channel in the Brazilian economy, we use two different measures of income distribution: a functional measure - that is, the distribution

[25] That is, assuming that increasing TFP is somehow related to higher growth rates, a point that will be discussed later on this essay.

of aggregate income between wages and profits - and a personal measure, through an aggregate index.

Table 32 shows the results for the Johansen's cointegration test for two different specifications: one using the wage share as a measure of the functional distribution of income and one using the GINI coefficient as a measure of personal income inequality. For both specifications, we do not find evidence of cointegration relations between income distribution and FDI flows. Therefore, we proceed to the estimation of two VAR models for the first difference of the endogenous variables, considering 3 lags for both models and the inclusion of the terms of trade as a control variable. The results of the tests regarding the behavior of the residuals of each estimation indicate that these residuals of both the estimations examined in this section do not present autocorrelation problems and only the residual associated with the growth rate of the wage share in the first specification do not present third and fourth moments similar to the normal distribution.

Variables Selected lags (VAR)	Test type	Number of cointegration relations					
		Model	1	2	3	4	5
FDI and wage share	Trace		0	0	0	1	2
4 lags	Max-Eig		0	0	0	1	2
FDI and GINI index	Trace		0	0	0	0	0
4 lags	Max-Eig		0	0	0	0	0

Table 32 – Cointegration relations - Annual data - FDI and income distribution

Moreover, Table 33 presents the Granger-causality test for this estimation and the results can be summarized as follows: although the growth rate of FDI flows do not "Granger-causes" the growth rate of the wage share, the growth rate of the wage share "Granger-causes" the growth rate of FDI flows. This means that variations in the functional income distribution seems to precede the growth rate of FDI flows to the Brazilian economy.

For the impulse response functions, we present, in Figures 50 and 51, the results for only one ordering for the Cholesky decomposition, as the Granger-causality test gave us evidence of the temporal relation between the variables. The ordering is such that the growth rate of wage share is affected only by its own shocks in the first period, whilst the growth rate of FDI flows is affected by shocks of wage share growth rate as well as its own shocks in the first period ($D(LWSHARE) \longrightarrow D(LIDPPC)$).

The results for the IRFs indicate that shocks in the growth rate of FDI flows do not impact the growth rate of the wage share. However, we find evidence that wage share growth rate shocks negatively impact the growth rate of FDI flows in the Brazilian

Dependent variable: D(LIDPPC)			
Excluded	Chi-sq	df	Prob.
D(LWSHARE)	11.10652	3	0.0112
All	11.10652	3	0.0112

Dependent variable: D(LWSHARE)			
Excluded	Chi-sq	df	Prob.
D(LIDPPC)	2.757024	3	0.4306
All	2.757024	3	0.4306

Table 33 – Granger-causality test (annual data) - FDI and wage share

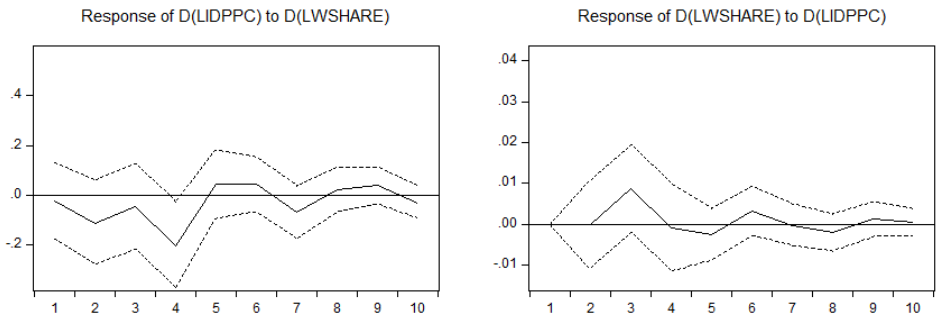

Figure 50 – Impulse-response functions - FDI and wage share

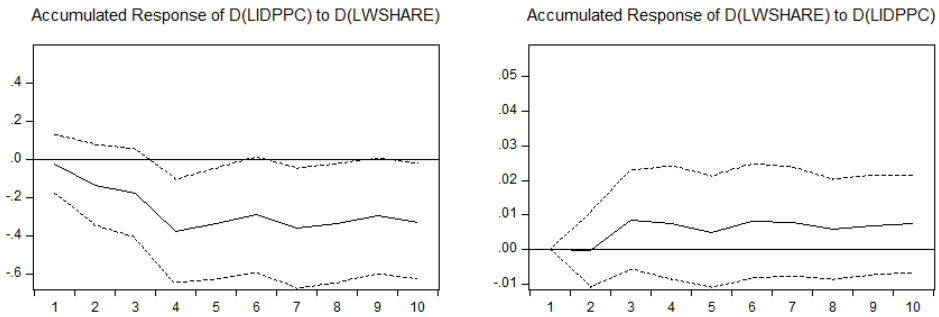

Figure 51 – Accumulated impulse-response functions - FDI and wage share

case. Coupled with the result of the Granger-causality test, it is possible to conclude that increases in the relative remuneration of the labor factor are negatively related to FDI flows. Thus, the evidence suggests that greater profit shares are related to increasing inflows of FDI to Brazil. It is interesting to analyze this result as a further suggestion to the one in the previous subsection - our findings seem to point out a connection between higher profitability and increased attractiveness of the Brazilian economy to FDI flows. Although the relationship between TFP and the profit share should be further analyzed, the results of this exercise indicate that, in fact, aggregate productivity and profitability are variables that boost FDI flows to Brazil (and the opposite direction is not observed for these relations).

Moreover, now looking at the specification with the GINI coefficient, Table 34 presents the output of the Granger-causality test. In this case, the growth rate of FDI flows "Granger-causes" the growth rate of the GINI coefficient, and the contrary is not observed. Thus, we have direct evidence that increasing FDI flows precede variations in the GINI coefficient. Figures 52 and 53 presents, respectively, the IRF and the accumulated IRF for

Dependent variable: D(LIDPPC)

Excluded	Chi-sq	df	Prob.
D(LGINI)	0.163444	3	0.9833
All	0.163444	3	0.9833

Dependent variable: D(LGINI)

Excluded	Chi-sq	df	Prob.
D(LIDPPC)	10.14954	3	0.0173
All	10.14954	3	0.0173

Table 34 – Granger-causality test (annual data) - FDI and GINI index

the ordering in which the growth rate FDI flows is affected only by its own shocks in the first period, whilst the growth rate of GINI coefficient is affected by shocks of FDI flows growth rate as well as its own shocks in the first period (that is, $D(LIDPPC) \longrightarrow D(LGINI)$).

For this specification, the results for the IRFs reveal that shocks in the growth rate of the GINI coefficient do not impact the growth rate of FDI flows. However, we find evidence that shocks in the FDI flows growth rate has a positive impact on the growth

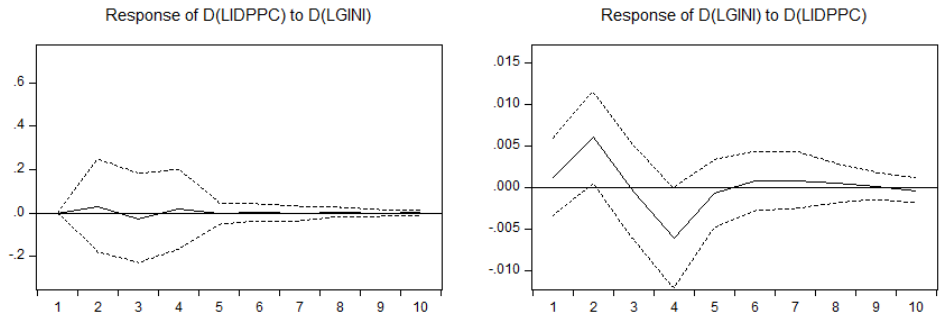

Figure 52 – Impulse-response functions - FDI and GINI coefficient

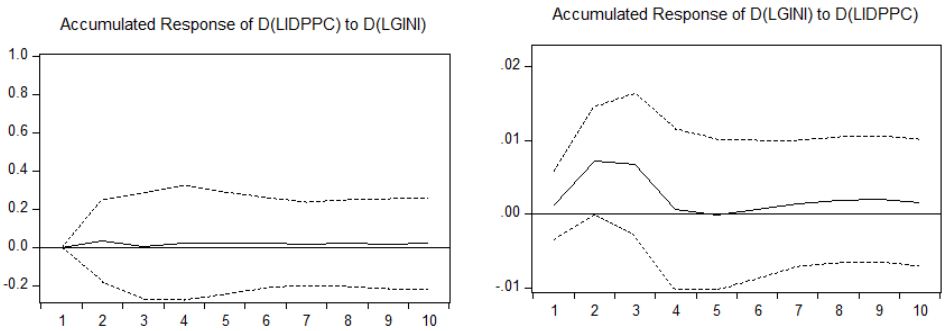

Figure 53 – Accumulated impulse-response functions - FDI and GINI coefficient

rate of the GINI coefficient 2 periods after the innovation. Thus, we have further evidence suggesting that increasing FDI flows to the Brazilian economy might be related to an increase in income inequality.

In essence, the results presented in this subsection allow us to indicate a certain relationship between FDI flows and income distribution in Brazil. In this long-run analysis, we find evidence that both the functional and the personal distribution might, in fact, be related to increasing FDI flows. If, on one hand, our results suggest that increasing profit shares are related to increasing FDI flows to Brazil, on the other hand, we present evidence that those increasing FDI flows are related, in turn, to an increase in the growth rate of GINI coefficient, that is, to greater income inequality.

Therefore, there seems to be a trade-off between promoting growth related to FDI inflows (if this is the case for the long-run, as it seems to be for the economic activity in the short term) and increasing inequality, at least concerning personal distribution. This result is similar to the findings of Basu and Guariglia (2007) and Herzer, Hühne and Nunnenkamp (2014). Nevertheless, this econometric exercise also looks to another measure of income distribution - a functional one - finding evidence that decreases in the growth rate of the wage share boost the growth rate of FDI flows to the Brazilian economy, a further suggestion that FDI inflows might be related to (and preceded by) a measure of

the profitability of the economy.

3.4.4 FDI, trade balance and income distribution

Given the results found for the income distribution channel and, also, given the conclusions that the econometric exercise performed in the second essay of this thesis obtained regarding the role of (functional) income distribution in determining trade flows, it seems interesting to analyze the concomitant relations between FDI, trade balance and income distribution for the Brazilian economy.

Table 35 presents the results for the Johansen's cointegration test for two different specifications: one using the wage share as a measure of the functional distribution of income and one using the GINI coefficient as a measure of personal income inequality. For the first specification, we find evidence of one cointegration relation between the variables treated (especially because we consider that Model 4 is the best specification considering the behavior of the data). Therefore, we estimate a VEC model for this case, including a constant and a trend term in the cointegration vector, a constant and 3 lags of the endogenous variables in the VEC, and the terms of trade as a control variable. Moreover, the evidence for the second specification indicates that there is not a cointegration relation between the variables and, thus, we proceed to the estimation of a VAR model for the first difference of the endogenous variables (including 3 lags and the usual control variable). In summary, the residuals of both the estimations examined in this section do not present serious autocorrelation problems (although the first model might suffer from correlation in some lags) and the residuals of both the growth rates of the wage share and the GINI coefficient do not seem to be normally distributed.

Variables Selected lags (VAR)	Test type	Number of cointegration relations					
		Model	1	2	3	4	5
FDI, trade balance and wage share	Trace		1	2	1	1	3
4 lags	Max-Eig		0	0	0	1	1
FDI, trade balance and GINI index	Trace		0	0	0	0	0
4 lags	Max-Eig		0	0	0	0	0

Table 35 – Cointegration relations - Annual data - FDI, trade balance and income distribution

First, let us focus our attention on the VEC model. Table 36 shows the output of this estimation. The most relevant results from Table 36 are related to long-term relationships, that is, the coefficients within the cointegration vector. It is direct to see that, with the normalization proposed (for LIDPPC), the coefficients indicate that both

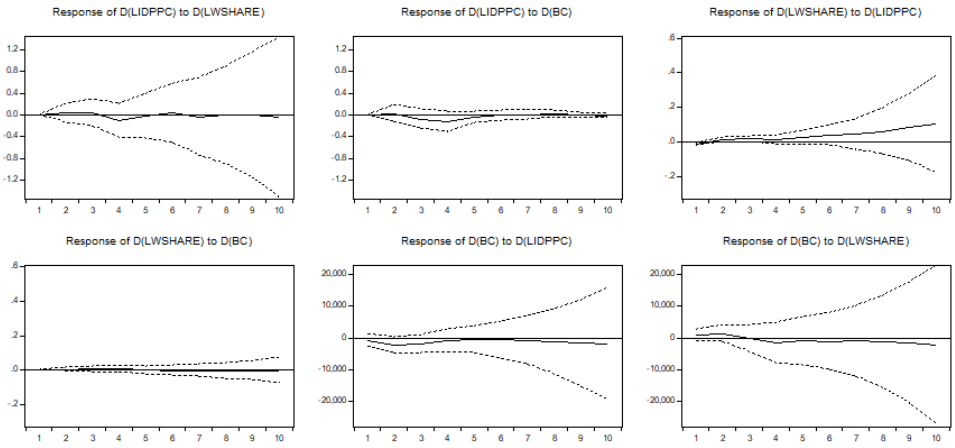

Figure 54 – Impulse-response functions - FDI, trade balance and wage share - First ordering

the wage share and the trade balance are negatively related to FDI flows in the long-run (and the results are statistically significant). Furthermore, the trend term included in the cointegration vector is quite significant in statistical terms, which corroborates our choice for the estimation of Model 4. In the VEC, the adjustment coefficients, α (again, represented by "CointEq1"), associated with the short-term relationships present the expected signs and is statistically significant for FDI flows growth rate and wage share growth rate, although the sign of the coefficient associated with trade balance variations in not the expected (but it is also non-significant).

Besides, Table 37 presents the output for the Granger-causality test. For this specification, both the trade balance variations and the growth rate of FDI flows are not "Granger-caused" by the other variables. However, we find evidence that FDI flows growth rate "Granger-causes" the growth rate of wage share. This means that, when we take into consideration the trade balance as an endogenous variable in our model, the evidence suggests that the growth rate of FDI flows precede the growth rate of wage share in the Brazilian economy.

Regarding the impulse response functions, we analyze the results for two different orderings for the shocks (following a Cholesky decomposition). Figures 54 and 55 show the IRFs for the ordering in which the growth rate of FDI flows is affected only by its own shocks in the first period, whilst the growth rate of wage share is affected by shocks of FDI flows growth rate as well as its own shocks and the trade balance variations are affected by all shocks in the first period (that is, $D(LIDPPC) \longrightarrow D(LWSHARE) \longrightarrow D(BC)$).

The results for this ordering indicate that shocks of the three endogenous variables considered in our estimations do not impact the other ones. When we consider the second ordering, in which $D(LIDPPC) \longrightarrow D(BC) \longrightarrow D(LWSHARE)$, Figures 56 and 57 reveal that the results are quite similar. This means that, when we take into consideration

Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1		
LIDPPC(-1)	1.000000		
LWSHARE(-1)	14.09700 (1.13623) [12.4068]		
BC(-1)	$2.28E-05$ $(6.1E-06)$ [3.72793]		
@TREND(70)	−0.147216 (0.00648) [-22.7260]		
C	4.923830		
Error Correction:	**D(LIDPPC)**	**D(LWSHARE)**	**D(BC)**
CointEq1	−0.540407 (0.24984) [-2.16302]	−0.067788 (0.01661) [-4.08149]	277.4612 (3401.19) [0.08158]
D(LIDPPC(-1))	0.029344 (0.21578) [0.13599]	0.042011 (0.01434) [2.92878]	−3427.255 (2937.49) [-1.16673]
D(LIDPPC(-2))	−0.153808 (0.17815) [-0.86336]	0.045455 (0.01184) [3.83814]	−4640.444 (2425.26) [-1.91338]
D(LIDPPC(-3))	0.137819 (0.16224) [0.84950]	0.019598 (0.01078) [1.81713]	−3040.290 (2208.60) [-1.37657]
D(LWSHARE(-1))	1.016996 (3.12763) [0.32516]	0.498921 (0.20792) [2.39963]	39076.81 (42578.2) [0.91777]
D(LWSHARE(-2))	0.947471 (2.92593) [0.32382]	0.519545 (0.19451) [2.67109]	−38652.68 (39832.2) [-0.97039]
D(LWSHARE(-3))	−3.708646 (2.61247) [-1.41960]	0.660902 (0.17367) [3.80552]	−47373.49 (35564.9) [-1.33203]
D(BC(-1))	$3.74E-06$ $(1.3E-05)$ [0.28240]	$6.24E-07$ $(8.8E-07)$ [0.70939]	0.356106 (0.18013) [1.97698]
D(BC(-2))	$-1.46E-05$ $(1.4E-05)$ [-1.02311]	$3.66E-07$ $(9.5E-07)$ [0.38518]	0.029480 (0.19459) [0.15150]
D(BC(-3))	$-1.72E-05$ $(1.5E-05)$ [-1.17928]	$4.30E-07$ $(9.7E-07)$ [0.44272]	−0.396757 (0.19873) [-1.99649]
C	0.107444 (0.09353) [1.14882]	−0.010506 (0.00622) [-1.68976]	1419.072 (1273.21) [1.11456]
LPXM	−0.579700 (0.76938) [-0.75347]	−0.059061 (0.05115) [-1.15475]	−5342.816 (10473.9) [-0.51011]

Table 36 – Estimation output - Cointegration: FDI, trade balance and wage share

Dependent variable: D(LIDPPC)

Excluded	Chi-sq	df	Prob.
D(LWSHARE)	3.472708	3	0.3243
D(BC)	3.201544	3	0.3616
All	8.595530	6	0.1976

Dependent variable: D(LWSHARE)

Excluded	Chi-sq	df	Prob.
D(LIDPPC)	15.68988	3	0.0013
D(BC)	1.211076	3	0.7503
All	16.81756	6	0.0100

Dependent variable: D(BC)

Excluded	Chi-sq	df	Prob.
D(LIDPPC)	4.138184	3	0.2469
D(LWSHARE)	5.957124	3	0.1137
All	9.784756	6	0.1340

Table 37 – Granger-causality test (annual data) - FDI, trade balance and wage share

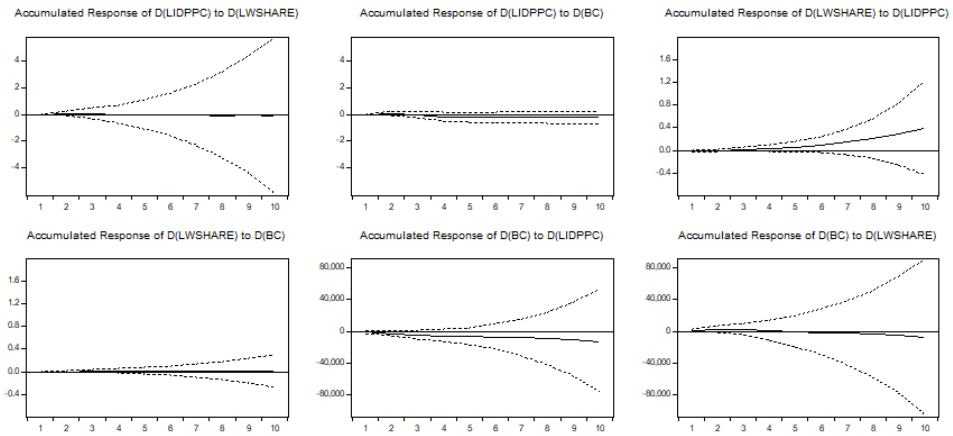

Figure 55 – Accumulated impulse-response functions - FDI, trade balance and wage share - First ordering

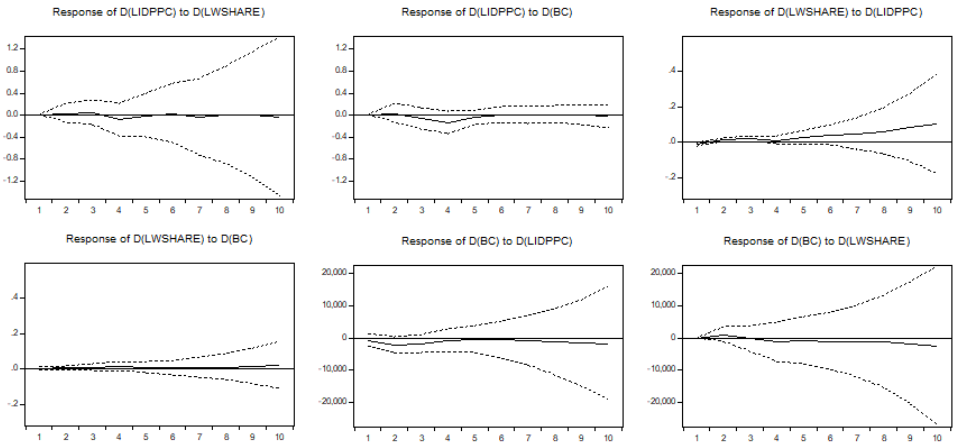

Figure 56 – Impulse-response functions - FDI, trade balance and wage share - Second ordering

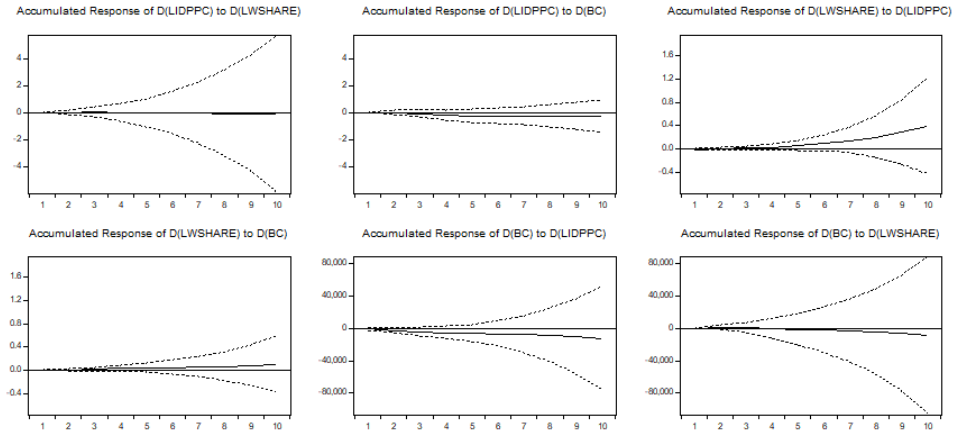

Figure 57 – Accumulated impulse-response functions - FDI, trade balance and wage share - Second ordering

the concomitant interaction between these variables, the results are less clear than those presented earlier in this essay.

Now, let us move to the analysis of the second estimation of this subsection, using a measure of personal income inequality. Table 38 shows the results for the Granger-causality test, indicating that both the growth rate of FDI inflows and trade balance variations are not "Granger-caused" by other variables. Nevertheless, we find further evidence that the FDI flows growth rate seems to precede the growth rate of the GINI coefficient.

Regarding the impulse response functions, we again analyze the results for two different orderings for the shocks. First, Figures 58 and 59 presents, respectively, the IRF and the accumulated IRF for the ordering in which the growth rate of FDI flows is affected only by its own shocks in the first period, whilst the growth rate of GINI coefficient is affected by shocks of FDI flows growth rate as well as its own shocks

Dependent variable: D(LIDPPC)

Excluded	Chi-sq	df	Prob.
D(LGINI)	0.484709	2	0.7848
D(BC)	4.504565	2	0.1052
All	4.611061	4	0.3296

Dependent variable: D(LGINI)

Excluded	Chi-sq	df	Prob.
D(LIDPPC)	5.255039	2	0.0723
D(BC)	1.388375	2	0.4995
All	7.359848	4	0.1181

Dependent variable: D(BC)

Excluded	Chi-sq	df	Prob.
D(LIDPPC)	1.561047	2	0.4582
D(LGINI)	1.252288	2	0.5346
All	3.315270	4	0.5065

Table 38 – Granger-causality test (annual data) - FDI, trade balance and GINI index

and the trade balance variations are affected by all shocks in the first period (that is, $D(LIDPPC) \longrightarrow D(LGINI) \longrightarrow D(BC)$).

For this first ordering, the results indicate that shocks of GINI coefficient growth rate and trade balance variations do not impact the other endogenous variables. Nevertheless, we find evidence that shocks in the growth rate of FDI flows have a positive impact on the growth rate of the GINI coefficient for the second period after the innovation. Again, the results for the second ordering ($D(LIDPPC) \longrightarrow D(BC) \longrightarrow D(LGINI)$), presented in Figures 60 and 61, are similar, what can be understand as a suggestion of the robustness of these findings.

In essence, the results presented in this subsection corroborate the findings regarding the operation of the income distribution channel. Our results suggest that, in fact, there is a causal relation (in the sense of Granger) between FDI flows and the functional distribution

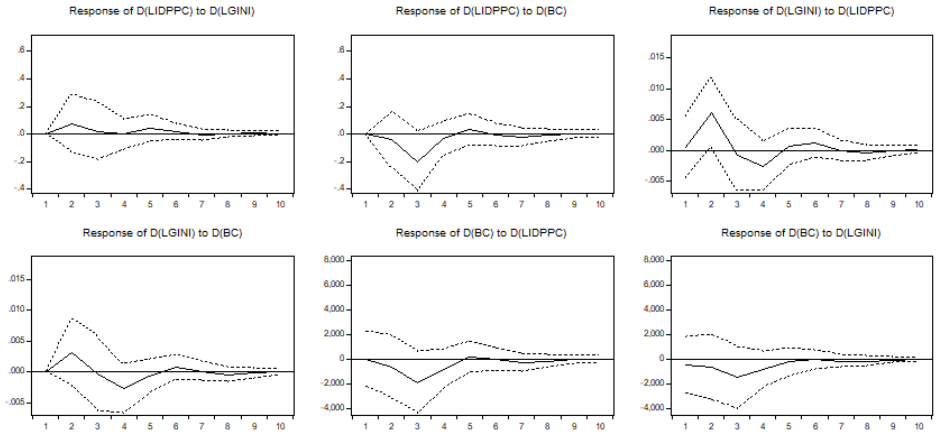

Figure 58 – Impulse-response functions - FDI, trade balance and GINI coefficient - First ordering

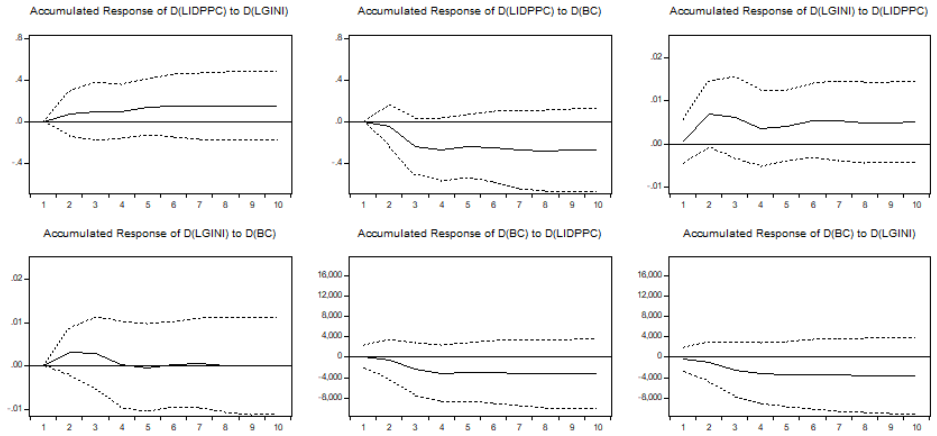

Figure 59 – Accumulated impulse-response functions - FDI, trade balance and GINI coefficient - First ordering

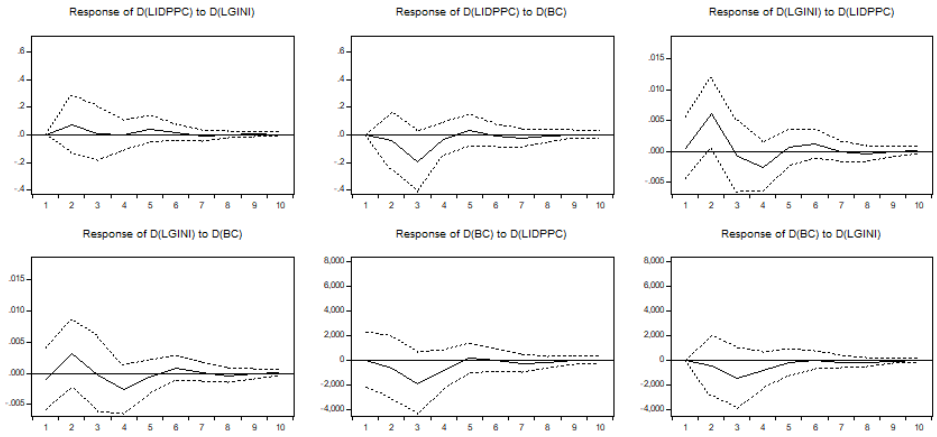

Figure 60 – Impulse-response functions - FDI, trade balance and GINI coefficient - Second ordering

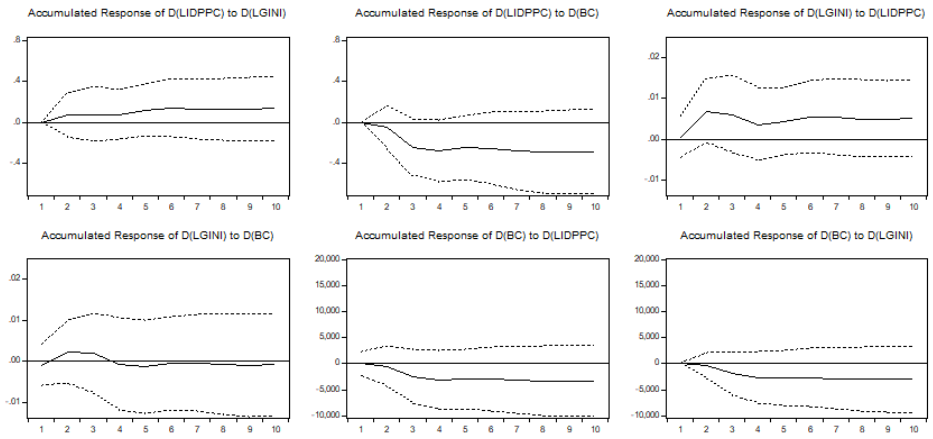

Figure 61 – Accumulated impulse-response functions - FDI, trade balance and GINI coefficient - Second ordering

of income and it seems that this relationship operates in a certain way: increasing profit shares are positively related to increasing FDI flows. Furthermore, in this case, we find a negative relationship between trade balance and FDI flows, indicating that, when we consider the concomitant relationships between FDI, trade balance, and functional income distributions, we observe a negative impact on the balance-of-payments component channel for the Brazilian economy. It is possible to link this result with some of the arguments presented in our previous essay: as higher profit shares are related to higher FDI flows, this pattern of functional distribution might be related to increased imports *vis-a-vis* exports and, therefore, to a negative result of the trade balance. Furthermore, if we connect this evidence with the suggestion made in our long-run analysis of the relationship between FDI, exports and imports - that both components of the trade balance are positively related to FDI flows- this result might indicate, in fact, that the effects on imports are higher than on exports and, even though FDI flows might represent an alleviation of the external constraint in the short run, in the long run these capital flows tend to reduce the economic growth rate associated with balance-of-payments equilibrium. Besides, considering the personal income distribution, we find further evidence of a causal relation (again, in Granger's sense) between the growth rate of FDI flows and the growth rate of GINI coefficient and that variations in FDI flows growth rate seems to positively impact the growth rate of GINI coefficient. Thus, our results suggest that increasing FDI flows to the Brazilian economy might be related to increases in income inequality.

3.4.5 FDI and economic growth

After presenting the analyses of several of the channels through which FDI can impact the economic growth of the Brazilian economy in the long run, we now turn our attention to the aggregate effect of FDI flows on the Brazilian real GDP growth rate. As

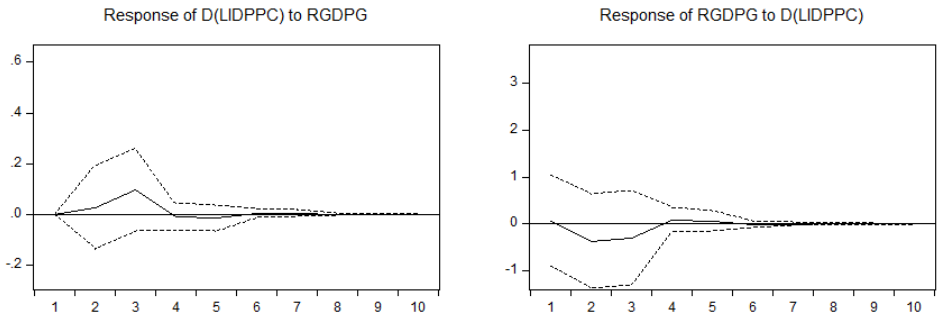

Figure 62 – Impulse-response functions - FDI and real GDP growth

this last variable is already stationary, we estimate a VAR model for the growth rates of FDI flows and the real GDP, including two lags for each endogenous variable and the terms of trade as a control variable. The residuals of the estimation do not present autocorrelation problems and also seem to be normally distributed. Table 39 shoes the results for the Granger-causality test for this specification, indicating that neither variables "Granger-cause" the other one.

Dependent variable: D(LIDPPC)

Excluded	Chi-sq	df	Prob.
RGDPG	1.808419	2	0.4049
All	1.808419	2	0.4049

Dependent variable: RGDPG

Excluded	Chi-sq	df	Prob.
D(LIDPPC)	0.927761	2	0.6288
All	0.927761	2	0.6288

Table 39 – Granger-causality test (annual data) - FDI and real GDP growth rate

Besides, Figures 62 and 63 presents, respectively, the IRF and the accumulated IRF for the ordering in which FDI flows growth rate is affected only by its own shocks in the first period, whilst real GDP growth is affected by its own shocks and by FDI flows growth rate shocks (that is, $D(LIDPPC) \longrightarrow RGDPG$).

The results for this estimation portray that shocks of both endogenous variables

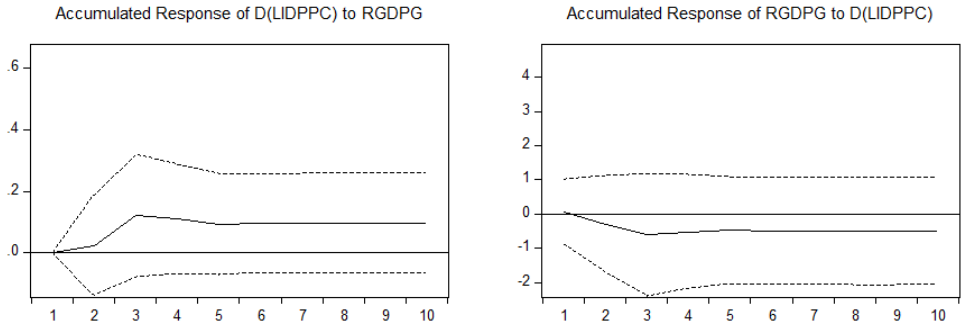

Figure 63 – Accumulated impulse-response functions - FDI and real GDP growth

considered in our estimations do not impact the other one. It is worth saying that the IRFs for other possible ordering of the shocks are quite similar (we chose not to present this case for simplicity). Thus, our evidence suggests that, at least for this simple estimation, there is not a clear relationship between the growth rate of FDI flows and the real GDP growth rate of the Brazilian economy.

Nevertheless, as we find in this long-term analysis a positive relationship between FDI flows and aggregate productivity and, besides, there is evidence in the literature that aggregate productivity is positively related to the growth rate of real output[26], it seems interesting to analyze the concomitant relationships of these three variables for the Brazilian economy in order to further understand the effects of FDI flows on economic growth. With that in mind, we proceed to the estimation of a VAR model that includes the growth rates of FDI inflows, current TFP, and real GDP as endogenous variables, 5 lags of those variables, and the terms of trade as a control variable. Similar to the previous case, the residuals of this estimation do not present autocorrelation problems and seem to be normally distributed. Table 40 presents the output of the Granger-causality test for this specification and the results reveal that the growth rate of FDI flows is "Granger-caused" by the growth rate of TFP and real GDP growth rate. Furthermore, we also find evidence of a double (two-way) causality relation (in Granger's sense) between the real GDP growth rate and the TFP growth rate.

Moreover, for the IRFs, we analyze the results for only one ordering for the Cholesky decomposition, following the evidence of the Granger-causility test. Figures 64 and 65 show the results for the ordering in which real GDP growth rate is affected only by its own shocks in the first period, while TFP growth rate is affected by its own shocks and real GDP growth rate shocks in the first period and the growth rate of FDI flows is affected by all shocks in the first period ($RGDPG \longrightarrow D(LTFPNA) \longrightarrow D(LIDPPC)$).

The evidence presented in Figures 64 and 65 indicate that real GDP growth rate

[26] See, for instance, Gomes, Pessôa and Veloso (2003), Barbosa Filho, Pessôa and Veloso (2010) and Ferreira, Pessoa and Veloso (2013).

Dependent variable: D(LIDPPC)

Excluded	Chi-sq	df	Prob.
RGDPG	15.66598	5	0.0079
D(LTFPNA)	16.77449	5	0.0049
All	25.84151	10	0.0040

Dependent variable: RGDPG

Excluded	Chi-sq	df	Prob.
D(LIDPPC)	3.130920	5	0.6798
D(LTFPNA)	10.29237	5	0.0674
All	12.06923	10	0.2805

Dependent variable: D(LTFPNA)

Excluded	Chi-sq	df	Prob.
D(LIDPPC)	9.059211	5	0.1067
RGDPG	13.27884	5	0.0209
All	22.06897	10	0.0148

Table 40 – Granger-causality test (annual data) - FDI, real GDP growth rate and TFP

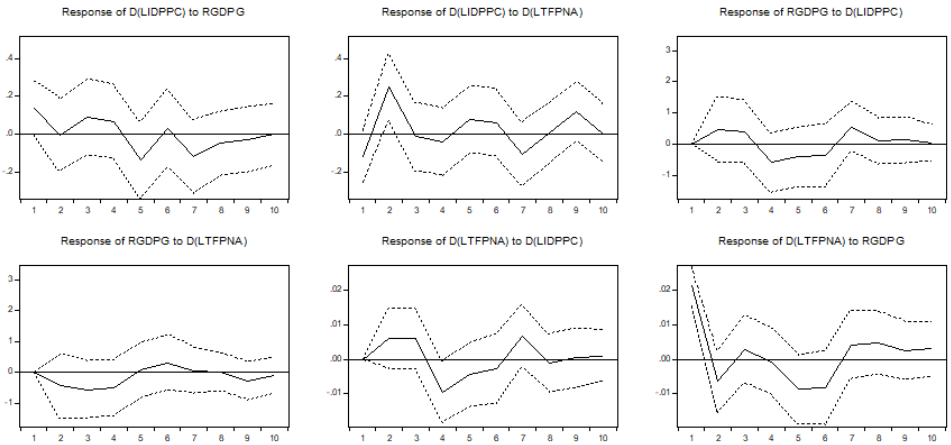

Figure 64 – Impulse-response functions - FDI, real GDP growth and TFP

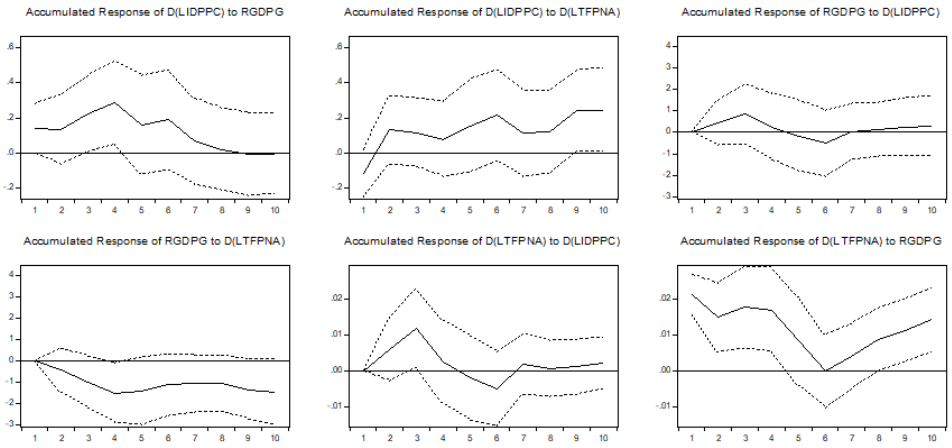

Figure 65 – Accumulated impulse-response functions - FDI, real GDP growth and TFP

shocks have a positive impact on the growth rate of FDI flows but the contrary is not observed. Furthermore, we find the expected result that shocks in the real GDP growth rate have a positive impact on the growth rate of TFP. Besides, our results suggest that shocks in the growth rate of FDI flows have a positive impact on TFP growth rate. Therefore, the general evidence that arises from this estimation is that there seems to be a positive relationship between real GDP growth rate and increasing FDI flows, and the causality (in Granger's sense) is from economic growth to FDI. This evidence is partially in line with the findings of (BASU; CHAKRABORTY; REAGLE, 2003), as for a relatively closed economy we find that the long-run dominant relation is that of economic growth to FDI inflows, although we do not find evidence of double causality. However, it is important to highlight that this relationship goes through a technological change channel, as the growth rate of TFP is positively related to FDI flows and the economic growth of the Brazilian economy.[27]

By way of conclusion, it is worth presenting in a summarized manner the results found in this econometric exercise before moving to the concluding remarks of this essay. In this long-term analysis for the Brazilian economy, we find evidence that FDI flows have a positive relationship with aggregate productivity (measured by the TFP) and the profit share, and our findings suggest that the relationship goes from increasing productivity and increasing profit share to increasing FDI flows. We argue that a possible explanation for this connection between the variables is that increases in productivity might be related to increases in profitability (decreases in the wage share) and these effects seem to boost the flows of direct investment to Brazil. Moreover, our results reveal a positive relationship between FDI and the components of the Brazilian trade balance. Although the net result

[27] A first empirical advance to be considered in order to better understand the relationship between FDI and economic growth in Brazil is to also include a profitability (and hence distributional) measure in this analysis, since our findings are suggestive of an important connection between these capital flows and profitability in the Brazilian economy.

on the trade balance depended, in a first view, on the relative magnitudes of the impacts of these capital flows on exports and imports, when considering the role of functional income distribution, we obtained an indication that the relationship between the FDI and the trade balance is negative. Thus, the evidence is suggestive of a tightening of the external constraint of the Brazilian economy in the long run. Furthermore, in the aggregate analysis of the effects of the FDI on economic growth, we find a positive relationship between the variables when we take into account the impacts of such investment flows on the rate of productivity growth (technological change channel).

Lastly, our results indicate the existence of a certain trade-off between promoting economic growth related to FDI inflows (mainly as a result of productivity growth) and increasing income inequality, especially regarding the personal income distribution. The evidence of a positive relationship between increases in FDI flows and increases in the GINI coefficient and, in special, that the causal relation (in Granger's sense) goes from FDI to income inequality, reveals that income distribution needs to be considered as a key variable for understanding the aggregate effects of such capital flows on the domestic economy.

3.5 Concluding remarks

In order to complete this econometric exercise, it is worth synthesizing the main results obtained in the estimation of the proposed models and, of course, indicating the limitations of the conclusions derived from them.

First, it is important to say that some of our models can be criticized for the great instability and variation of results with small changes in the estimation period, the inclusion of lags and, mainly, for changes in the ordering of the Cholesky decomposition when an important objective of the exercise rely on the impulse response functions of the models estimated (that is, distinct identifications can profoundly alter the outcome of responses). Up to this point, we have used the simplest Cholesky ordering, chosen from a partially discretionary definition. Notwithstanding, it is important to highlight that for several of our estimations we presented more than one ordering for the Cholesky decomposition and compared the results, seeking to present a robustness test for our evidence. An interesting first extension that could, although theoretically, overcome the limitations listed so far is to advance to the estimation of a structural decomposition of the model's residuals terms, that is, to use distinct identification strategies that characterize a structural autoregressive vector model (SVAR) and a structural vector of error correction model (SVEC). For that, we would follow the seminal example of Sims et al. (1986) and we could test some different specifications, both for short and long term relationships. This option seems to enrich the analysis of the impulse response functions and, therefore,

can guarantee greater "robustness" to the results obtained by enabling greater relations with economic theory (LÜTKEPOHL; KRÄTZIG; PHILLIPS, 2004). Another possible extension is to use an "agnostic" identification strategy, as Uhlig (2005) indicates, for the decomposition of error terms, using "signal restrictions" instead of stipulating values for the estimation. As in the structural case, this possibility also brings greater "robustness" to the empirical exercise that we seek to develop.

In addition to the questions of econometric methodology, during the preparation of this essay for the Brazilian case, another possibility of analysis drew our attention: to unveil some of the chains by which intercompany loans (operations) can affect and be affected by macroeconomic variables, seeking to better understand the composition of this accounting entry and its counterparts for the Brazilian economy. In addition to the possible relationship with other macroeconomic variables, the internal logic of this account still does not seem to be well identified, as well as its association with purely financial flows (e.g. portfolio investments). This interest derives, not only from the substantial variation that intercompany loans flows presented in recent years (with the annual flow being multiplied by 5 between 2017 and 2018 for the Brazilian economy), but also from the importance that these operations present as a major component of the total FDI position in Brazil (see Figure 15).[28] Besides, the lack of literature on the subject, both in terms of understanding the variables that attract this type of investment and its most diverse effects on underdeveloped economies, also drew our attention. Moreover, if we consider the conclusions of Blanchard and Acalin (2016) that for several countries, a large proportion of measured FDI inflows might be just flows going in and out of the country on their way to their final destination, with the stop due in part to favorable corporate tax conditions and that some of these measured FDI flows are much closer to portfolio debt flows, the use of variables such as intercompany loans and portfolio investments in estimates similar to those presented in this essay can serve as a certain robustness test, indicating whether the connections we capture here are related only to FDI flows and, in addition, if FDI might, in fact, present distinct characteristics of typically financial flows, as usually argued in the literature.

By way of conclusion, after presenting some of the limitations of this work as well as future possibilities, it remains only to summarize the main results obtained in this essay. First, for the monthly data analysis, in general, the results obtained allow us to conclude that FDI flows are positively related to the Brazilian trade balance (with a positive effect on exports and negative relationship with imports), to variations in the investment (measured by a GFCF index) and to economic activity as a whole. Nevertheless, the results regarding the unit labor costs and, therefore, to a measure of the international competitiveness of Brazilian production, seem to indicate that FDI flows are negatively

[28] In this point, see the detailed presentation of the annual FDI report in BCB (2017) and BCB (2018).

related to such competitiveness, which can undermine the positive effects on the trade balance and, therefore, on the external constraint in the long run. In brief, our monthly data results are suggestive of a connection between the characteristics of FDI flows to the Brazilian economy and a specific pattern of international insertion of the Brazilian economy that keeps it at the margin of global value chains. In special, our evidence suggests that FDI flows might be concentrated into commodities exporting sectors, a relation that is also revealed in the annual data analysis, as we find evidence that trade balance surpluses seem to precede FDI inflows. This point can indicate certain impossibilities of improving the income elasticity of exports in the long run.

Second, regarding the analysis with annual data, we find evidence that FDI flows have a positive relationship with the aggregate productivity, exports, imports, the profit share, and personal income inequality. When considering the role of functional income distribution, our results indicate that the relationship between the FDI and the Brazilian trade balance is negative. These findings, coupled with the results of the monthly data analysis concerning this balance-of-payments components channel, are suggestive of a worsening of the external constraint associated with increasing FDI flows in the long run, although the effects are positive in the short term. Thus, there seems to be further evidence of a connection between FDI flows and limited economic growth trends in the long run (associated with the balance-of-payments equilibrium). Besides, the evidence of a positive relationship between aggregate productivity and FDI and between profit share and FDI (in both case, with a Granger causality relation from productivity and profitability to FDI), suggests that increases in productivity might be related to increases in profitability and these effects seem to be a relevant factor in determining (and boosting the flows of) direct investment to the Brazilian economy. Furthermore, in the aggregate analysis of the effects of the FDI on economic growth, we find a positive relationship between the variables when we take into account the impacts of such investment flows on the rate of productivity growth. This latter result collaborates, albeit in a limited way, with a long discussion in the empirical literature on the effects of FDI flows on GDP and aggregate productivity. Nevertheless, it is important to highlight that our findings indicate the existence of a certain trade-off between promoting economic growth related to FDI inflows and increasing income inequality. Thus, considering the effects of FDI flows on income distribution seems to be fundamental for understanding the aggregate effect of these capital flows on the economic development of Brazil and, of course, for the design of public policies.

Although far from being conclusive, the empirical effort made in this essay has seemed fruitful, representing an initial step towards a better understanding of the mechanisms by which FDI flows can affect the Brazilian economy. Nevertheless, this first step has already allowed us to examine the impacts of FDI on a set of variables of interest that can

subsidize several discussions regarding the nexus between FDI and economic development for the Brazilian case and, furthermore, allowed us to suggest several connections that can be further analyzed in theoretical and empirical studies.

Conclusion

After presenting the three essays that make up this thesis, it remains only to indicate, in general, the conclusions of this research. As argued in the introduction, given the structure of this research, the best general conclusion that can be presented is one that actually summarizes the results and advances of each essay of this thesis, highlighting the economic interpretations of the results in view of the relationships between FDI, trade relations, economic growth, income distribution and, of course, uneven development.

Our first essay has examined a different application of Thirlwall's analysis: one that addresses the issue of uneven development between rich and poor countries, in other words, divergence, a question that has been widely discussed in the literature. It is worth saying that this application of Thirlwall's Law has been neglected in theoretical and empirical work following Thirlwall (1979). We have developed a theoretical-formal model of North-South trade, including capital flows from the North to South and taking into consideration some channels through which these FDI inflows can affect Southern long-run growth rate and its productive structure. The model shows how Thirlwall's analysis can be incorporated into North-South models to explain uneven development broadly. Similar to Dutt (2002) and others such as Vera (2006), our effort can be seen as a further step in understanding how Thirlwall's analysis can be incorporated into North-South models, as our model overcomes some of the objections to the existing applications of Thirlwall's analysis since it does not assume the terms of trade are fixed nor assume a trade balance from start and because it makes explicit the internal structures of regions and hence the determinants of growth in rich and poor countries. Nevertheless, this model is quite different from the literature mainly because we consider a demand-driven closure - in which the results of Dutt (2002) are obtained in a particular case of our analysis (when the South operates under full capacity utilization) - and we also allow trade balance to vary in the short-run, a feature that brought a new set of implications and mechanisms to the long-run analysis and, especially, to the ratio of growth rates between the regions.

In summary, the model shows once more that, at least for the case in which the Southern economy operates with full capacity utilization, if the income elasticity of imports for the South is higher than of the North, the world economy will come to a long-run equilibrium characterized by uneven development, that is with North growing faster than the South, so that the gap between Northern and Southern income will grow indefinitely. Nevertheless, for the case in which the Southern economy operates with excess capacity, there are several determinants, besides the income elasticities of import demand, of the ratio between the Southern and Northern growth rates in the long-run, such as the

functional income distribution and the terms of trade.

In a more specific way, we considered five channels through which capital flows could affect Southern growth rates: capital accumulation, balance-of-payments components, technological change, market structure, and income distribution. Technological changes caused by FDI flows, in the model captured by the growth rate of labor productivity in the South, have somewhat altered the productive structure in the region. Also, FDI inflows caused a greater capital accumulation in the South, even in the case in which the region has a wage-led overall growth regime, as we considered a dual rationale for the investment in the South and we further assume that there are no profit remittances, which lead in the long run to an equilibrium with faster growth rate for the South that, despite not representing an overcoming of the uneven development pattern, indicates a new path of development: a less unequal one. Furthermore, the effects of FDI on the market structure of the Southern region, captured by the evolution of the mark-up factor, represented a possibility of new long-run equilibrium with further variations in the functional income distribution, thus possibly with an equilibrium in which the workers in the South are benefited (that is, the wage share is higher). These effects on the functional distribution are directly related to the ratio between the regions' long-run growth rates, especially for the case in which the Southern economy operates with excess capacity. Moreover, the consideration of the effects of FDI inflows on the income elasticities ratio indicated a possible change in the long-run development pattern: if the effects of foreign presence in the Southern economy are strong enough on the income elasticities ratio, in the long-run we have that the South grows faster than the North and, thus, there is a quite different divergence in the global economy.

Nevertheless, these positive effects of FDI inflows on the Southern posed a potential problem: the possible instability of the economy in the long run. In particular, when we consider strong effects of the "internationalization" of the Southern economy on variables such as labor productivity, the wage share and, mainly, the income elasticities ratio, the dynamic systems showed a certain tendency towards local instability in the long run (with saddle-path trajectories). Therefore, in summary, the stronger the positive effects of FDI flows on the South, that is, the closer the region's economy is to overcoming uneven development, the greater the tendency to long-run instability. Thus, this essay also indicated the existence of an important long-run trade-off - a dichotomy between instability and the possible overcoming of uneven development. Even so, it is important to point out that this instability may, in fact, be positive for the Southern region.

The second essay of this thesis, in turn, presented an empirical contribution that dialogues, in particular, with a wide literature of growth regimes in open economies, balance-of-payments constrained growth and the role of RER misalignment in economic growth. In summary, we find robust empirical evidence that variations of the wage share

have a negative statistically significant impact on the volume of imports of underdeveloped countries (and for the entire sample). When indicating the importance of the functional distribution of income for the determination of imports, this effort pointed out not only the omission of a relevant variable in much of the empirical literature that estimates this trade flows, but also the omission of a relevant channel in the discussions of real exchange rate undervaluation and its impacts, external constraint and economic growth.

Furthermore, we also present evidence regarding two empirical questions that arise from the model developed in the first essay of this thesis: i) the validity of the income elasticity of import differential between regions and ii) the role of FDI flows on imports and income elasticity of import demand. Concerning the first point, the results indicate a preliminary corroboration of Dutt's findings (DUTT, 2003), that is, the elasticities differential hypothesis seems to be observed even when we consider recent periods and "emerging" economies. Although the results are not extremely robust, it is important to note that we took into consideration several variables as controls, including those regarding supply-side and time-specific factors. Briefly, we find evidence that supports the argument that the income elasticity of import demand is higher in poor (less developed) countries compared to richer economies, which strengthens the result of uneven development between regions in the long run. Besides, regarding the second point, we find evidence that FDI flows do not impact the imports of underdeveloped countries (and for the entire sample). Although this result does not allow us to understand the net impact of those flows on the trade balance, this evidence rules out a potential negative effect of FDI flows on the long-run equilibrium growth rate determined by the external constraint. Also, we took into consideration the possible effects of FDI flows on the income elasticities of import demand of the countries. Nevertheless, the empirical evidence supports the argument that FDI flows do not impact the income elasticity of imports of underdeveloped countries. This result does not help us to measure the net effect of FDI flows on the income elasticities of import ratio between the regions and, therefore, to point this mechanism as a possible means to overcome uneven development, but the evidence presented in Essay 2 at least indicates that the income elasticity of import demand of the Southern region will not increase with a possible internationalization of the economy. Thus, in general, our results indicate that FDI flows do not seem to represent a negative force for underdeveloped economies, at least concerning their trade balance and, through the import channel, their long-run economic growth rate associated with external equilibrium. It remains to be seen, on the other hand, if FDI flows can positively impact these countries.

Lastly, the final essay of this thesis presented a case study of the Brazilian economy, looking to the relationship between FDI and economic growth in the country. Initially, in a broad manner, our results obtained with monthly data allow us to conclude that FDI flows are positively related to the Brazilian trade balance (with a positive effect on exports and

negative relationship with imports), to variations in the investment (measured by a GFCF index) and to economic activity as a whole. Nevertheless, the results regarding the unit labor costs and, therefore, to a measure of the international competitiveness of Brazilian production, seem to indicate that FDI flows are negatively related to such competitiveness, which can undermine the positive effects on the trade balance and, therefore, on the external constraint in the long run. In short, our monthly data results are suggestive of a connection between the characteristics of FDI flows to the Brazilian economy and a specific pattern of international insertion of the Brazilian economy that keeps it at the margin of global value chains. In special, the evidence suggests that FDI flows might be concentrated into commodities exporting sectors, a relation that is also revealed in the annual data analysis, as we find suggestions that trade balance surpluses seem to precede FDI inflows. This point can indicate certain impossibilities of improving the income elasticity of exports in the long run.

Second, regarding the annual data analysis, we find evidence that FDI flows have a positive relationship with the aggregate productivity, exports, imports, the profit share, and personal income inequality. When considering the role of functional income distribution, our results indicate that the relationship between the FDI and the Brazilian trade balance is negative. These findings, coupled with the results with monthly data concerning this balance-of-payments components channel, are suggestive of a worsening of the external constraint associated with increasing FDI flows in the long run, although the effects are positive in the short term. Thus, there seems to be further evidence of a connection between FDI flows and limited economic growth trends in the long run (associated with the balance-of-payments equilibrium). Besides, the evidence of a positive relationship between aggregate productivity and FDI and between profit share and FDI (in both case, with a Granger causality relation from productivity and profitability to FDI), suggests that increases in productivity might be related to increases in profitability and these effects seem to be a relevant factor in determining (and boosting the flows of) direct investment to the Brazilian economy. Furthermore, in the aggregate analysis of the effects of the FDI on economic growth, we find a positive relationship between the variables when we take into account the impacts of such investment flows on the rate of productivity growth. This latter result collaborates, albeit in a limited way, with a long discussion in the empirical literature on the effects of FDI flows on GDP and aggregate productivity. Nevertheless, it is important to highlight that our findings indicate the existence of a certain trade-off between promoting economic growth related to FDI inflows and increasing income inequality. Thus, considering the effects of FDI flows on income distribution seems to be fundamental for understanding the aggregate effect of these capital flows on the economic development of Brazil and, of course, for the design of public policies.

By way of conclusion, it is important to defend, albeit timidly, the systematic

treatment of the structural specificities of less developed economies, both in theoretical and empirical works, in order to better understand the effects of the relations of these economies with the developed world. This work sought to consider the possible specificities of the effects that capital and commercial flows may have on the economic growth of less developed economies. As in the words of the famous British economist, presented at the beginning of this thesis, many times asking an additional question regarding the own nature of the problem addressed is extremely relevant for and during the production of economic theory. In a way more related to this work, we can formulate an additional question in such a way: do the growing commercial and financial relations between the North and the South show the same result for both regions? In one way or another, the exercise of self-understanding is an imperative even within the same group of economies, given that the heterogeneities within the Northern and the Southern regions are substantive. Looking inwards is of paramount importance and must go far beyond a simple process that, at first glance, may seem autotelic: overcoming structural barriers to economic development, both in absolute and relative terms, might directly depend on it.

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Appendix

APPENDIX A – Short-run equilibrium: closed forms - First essay

In this Appendix we present closed for the short-run equilibria analyzed in the first chapter of this thesis. Those solutions are presented in an output document from the software Mathematica.

The first two solutions, in the code called "sol1" and "sol2", are related to the case in which the Southern economy operates with excess capacity, that is $u_{SS}^{*} < 1$. We assume, respectively, that $(\varepsilon_S, \varepsilon_N) = (1, 1)$ and $(\varepsilon_S, \varepsilon_N) = (2, 1)$.

Furthermore, the solution for the case in which the Southern economy operates at full capacity utilization is presented in the code with the name "soln". We assume that both price elasticities are the same and equal to unity, that is: $\mu_S = \mu_N = 1$.

In[12]:=
```
F1[un_] = gamma0 + gamma1 * un;
F2[un_] = sn * pin * un;
F3[us_] = delta0 + delta1 * us + delta2 * p;
F4[us_] = ss * pis * us;
F5[us_, un_] = thetan * ((p) ^ (mus - 1)) * ((us * kss + ksn) ^ (es)) -
  thetas * ((p) ^ (-mun)) * ((un * kn) ^ (en));
eqns = {F1[un] == F2[un] - F5[us, un], F3[us] == F4[us] + F5[us, un]};

sol1 = Solve[eqns /. {es → 1, en → 1} , {us, un}]
       resolve

sol2 = Solve[eqns /. {es → 2, en → 1} , {us, un}]
       resolve
```

Out[13]=

$$\left\{\left\{us \to -\left(\left(kn\, p^{-mun}\left(gamma0 + ksn\, p^{-1+mus}\, thetan\right) thetas - \left(delta0 + delta2\, p - ksn\, p^{-1+mus}\, thetan\right)\left(gamma1 - pin\, sn - kn\, p^{-mun}\, thetas\right)\right) \Big/ \left(kn\, kss\, p^{-1-mun+mus}\, thetan\, thetas - \left(delta1 - pis\, ss - kss\, p^{-1+mus}\, thetan\right)\left(gamma1 - pin\, sn - kn\, p^{-mun}\, thetas\right)\right)\right),\right.$$

$$\left. un \to \left(p^{mun}\left(delta1\, gamma0\, p - gamma0\, p\, pis\, ss + delta1\, ksn\, p^{mus}\, thetan - delta0\, kss\, p^{mus}\, thetan - gamma0\, kss\, p^{mus}\, thetan - delta2\, kss\, p^{1+mus}\, thetan - ksn\, p^{mus}\, pis\, ss\, thetan\right)\right) \Big/ \left(-delta1\, gamma1\, p^{1+mun} + delta1\, p^{1+mun}\, pin\, sn + gamma1\, p^{1+mun}\, pis\, ss - p^{1+mun}\, pin\, pis\, sn\, ss + gamma1\, kss\, p^{mun+mus}\, thetan - kss\, p^{mun+mus}\, pin\, sn\, thetan + delta1\, kn\, p\, thetas - kn\, p\, pis\, ss\, thetas\right)\right\}\right\}$$

Out[14]=

$$\left\{\left\{us \to \frac{1}{2\, kss^2\, (gamma1 - pin\, sn)\, thetan}\right.\right.$$

$$p^{-1-2\,mun-mus}\left(-p^{1+mun}\left(-delta1\, gamma1\, p^{1+mun} + delta1\, p^{1+mun}\, pin\, sn + gamma1\, p^{1+mun}\, pis\, ss - p^{1+mun}\, pin\, pis\, sn\, ss + 2\, gamma1\, ksn\, kss\, p^{mun+mus}\, thetan - 2\, ksn\, kss\, p^{mun+mus}\, pin\, sn\, thetan + delta1\, kn\, p\, thetas - kn\, p\, pis\, ss\, thetas\right) - \sqrt{\left(-4\, kss^2\, p^{1+2\,mun+mus}\, (gamma1 - pin\, sn)\, thetan\left(-delta0\, gamma1\, p^{2+2\,mun} - delta2\, gamma1\, p^{3+2\,mun} + delta0\, p^{2+2\,mun}\, pin\, sn + delta2\, p^{3+2\,mun}\, pin\, sn + gamma1\, ksn^2\, p^{1+2\,mun+mus}\, thetan - ksn^2\, p^{1+2\,mun+mus}\, pin\, sn\, thetan + delta0\, kn\, p^{2+mun}\, thetas + gamma0\, kn\, p^{2+mun}\, thetas + delta2\, kn\, p^{3+mun}\, thetas\right) + p^{2+2\,mun}\left(-delta1\, gamma1\, p^{1+mun} + delta1\, p^{1+mun}\, pin\, sn + gamma1\, p^{1+mun}\, pis\, ss - p^{1+mun}\, pin\, pis\, sn\, ss + 2\, gamma1\, ksn\, kss\, p^{mun+mus}\, thetan - 2\, ksn\, kss\, p^{mun+mus}\, pin\, sn\, thetan + delta1\, kn\, p\, thetas - kn\, p\, pis\, ss\, thetas\right)^2\right)}\right),$$

$$un \to \frac{1}{kn\, p\, thetas}\left(-delta0\, p^{1+mun} - delta2\, p^{2+mun} + ksn^2\, p^{mun+mus}\, thetan + \frac{1}{kss\, (gamma1 - pin\, sn)}\right.$$

$$ksn\, p^{-1-mun}\left(-p^{1+mun}\left(-delta1\, gamma1\, p^{1+mun} + delta1\, p^{1+mun}\, pin\, sn + gamma1\, p^{1+mun}\, pis\, ss - p^{1+mun}\, pin\, pis\, sn\, ss + 2\, gamma1\, ksn\, kss\, p^{mun+mus}\, thetan - 2\, ksn\, kss\, p^{mun+mus}\, pin\, sn\, thetan + delta1\, kn\, p\, thetas - kn\, p\, pis\, ss\, thetas\right) - \sqrt{\left(-4\, kss^2\, p^{1+2\,mun+mus}\, (gamma1 - pin\, sn)\, thetan\left(-delta0\, gamma1\, p^{2+2\,mun} - delta2\, gamma1\, p^{3+2\,mun} + delta0\, p^{2+2\,mun}\, pin\, sn + delta2\, p^{3+2\,mun}\, pin\, sn + gamma1\, ksn^2\, p^{1+2\,mun+mus}\, thetan - ksn^2\, p^{1+2\,mun+mus}\, pin\, sn\, thetan + delta0\, kn\, p^{2+mun}\, thetas + gamma0\, kn\, p^{2+mun}\, thetas + delta2\, kn\, p^{3+mun}\, thetas\right) +$$

$$p^{2+2\,mun}\left(-delta1\,gamma1\,p^{1+mun}+delta1\,p^{1+mun}\,pin\,sn+gamma1\,p^{1+mun}\,pis\,ss-p^{1+mun}\,pin\,pis\,sn\,ss+2\,gamma1\,ksn\,kss\,p^{mun+mus}\,thetan-2\,ksn\,kss\,p^{mun+mus}\,pin\,sn\,thetan+delta1\,kn\,p\,thetas-kn\,p\,pis\,ss\,thetas\right)^2\Big)\Big)-\frac{1}{2\,kss^2\,(gamma1-pin\,sn)\,thetan}$$

$$delta1\,p^{-mun-mus}\left(-p^{1+mun}\left(-delta1\,gamma1\,p^{1+mun}+delta1\,p^{1+mun}\,pin\,sn+gamma1\,p^{1+mun}\,pis\,ss-p^{1+mun}\,pin\,pis\,sn\,ss+2\,gamma1\,ksn\,kss\,p^{mun+mus}\,thetan-2\,ksn\,kss\,p^{mun+mus}\,pin\,sn\,thetan+delta1\,kn\,p\,thetas-kn\,p\,pis\,ss\,thetas\right)-\sqrt{\Big(-4\,kss^2\,p^{1+2\,mun+mus}\,(gamma1-pin\,sn)\,thetan\left(-delta0\,gamma1\,p^{2+2\,mun}-delta2\,gamma1\,p^{3+2\,mun}+delta0\,p^{2+2\,mun}\,pin\,sn+delta2\,p^{3+2\,mun}\,pin\,sn+gamma1\,ksn^2\,p^{1+2\,mun+mus}\,thetan-ksn^2\,p^{1+2\,mun+mus}\,pin\,sn\,thetan+delta0\,kn\,p^{2+mun}\,thetas+gamma0\,kn\,p^{2+mun}\,thetas+delta2\,kn\,p^{3+mun}\,thetas\right)+p^{2+2\,mun}\left(-delta1\,gamma1\,p^{1+mun}+delta1\,p^{1+mun}\,pin\,sn+gamma1\,p^{1+mun}\,pis\,ss-p^{1+mun}\,pin\,pis\,sn\,ss+2\,gamma1\,ksn\,kss\,p^{mun+mus}\,thetan-2\,ksn\,kss\,p^{mun+mus}\,pin\,sn\,thetan+delta1\,kn\,p\,thetas-kn\,p\,pis\,ss\,thetas\right)^2\Big)\Big)+\frac{1}{2\,kss^2\,(gamma1-pin\,sn)\,thetan}$$

$$p^{-mun-mus}\,pis\,ss\left(-p^{1+mun}\left(-delta1\,gamma1\,p^{1+mun}+delta1\,p^{1+mun}\,pin\,sn+gamma1\,p^{1+mun}\,pis\,ss-p^{1+mun}\,pin\,pis\,sn\,ss+2\,gamma1\,ksn\,kss\,p^{mun+mus}\,thetan-2\,ksn\,kss\,p^{mun+mus}\,pin\,sn\,thetan+delta1\,kn\,p\,thetas-kn\,p\,pis\,ss\,thetas\right)-\sqrt{\Big(-4\,kss^2\,p^{1+2\,mun+mus}\,(gamma1-pin\,sn)\,thetan\left(-delta0\,gamma1\,p^{2+2\,mun}-delta2\,gamma1\,p^{3+2\,mun}+delta0\,p^{2+2\,mun}\,pin\,sn+delta2\,p^{3+2\,mun}\,pin\,sn+gamma1\,ksn^2\,p^{1+2\,mun+mus}\,thetan-ksn^2\,p^{1+2\,mun+mus}\,pin\,sn\,thetan+delta0\,kn\,p^{2+mun}\,thetas+gamma0\,kn\,p^{2+mun}\,thetas+delta2\,kn\,p^{3+mun}\,thetas\right)+p^{2+2\,mun}\left(-delta1\,gamma1\,p^{1+mun}+delta1\,p^{1+mun}\,pin\,sn+gamma1\,p^{1+mun}\,pis\,ss-p^{1+mun}\,pin\,pis\,sn\,ss+2\,gamma1\,ksn\,kss\,p^{mun+mus}\,thetan-2\,ksn\,kss\,p^{mun+mus}\,pin\,sn\,thetan+delta1\,kn\,p\,thetas-kn\,p\,pis\,ss\,thetas\right)^2\Big)\Big)+\frac{1}{4\,kss^2\,(gamma1-pin\,sn)^2\,thetan}$$

$$p^{-2-3\,mun-mus}\left(-p^{1+mun}\left(-delta1\,gamma1\,p^{1+mun}+delta1\,p^{1+mun}\,pin\,sn+gamma1\,p^{1+mun}\,pis\,ss-p^{1+mun}\,pin\,pis\,sn\,ss+2\,gamma1\,ksn\,kss\,p^{mun+mus}\,thetan-2\,ksn\,kss\,p^{mun+mus}\,pin\,sn\,thetan+delta1\,kn\,p\,thetas-kn\,p\,pis\,ss\,thetas\right)-\sqrt{\Big(-4\,kss^2\,p^{1+2\,mun+mus}\,(gamma1-pin\,sn)\,thetan\left(-delta0\,gamma1\,p^{2+2\,mun}-delta2\,gamma1\,p^{3+2\,mun}+delta0\,p^{2+2\,mun}\,pin\,sn+delta2\,p^{3+2\,mun}\,pin\,sn+gamma1\,ksn^2\,p^{1+2\,mun+mus}\,thetan-ksn^2\,p^{1+2\,mun+mus}\,pin\,sn\,thetan+delta0\,kn\,p^{2+mun}\,thetas+gamma0\,kn\,p^{2+mun}\,thetas+delta2\,kn\,p^{3+mun}\,thetas\right)+p^{2+2\,mun}\left(-delta1\,gamma1\,p^{1+mun}+delta1\,p^{1+mun}\,pin\,sn+gamma1\,p^{1+mun}\,pis\,ss-p^{1+mun}\,pin\,pis\,sn\,ss+2\,gamma1\,ksn\,kss\,p^{mun+mus}\,thetan-2\,ksn\,kss\,p^{mun+mus}\,pin\,sn\,thetan+delta1\,kn\,p\,thetas-kn\,p\,pis\,ss\,thetas\right)^2\Big)^2\Big)\Big\},$$

$$\left\{us\to\frac{1}{2\,kss^2\,(gamma1-pin\,sn)\,thetan}p^{-1-2\,mun-mus}\left(-p^{1+mun}\left(-delta1\,gamma1\,p^{1+mun}+delta1\,p^{1+mun}\,pin\,sn+gamma1\,p^{1+mun}\,pis\,ss-p^{1+mun}\,pin\,pis\,sn\,ss+2\,gamma1\,ksn\,kss\,p^{mun+mus}\,thetan-2\,ksn\,kss\,p^{mun+mus}\,pin\,sn\,thetan+delta1\,kn\,p\,thetas-kn\,p\,pis\,ss\,thetas\right)+\sqrt{\Big(-4\,kss^2\,p^{1+2\,mun+mus}\,(gamma1-pin\,sn)\,thetan\left(-delta0\,gamma1\,p^{2+2\,mun}-\right.\right.\right.$$

$$\text{delta2 gamma1 p}^{3+2\,\text{mun}} + \text{delta0 p}^{2+2\,\text{mun}}\,\text{pin sn} + \text{delta2 p}^{3+2\,\text{mun}}\,\text{pin sn} + \text{gamma1 ksn}^2\,\text{p}^{1+2\,\text{mun}+\text{mus}}\,\text{thetan} - \text{ksn}^2\,\text{p}^{1+2\,\text{mun}+\text{mus}}\,\text{pin sn thetan} + \text{delta0 kn p}^{2+\text{mun}}\,\text{thetas} + \text{gamma0 kn p}^{2+\text{mun}}\,\text{thetas} + \text{delta2 kn p}^{3+\text{mun}}\,\text{thetas}\Big) + \text{p}^{2+2\,\text{mun}}\Big(-\text{delta1 gamma1 p}^{1+\text{mun}} + \text{delta1 p}^{1+\text{mun}}\,\text{pin sn} + \text{gamma1 p}^{1+\text{mun}}\,\text{pis ss} - \text{p}^{1+\text{mun}}\,\text{pin pis sn ss} + 2\,\text{gamma1 ksn kss p}^{\text{mun}+\text{mus}}\,\text{thetan} - 2\,\text{ksn kss p}^{\text{mun}+\text{mus}}\,\text{pin sn thetan} + \text{delta1 kn p thetas} - \text{kn p pis ss thetas}\Big)^2\Big)\Big),$$

$$\text{un} \to \frac{1}{\text{kn p thetas}}\Bigg(-\text{delta0 p}^{1+\text{mun}} - \text{delta2 p}^{2+\text{mun}} + \frac{\text{ksn}^2}{\text{p}^{\text{mun}+\text{mus}}}\,\text{thetan} + \frac{1}{\text{kss}\,(\text{gamma1} - \text{pin sn})}\,\frac{\text{ksn}}{\text{p}^{-1-\text{mun}}}\Big(-\text{p}^{1+\text{mun}}\Big(-\text{delta1 gamma1 p}^{1+\text{mun}} + \text{delta1 p}^{1+\text{mun}}\,\text{pin sn} + \text{gamma1 p}^{1+\text{mun}}\,\text{pis ss} - \text{p}^{1+\text{mun}}\,\text{pin pis sn ss} + 2\,\text{gamma1 ksn kss p}^{\text{mun}+\text{mus}}\,\text{thetan} - 2\,\text{ksn kss p}^{\text{mun}+\text{mus}}\,\text{pin sn thetan} + \text{delta1 kn p thetas} - \text{kn p pis ss thetas}\Big) + \sqrt{\Big(-4\,\text{kss}^2\,\text{p}^{1+2\,\text{mun}+\text{mus}}\,(\text{gamma1} - \text{pin sn})\,\text{thetan}\Big(-\text{delta0 gamma1 p}^{2+2\,\text{mun}} - \text{delta2 gamma1 p}^{3+2\,\text{mun}} + \text{delta0 p}^{2+2\,\text{mun}}\,\text{pin sn} + \text{delta2 p}^{3+2\,\text{mun}}\,\text{pin sn} + \text{gamma1 ksn}^2\,\text{p}^{1+2\,\text{mun}+\text{mus}}\,\text{thetan} - \text{ksn}^2\,\text{p}^{1+2\,\text{mun}+\text{mus}}\,\text{pin sn thetan} + \text{delta0 kn p}^{2+\text{mun}}\,\text{thetas} + \text{gamma0 kn p}^{2+\text{mun}}\,\text{thetas} + \text{delta2 kn p}^{3+\text{mun}}\,\text{thetas}\Big) + \text{p}^{2+2\,\text{mun}}\Big(-\text{delta1 gamma1 p}^{1+\text{mun}} + \text{delta1 p}^{1+\text{mun}}\,\text{pin sn} + \text{gamma1 p}^{1+\text{mun}}\,\text{pis ss} - \text{p}^{1+\text{mun}}\,\text{pin pis sn ss} + 2\,\text{gamma1 ksn kss p}^{\text{mun}+\text{mus}}\,\text{thetan} - 2\,\text{ksn kss p}^{\text{mun}+\text{mus}}\,\text{pin sn thetan} + \text{delta1 kn p thetas} - \text{kn p pis ss thetas}\Big)^2\Big)\Big) - \frac{1}{2\,\text{kss}^2\,(\text{gamma1} - \text{pin sn})\,\text{thetan}}\,\text{delta1 p}^{-\text{mun}-\text{mus}}\Big(-\text{p}^{1+\text{mun}}\Big(-\text{delta1 gamma1 p}^{1+\text{mun}} + \text{delta1 p}^{1+\text{mun}}\,\text{pin sn} + \text{gamma1 p}^{1+\text{mun}}\,\text{pis ss} - \text{p}^{1+\text{mun}}\,\text{pin pis sn ss} + 2\,\text{gamma1 ksn kss p}^{\text{mun}+\text{mus}}\,\text{thetan} - 2\,\text{ksn kss p}^{\text{mun}+\text{mus}}\,\text{pin sn thetan} + \text{delta1 kn p thetas} - \text{kn p pis ss thetas}\Big) + \sqrt{\Big(-4\,\text{kss}^2\,\text{p}^{1+2\,\text{mun}+\text{mus}}\,(\text{gamma1} - \text{pin sn})\,\text{thetan}\Big(-\text{delta0 gamma1 p}^{2+2\,\text{mun}} - \text{delta2 gamma1 p}^{3+2\,\text{mun}} + \text{delta0 p}^{2+2\,\text{mun}}\,\text{pin sn} + \text{delta2 p}^{3+2\,\text{mun}}\,\text{pin sn} + \text{gamma1 ksn}^2\,\text{p}^{1+2\,\text{mun}+\text{mus}}\,\text{thetan} - \text{ksn}^2\,\text{p}^{1+2\,\text{mun}+\text{mus}}\,\text{pin sn thetan} + \text{delta0 kn p}^{2+\text{mun}}\,\text{thetas} + \text{gamma0 kn p}^{2+\text{mun}}\,\text{thetas} + \text{delta2 kn p}^{3+\text{mun}}\,\text{thetas}\Big) + \text{p}^{2+2\,\text{mun}}\Big(-\text{delta1 gamma1 p}^{1+\text{mun}} + \text{delta1 p}^{1+\text{mun}}\,\text{pin sn} + \text{gamma1 p}^{1+\text{mun}}\,\text{pis ss} - \text{p}^{1+\text{mun}}\,\text{pin pis sn ss} + 2\,\text{gamma1 ksn kss p}^{\text{mun}+\text{mus}}\,\text{thetan} - 2\,\text{ksn kss p}^{\text{mun}+\text{mus}}\,\text{pin sn thetan} + \text{delta1 kn p thetas} - \text{kn p pis ss thetas}\Big)^2\Big)\Big) + \frac{1}{2\,\text{kss}^2\,(\text{gamma1} - \text{pin sn})\,\text{thetan}}\,\text{p}^{-\text{mun}-\text{mus}}\,\text{pis ss}\Big(-\text{p}^{1+\text{mun}}\Big(-\text{delta1 gamma1 p}^{1+\text{mun}} + \text{delta1 p}^{1+\text{mun}}\,\text{pin sn} + \text{gamma1 p}^{1+\text{mun}}\,\text{pis ss} - \text{p}^{1+\text{mun}}\,\text{pin pis sn ss} + 2\,\text{gamma1 ksn kss p}^{\text{mun}+\text{mus}}\,\text{thetan} - 2\,\text{ksn kss p}^{\text{mun}+\text{mus}}\,\text{pin sn thetan} + \text{delta1 kn p thetas} - \text{kn p pis ss thetas}\Big) + \sqrt{\Big(-4\,\text{kss}^2\,\text{p}^{1+2\,\text{mun}+\text{mus}}\,(\text{gamma1} - \text{pin sn})\,\text{thetan}\Big(-\text{delta0 gamma1 p}^{2+2\,\text{mun}} - \text{delta2 gamma1 p}^{3+2\,\text{mun}} + \text{delta0 p}^{2+2\,\text{mun}}\,\text{pin sn} + \text{delta2 p}^{3+2\,\text{mun}}\,\text{pin sn} +$$

$$\text{gamma1}\ \text{ksn}^2\ p^{1+2\,\text{mun}+\text{mus}}\ \text{thetan} - \text{ksn}^2\ p^{1+2\,\text{mun}+\text{mus}}\ \text{pin sn thetan} + \text{delta0 kn}\ p^{2+\text{mun}}\ \text{thetas} + \text{gamma0 kn}\ p^{2+\text{mun}}\ \text{thetas} + \text{delta2 kn}\ p^{3+\text{mun}}\ \text{thetas}\Big) + p^{2+2\,\text{mun}}\ \Big(-\text{delta1 gamma1}\ p^{1+\text{mun}} + \text{delta1}\ p^{1+\text{mun}}\ \text{pin sn} + \text{gamma1}\ p^{1+\text{mun}}\ \text{pis ss} - p^{1+\text{mun}}\ \text{pin pis sn ss} + 2\ \text{gamma1 ksn kss}\ p^{\text{mun}+\text{mus}}\ \text{thetan} - 2\ \text{ksn kss}\ p^{\text{mun}+\text{mus}}\ \text{pin sn thetan} + \text{delta1 kn p thetas} - \text{kn p pis ss thetas}\Big)^2\Big) + \frac{1}{4\ \text{kss}^2\ (\text{gamma1} - \text{pin sn})^2\ \text{thetan}}$$

$$p^{-2-3\,\text{mun}-\text{mus}}\ \Big(-p^{1+\text{mun}}\ \Big(-\text{delta1 gamma1}\ p^{1+\text{mun}} + \text{delta1}\ p^{1+\text{mun}}\ \text{pin sn} + \text{gamma1}\ p^{1+\text{mun}}\ \text{pis ss} - p^{1+\text{mun}}\ \text{pin pis sn ss} + 2\ \text{gamma1 ksn kss}\ p^{\text{mun}+\text{mus}}\ \text{thetan} - 2\ \text{ksn kss}\ p^{\text{mun}+\text{mus}}\ \text{pin sn thetan} + \text{delta1 kn p thetas} - \text{kn p pis ss thetas}\Big) + \sqrt{\Big(-4\ \text{kss}^2\ p^{1+2\,\text{mun}+\text{mus}}\ (\text{gamma1} - \text{pin sn})\ \text{thetan}\ \Big(-\text{delta0 gamma1}\ p^{2+2\,\text{mun}} - \text{delta2 gamma1}\ p^{3+2\,\text{mun}} + \text{delta0}\ p^{2+2\,\text{mun}}\ \text{pin sn} + \text{delta2}\ p^{3+2\,\text{mun}}\ \text{pin sn} + \text{gamma1 ksn}^2\ p^{1+2\,\text{mun}+\text{mus}}\ \text{thetan} - \text{ksn}^2\ p^{1+2\,\text{mun}+\text{mus}}\ \text{pin sn thetan} + \text{delta0 kn}\ p^{2+\text{mun}}\ \text{thetas} + \text{gamma0 kn}\ p^{2+\text{mun}}\ \text{thetas} + \text{delta2 kn}\ p^{3+\text{mun}}\ \text{thetas}\Big) + p^{2+2\,\text{mun}}\ \Big(-\text{delta1 gamma1}\ p^{1+\text{mun}} + \text{delta1}\ p^{1+\text{mun}}\ \text{pin sn} + \text{gamma1}\ p^{1+\text{mun}}\ \text{pis ss} - p^{1+\text{mun}}\ \text{pin pis sn ss} + 2\ \text{gamma1 ksn kss}\ p^{\text{mun}+\text{mus}}\ \text{thetan} - 2\ \text{ksn kss}\ p^{\text{mun}+\text{mus}}\ \text{pin sn thetan} + \text{delta1 kn p thetas} - \text{kn p pis ss thetas}\Big)^2\Big)^2}\Big)\Big\}\Big\}$$

In[ ]:=

```
F1[un_] = gamma0 + gamma1 * un;
F2[un_] = sn * pin * un;
F3[p_] = delta0 + delta1 + delta2 * p;
F4[p_] = ss * pis;
F5[p_, un_] =
 thetan * ((p) ^ (c - 1)) * ((ys) ^ (es)) - thetas * ((p) ^ (-c)) * ((un * kn) ^ (en));
eqns = {F1[un] == F2[un] - F5[p, un], F3[p] == F4[p] + F5[p, un]};
soln = Solve[eqns /. {en → 1, c → 1}, {p, un}]
```

resolve

Out[ ]=

$$\Big\{\Big\{p \to \frac{1}{2\ \text{delta2}\ (\text{gamma1} - \text{pin sn})}\ \Big(-\text{delta0 gamma1} - \text{delta1 gamma1} + \text{delta0 pin sn} + \text{delta1 pin sn} + \text{gamma1 pis ss} - \text{pin pis sn ss} + \text{delta2 kn thetas} + \text{gamma1 thetan ys}^{\text{es}} - \text{pin sn thetan ys}^{\text{es}} - \sqrt{\Big(4\ \text{delta2 kn}\ (\text{gamma1} - \text{pin sn})\ (\text{delta0} + \text{delta1} + \text{gamma0} - \text{pis ss})\ \text{thetas} + \Big(\text{delta0 gamma1} + \text{delta1 gamma1} - \text{delta0 pin sn} - \text{delta1 pin sn} - \text{gamma1 pis ss} + \text{pin pis sn ss} - \text{delta2 kn thetas} - \text{gamma1 thetan ys}^{\text{es}} + \text{pin sn thetan ys}^{\text{es}}\Big)^2\Big)}\Big),$$

$$\text{un} \to \frac{1}{2\ \text{delta2 kn}\ (\text{gamma1} - \text{pin sn})\ \text{thetas}}\ \Big(-\text{delta0 gamma1} - \text{delta1 gamma1} + \text{delta0 pin sn} + \text{delta1 pin sn} + \text{gamma1 pis ss} - \text{pin pis sn ss} + \text{delta2 kn thetas} + \text{gamma1 thetan ys}^{\text{es}} - \text{pin sn thetan ys}^{\text{es}} - \sqrt{\Big(4\ \text{delta2 kn}\ (\text{gamma1} - \text{pin sn})\ (\text{delta0} + \text{delta1} + \text{gamma0} - \text{pis ss})\ \text{thetas} + \Big(\text{delta0 gamma1} + \text{delta1 gamma1} - \text{delta0 pin sn} - \text{delta1 pin sn} - \text{gamma1 pis ss} + \text{pin pis sn ss} - \text{delta2 kn thetas} - \text{gamma1 thetan ys}^{\text{es}} + \text{pin sn thetan ys}^{\text{es}}\Big)^2\Big)}\Big)$$

$$\Big(-\text{delta0} - \text{delta1} + \text{pis ss} + \text{thetan ys}^{\text{es}} - \frac{1}{2\ (\text{gamma1} - \text{pin sn})}$$

$$\left(-\text{delta0 gamma1}-\text{delta1 gamma1}+\text{delta0 pin sn}+\text{delta1 pin sn}+\text{gamma1 pis ss}-\text{pin pis sn ss}+\text{delta2 kn thetas}+\text{gamma1 thetan ys}^{\text{es}}-\text{pin sn thetan ys}^{\text{es}}-\sqrt{\left(4\,\text{delta2 kn}\,(\text{gamma1}-\text{pin sn})\,(\text{delta0}+\text{delta1}+\text{gamma0}-\text{pis ss})\,\text{thetas}+\left(\text{delta0 gamma1}+\text{delta1 gamma1}-\text{delta0 pin sn}-\text{delta1 pin sn}-\text{gamma1 pis ss}+\text{pin pis sn ss}-\text{delta2 kn thetas}-\text{gamma1 thetan ys}^{\text{es}}+\text{pin sn thetan ys}^{\text{es}}\right)^2\right)}\right)\Big\},$$

$$\left\{\text{p}\to\frac{1}{2\,\text{delta2}\,(\text{gamma1}-\text{pin sn})}\left(-\text{delta0 gamma1}-\text{delta1 gamma1}+\text{delta0 pin sn}+\text{delta1 pin sn}+\text{gamma1 pis ss}-\text{pin pis sn ss}+\text{delta2 kn thetas}+\text{gamma1 thetan ys}^{\text{es}}-\text{pin sn thetan ys}^{\text{es}}+\sqrt{\left(4\,\text{delta2 kn}\,(\text{gamma1}-\text{pin sn})\,(\text{delta0}+\text{delta1}+\text{gamma0}-\text{pis ss})\,\text{thetas}+\left(\text{delta0 gamma1}+\text{delta1 gamma1}-\text{delta0 pin sn}-\text{delta1 pin sn}-\text{gamma1 pis ss}+\text{pin pis sn ss}-\text{delta2 kn thetas}-\text{gamma1 thetan ys}^{\text{es}}+\text{pin sn thetan ys}^{\text{es}}\right)^2\right)}\right),\right.$$

$$\text{un}\to\frac{1}{2\,\text{delta2 kn}\,(\text{gamma1}-\text{pin sn})\,\text{thetas}}\left(-\text{delta0 gamma1}-\text{delta1 gamma1}+\text{delta0 pin sn}+\text{delta1 pin sn}+\text{gamma1 pis ss}-\text{pin pis sn ss}+\text{delta2 kn thetas}+\text{gamma1 thetan ys}^{\text{es}}-\text{pin sn thetan ys}^{\text{es}}+\sqrt{\left(4\,\text{delta2 kn}\,(\text{gamma1}-\text{pin sn})\,(\text{delta0}+\text{delta1}+\text{gamma0}-\text{pis ss})\,\text{thetas}+\left(\text{delta0 gamma1}+\text{delta1 gamma1}-\text{delta0 pin sn}-\text{delta1 pin sn}-\text{gamma1 pis ss}+\text{pin pis sn ss}-\text{delta2 kn thetas}-\text{gamma1 thetan ys}^{\text{es}}+\text{pin sn thetan ys}^{\text{es}}\right)^2\right)}\right)$$

$$\left(-\text{delta0}-\text{delta1}+\text{pis ss}+\text{thetan ys}^{\text{es}}-\frac{1}{2\,(\text{gamma1}-\text{pin sn})}\left(-\text{delta0 gamma1}-\text{delta1 gamma1}+\text{delta0 pin sn}+\text{delta1 pin sn}+\text{gamma1 pis ss}-\text{pin pis sn ss}+\text{delta2 kn thetas}+\text{gamma1 thetan ys}^{\text{es}}-\text{pin sn thetan ys}^{\text{es}}+\sqrt{\left(4\,\text{delta2 kn}\,(\text{gamma1}-\text{pin sn})\,(\text{delta0}+\text{delta1}+\text{gamma0}-\text{pis ss})\,\text{thetas}+\left(\text{delta0 gamma1}+\text{delta1 gamma1}-\text{delta0 pin sn}-\text{delta1 pin sn}-\text{gamma1 pis ss}+\text{pin pis sn ss}-\text{delta2 kn thetas}-\text{gamma1 thetan ys}^{\text{es}}+\text{pin sn thetan ys}^{\text{es}}\right)^2\right)}\right)\right)\Big\}\Big\}$$

APPENDIX B – List of variables, countries and descriptive statistics - Second essay

Variable	Definition	Source
Real GDP (rgdpna)	Real GDP at constant 2011 national prices (in million 2011 USD)	PWT
Exchange Rate	Exchange rate, national currency/USD (market and estimated)	PWT
Wage share	Share of labour compensation in GDP at current national prices	PWT
Government spending (%GDP)	Share of government consumption at current PPPs	PWT
Investment share (% GDP)	Share of gross capital formation at current PPPs	PWT
Capital stock (rnna)	Capital stock at constant 2011 national prices (in million 2011 USD)	PWT
PL_X	Price level of exports (price level of USA GDPo in 2011 = 1)	PWT
PL_M	Price level of imports (price level of USA GDPo in 2011 = 1)	PWT
Terms of trade	PL_X/PL_M	Author's calculation
Import Volume	Import volume index (2000 = 100)	UNCTAD; WB
Import Unit Price	Import unit value index (2000 = 100)	UNCTAD; WB
FDI inflows	Foreign direct investment, net inflows in current prices (in million USD)	UNCTAD; WB

Table 41 – List of variables

Australia	Iceland	Norway
Austria	Ireland	Portugal
Canada	Israel	Slovakia
Czech Republic	Italy	Slovenia
Denmark	Japan	Spain
Estonia	Latvia	Sweden
Finland	Lithuania	United Kingdom
France	Netherlands	United States
Germany	New Zealand	

Table 42 – List of developed countries

Angola	Bolivia	Chile	Eswatini	Jamaica	Malaysia	Niger	Rwanda	Thailand
Argentina	Bosnia and Herzegovina	China	Fiji	Jordan	Malta	Nigeria	Saudi Arabia	Togo
Armenia	Botswana	Colombia	Gabon	Kazakhstan	Mauritania	Oman	Senegal	Trinidad and Tobago
Aruba	Brazil	Costa Rica	Georgia	Kenya	Mauritius	Panama	Sierra Leone	Tunisia
Azerbaijan	Bulgaria	Croatia	Guatemala	South Korea	Mexico	Paraguay	Singapore	Turkey
Bahamas	Burkina Faso	Cyprus	Honduras	Kuwait	Moldova	Peru	South Africa	Ukraine
Bahrain	Cabo Verde	Côte d'Ivoire	Hong Kong	Kyrgyzstan	Mongolia	Philippines	Sri Lanka	Uruguay
Barbados	Cameroon	Djibouti	Hungary	PDR Lao	Morocco	Poland	Sudan	Venezuela
Belarus	Cayman Islands	Dominican Republic	India	Lebanon	Mozambique	Qatar	Suriname	Virgin Islands
Benin	Central African Republic	Ecuador	Iran	Lesotho	Namibia	Romania	Tajikistan	Zimbabwe
Bermuda	Chad	Egypt	Iraq	Macao	Nicaragua	Russian	Tanzania	

Table 43 – List of underdeveloped countries

Variable		Mean	Std. Dev.	Min	Max	Observations
Log of import volume	overall	5.198951	.5445626	2.805297	6.934744	2108
	between	.	.4068561	3.824909	6.072995	124
	within	.	.3636943	3.577109	6.321222	17
Log of import unit price	overall	4.893803	.2813292	4.016017	6.070382	2108
	between	.	.1882152	4.276662	5.645819	124
	within	.	.2097384	3.869314	5.447408	17
Log of real GDP	overall	11.50054	2.0194	6.538409	16.75882	2108
	between	.	2.015008	6.643605	16.54247	124
	within	.	.2203372	10.56138	12.1107	17
Log of wage share	overall	-.7318605	.2874918	-2.004699	-.2154216	2108
	between	.	.2790317	-1.704647	-.2154216	124
	within	.	.073376	-1.356108	-.4010686	17
Log of exchange rate	overall	2.592472	2.693221	-1.973281	10.4111	2108
	between	.	2.690838	-1.235829	9.427673	124
	within	.	.2604067	.6911919	8.062319	17
Log of the terms of trade	overall	.380173	.1189459	-.4168094	1.62104	2108
	between	.	.998709	-.2435098	.2830558	124
	within	.	.0651895	-.3228111	1.773649	17
Log of investment share of GDP	overall	-1.523148	.3923465	-3.759232	.7784234	2108
	between	.	.3234929	-2.559852	-.8846853	124
	within	.	.2237205	-2.894968	.513263	17
Log of gov. cons. share of GDP	overall	-1.786669	.368249	-4.101109	.864169	2108
	between	.	.3237314	-2.731814	-1.051796	124
	within	.	.1781771	-3.222268	.3563735	17
Log of FDI inflows	overall	24.30858	.4743876	17.12577	27.36041	2108
	between	.	.3957278	23.88405	26.3475	124
	within	.	.2638793	17.5503	25.8499	17
Interaction FDI-GDP (log)	overall	280.0306	52.63785	159.327	449.7948	2108
	between	.	52.39318	165.0633	435.8806	124
	within	.	6.822986	195.4228	304.6285	17

Table 44 – Descriptive Statistics

APPENDIX C – List of variables, unit root tests and residuals analysis - Third essay

Variable	Definition	Source
Economic activity index (IBC-BR)	Central Bank Economic Activity Index (IBC-Br) - seasonally adjusted	BCB
Real Exchange Rate	Real effective exchange rate index (IPCA) - Jun/1994=100	BCB
Trade balance (BC)	Trade balance (net, in million USD)	BCB
Trade and services balance (BCS)	Balance on goods and services (net, in million USD)	BCB
Unit labor cost (ULC)	Unit labor cost - ULC-USD - June/1994=100	BCB
GFCF index (FBKF)	IPEA GFCF index: seasonally adjusted chained index (1995 average = 100)	IPEA
Commodity Index	Commodity Index - Brazil (Dez/2005 =100)	BCB
Exports (X)	Exports - Balance of Payments (in million USD)	BCB
Imports (M)	Imports - Balance of Payments (in million USD)	BCB
FDI flows (IDPPC)	Direct investment - liabilities - Equity and investment fund shares (net, in million USD)	BCB

Table 45 – List of variables - Monthly data

Variable	Definition	Source
Real GDP growth rate (RGDPG)	GDP at market prices - real growth rate (% per year)	IBGE
RTFPNA	Total Factor Productivity at Constant National Prices (2011 = 1)	PWT
Wage share	Share of labor compensation in GDP at current national prices	Marquetti, Filho and Lautert (2010)
GINI	Income inequality - Gini coefficient	IPEA
Trade balance (BC)	Trade balance (net, in million USD)	BCB
PL_X	Price level of exports (price level of USA GDPo in 2011 = 1)	PWT
PL_M	Price level of imports (price level of USA GDPo in 2011 = 1)	PWT
Terms of trade	PL_X/PL_M	Author's calculation
Exports (X)	Exports (FOB) - Balance of Payments (in million USD)	BCB
Imports (M)	Imports (CIF) - Balance of Payments (in million USD)	BCB
FDI flows (IDPPC)	FDI - equity capital (including reinvestment) - total (net, in million USD)	BCB

Table 46 – List of variables - Annual data

Variables	Level						First difference					
	ADF		KPSS				ADF		KPSS			
	model	statistic	model	statistic	model	statistic	model	statistic	model	statistic	model	statistic
Trade balance (goods)	1	-1,062	2	0,315***	3	0,294***	1	-3,942***	2	0,125	3	0,108
Trade balance (goods and services)	1	-2,395**	2	0,430*	3	0,324***	1	-15,661***	2	0,129	3	0,059
Log of IBC-BR	2	-2,674*	2	1,067***	3	0,398***	3	-11,390***	2	0,644**	3	0,044
Log of commodities index	3	-3,457**	2	1,649***	3	0,240***	1	-9,481***	2	0,100	3	0,039
FDI (equity)	2	-3,585***	2	0,709**	3	0,194**	1	-12,751***	2	0,174	3	0,092
Log of GFCF index	2	-2,073	2	0,529**	3	0,399***	1	-17,637***	2	0,482**	3	0,040
Log of imports	2	-2,838*	2	0,772***	3	0,346***	1	-20,868***	2	0,226	3	0,057
Log of export	2	-2,615*	2	0,967***	3	0,307***	1	-3,066***	2	0,171	3	0,058
Log of real GDP	2	-3,222**	2	1,739***	3	0,425***	3	-5,088***	2	1,000***	3	0,069
Log of real exchange rate index	3	-1,944	2	0,522**	3	0,352***	1	-9,110***	2	0,457*	3	0,040
Log of unit labor cost	2	-2,562	2	0,510**	3	0,400***	3	-13,163***	2	0,520**	3	0,108

Table 47 – Unit root tests - monthly data

Variables	Level						First difference					
	ADF		KPSS				ADF		KPSS			
	model	statistic	model	statistic	model	statistic	model	statistic	model	statistic	model	statistic
Trade balance	1	-1,915*	2	0,365*	3	0,053	1	-4,227***	2	0,139	3	0,100
Log of TFP at constant national prices	3	-3,896**	2	0,708**	3	0,095	1	-5,641***	2	0,180	3	0,107
Log of wage share	2	-1,901	2	0,280	3	0,128*	1	-6,918***	2	0,083	3	0,078
Log of GINI coefficient	1	1,869	2	0,574**	3	0,173**	3	-5,346***	2	0,209	3	0,155*
Log of FDI (equity)	3	-2,017	2	0,700**	3	0,176**	3	-4,832***	2	0,171	3	0,080
Log of exports	3	-2,812	2	0,840***	3	0,118	2	-5,271***	2	0,261	3	0,137*
Log of imports	3	-2,480	2	0,836***	3	0,092	2	-4,946***	2	0,116	3	0,100
Real GDP growth	3	-4,459***	2	0,429*	3	0,185**	1	-10,547***	2	0,070	3	0,057
Log of export/import price ratio	1	-2,797***	2	0,267	3	0,154**	1	-5,497***	2	0,112	3	0,047

Table 48 – Unit root tests - annual data

C.1 Monthly data estimations

C.1.1 FDI and trade balance

Null hypothesis: No serial correlation at lag h

Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	3.110119	4	0.5396	0.778964	(4, 300.0)	0.5396
2	2.069629	4	0.7230	0.517465	(4, 300.0)	0.7230
3	5.582522	4	0.2326	1.403973	(4, 300.0)	0.2326
4	7.001996	4	0.1358	1.765134	(4, 300.0)	0.1358
5	3.614261	4	0.4607	0.905992	(4, 300.0)	0.4607
6	5.898107	4	0.2069	1.484121	(4, 300.0)	0.2069
7	1.456657	4	0.8343	0.363834	(4, 300.0)	0.8343
8	2.595742	4	0.6276	0.649576	(4, 300.0)	0.6276
9	4.969480	4	0.2904	1.248521	(4, 300.0)	0.2904
10	2.948217	4	0.5665	0.738215	(4, 300.0)	0.5665
11	10.24827	4	0.0364	2.597523	(4, 300.0)	0.0364
12	2.359986	4	0.6699	0.590348	(4, 300.0)	0.6699
13	2.954487	4	0.5655	0.739793	(4, 300.0)	0.5655
14	10.88661	4	0.0279	2.762261	(4, 300.0)	0.0279
15	3.986941	4	0.4078	1.000032	(4, 300.0)	0.4078
16	1.244534	4	0.8707	0.310742	(4, 300.0)	0.8707
17	9.320577	4	0.0536	2.358734	(4, 300.0)	0.0536
18	5.426937	4	0.2462	1.364491	(4, 300.0)	0.2462
19	2.118970	4	0.7139	0.529845	(4, 300.0)	0.7139
20	3.149204	4	0.5332	0.788805	(4, 300.0)	0.5332

Table 49 – Autocorrelation LM test - FDI and trade balance

	D(BC) resid	D(IDPPC) resid
Mean	$-8.74E-14$	$5.00E-14$
Median	-55.00290	-129.8182
Maximum	2582.958	5656.536
Minimum	-2589.164	-6774.794
Std. Dev.	1070.768	1777.027
Skewness	0.088182	-0.034919
Kurtosis	2.761418	4.707640
Jarque-Bera	0.649186	21.54172
Probability	0.722822	0.000021
Sum	$-9.55E-12$	$4.43E-12$
Sum Sq. Dev.	$2.02E+08$	$5.56E+08$
Observations	177	177

Table 50 – Residuals descriptive stats - FDI and trade balance

Null hypothesis: No serial correlation at lag h

Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	4.715290	4	0.3178	1.184157	(4, 300.0)	0.3178
2	3.007326	4	0.5566	0.753090	(4, 300.0)	0.5566
3	5.918853	4	0.2053	1.489393	(4, 300.0)	0.2053
4	6.851079	4	0.1440	1.726655	(4, 300.0)	0.1440
5	2.177271	4	0.7032	0.544476	(4, 300.0)	0.7032
6	6.595386	4	0.1589	1.661505	(4, 300.0)	0.1589
7	1.340173	4	0.8545	0.334675	(4, 300.0)	0.8545
8	1.900487	4	0.7541	0.475041	(4, 300.0)	0.7541
9	3.955855	4	0.4120	0.992184	(4, 300.0)	0.4120
10	2.737049	4	0.6027	0.685099	(4, 300.0)	0.6028
11	10.14152	4	0.0381	2.570009	(4, 300.0)	0.0381
12	1.945967	4	0.7457	0.486446	(4, 300.0)	0.7457
13	3.151870	4	0.5327	0.789476	(4, 300.0)	0.5327
14	10.30157	4	0.0356	2.611267	(4, 300.0)	0.0356
15	4.047139	4	0.3997	1.015233	(4, 300.0)	0.3997
16	0.628796	4	0.9598	0.156840	(4, 300.0)	0.9598
17	9.124226	4	0.0581	2.308287	(4, 300.0)	0.0581
18	9.957755	4	0.0411	2.522666	(4, 300.0)	0.0411
19	2.786892	4	0.5941	0.697633	(4, 300.0)	0.5941
20	2.600235	4	0.6268	0.650706	(4, 300.0)	0.6268

Table 51 – Autocorrelation LM test - FDI and trade and services balance

	D(BCS) resid	D(IDPPC) resid
Mean	$9.51E-14$	$-1.66E-14$
Median	-7.065842	-77.19779
Maximum	3149.156	5503.418
Minimum	-2984.940	-6801.543
Std. Dev.	1189.526	1774.367
Skewness	0.150767	-0.044619
Kurtosis	3.053902	4.711096
Jarque-Bera	0.691984	21.65162
Probability	0.707518	0.000020
Sum	$1.55E-11$	$-2.39E-12$
Sum Sq. Dev.	$2.49E+08$	$5.54E+08$
Observations	177	177

Table 52 – Residuals descriptive stats - FDI and trade and services balance

Null hypothesis: No serial correlation at lag h

Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	12.72948	9	0.1752	1.425425	(9, 365.2)	0.1753
2	12.03734	9	0.2112	1.346649	(9, 365.2)	0.2112
3	11.77813	9	0.2261	1.317185	(9, 365.2)	0.2261
4	13.01046	9	0.1621	1.457446	(9, 365.2)	0.1622
5	8.657585	9	0.4695	0.964097	(9, 365.2)	0.4695
6	6.683369	9	0.6700	0.742254	(9, 365.2)	0.6701
7	8.191745	9	0.5149	0.911643	(9, 365.2)	0.5150
8	6.426421	9	0.6966	0.713468	(9, 365.2)	0.6966
9	13.78171	9	0.1303	1.545469	(9, 365.2)	0.1303
10	14.50566	9	0.1054	1.628260	(9, 365.2)	0.1055
11	10.46103	9	0.3145	1.167791	(9, 365.2)	0.3145
12	7.041410	9	0.6328	0.782399	(9, 365.2)	0.6328
13	6.944546	9	0.6429	0.771535	(9, 365.2)	0.6429
14	12.84480	9	0.1698	1.438564	(9, 365.2)	0.1698
15	13.39833	9	0.1454	1.501691	(9, 365.2)	0.1454
16	14.52297	9	0.1049	1.630241	(9, 365.2)	0.1049
17	8.593767	9	0.4756	0.956907	(9, 365.2)	0.4756
18	11.74182	9	0.2283	1.313059	(9, 365.2)	0.2283
19	17.28258	9	0.0445	1.947340	(9, 365.2)	0.0445
20	8.144286	9	0.5197	0.906303	(9, 365.2)	0.5197

Table 53 – Autocorrelation LM test - FDI, exports and imports

	D(IDPPC) resid	D(LX) resid	D(LM) resid
Mean	62.03558	0.002030	−0.005826
Median	−27.17368	0.004219	−0.003891
Maximum	6610.243	0.208168	0.176764
Minimum	−7034.762	−0.198337	−0.200847
Std. Dev.	1792.165	0.072000	0.082859
Skewness	0.189185	−0.049618	−0.130758
Kurtosis	5.218709	3.194086	2.434224
Jarque-Bera	37.78267	0.354398	2.897513
Probability	0.000000	0.837613	0.234862
Sum	11104.37	0.363390	−1.042926
Sum Sq. Dev.	$5.72E+08$	0.922750	1.222086
Observations	179	179	179

Table 54 – Residuals descriptive stats - FDI, exports and imports

C.1.2 FDI and unit labor costs

C.1.3 FDI, trade balance and ULC

C.1.4 FDI and GFCF

C.1.5 FDI and IBC-BR

Null hypothesis: No serial correlation at lag h

Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	19.27117	4	0.0007	4.961763	(4, 294.0)	0.0007
2	6.416627	4	0.1701	1.616233	(4, 294.0)	0.1701
3	2.729522	4	0.6041	0.683223	(4, 294.0)	0.6041
4	2.844505	4	0.5842	0.712144	(4, 294.0)	0.5842
5	6.904941	4	0.1410	1.740676	(4, 294.0)	0.1410
6	3.511968	4	0.4761	0.880245	(4, 294.0)	0.4761
7	1.298597	4	0.8616	0.324262	(4, 294.0)	0.8616
8	1.217237	4	0.8753	0.303904	(4, 294.0)	0.8753
9	2.508737	4	0.6431	0.627724	(4, 294.0)	0.6431
10	2.524410	4	0.6403	0.631662	(4, 294.0)	0.6403
11	1.447424	4	0.8359	0.361516	(4, 294.0)	0.8359
12	4.610782	4	0.3296	1.157813	(4, 294.0)	0.3296
13	10.75202	4	0.0295	2.728312	(4, 294.0)	0.0295
14	2.136949	4	0.7106	0.534359	(4, 294.0)	0.7106
15	1.414764	4	0.8416	0.353339	(4, 294.0)	0.8416
16	14.55878	4	0.0057	3.718356	(4, 294.0)	0.0057
17	7.160128	4	0.1277	1.805790	(4, 294.0)	0.1277
18	1.006632	4	0.9088	0.251233	(4, 294.0)	0.9088
19	15.47225	4	0.0038	3.957835	(4, 294.0)	0.0038
20	1.644762	4	0.8007	0.410941	(4, 294.0)	0.8007

Table 55 – Autocorrelation LM test - FDI and ULC

	D(IDPPC) resid	D(LULC) resid
Mean	$7.49E-14$	$1.73E-18$
Median	-29.75822	-0.001374
Maximum	5400.272	0.100894
Minimum	-6828.589	-0.103185
Std. Dev.	1726.724	0.033055
Skewness	-0.249365	0.128882
Kurtosis	5.167421	3.591006
Jarque-Bera	36.27393	3.048690
Probability	0.000000	0.217764
Sum	$6.59E-12$	$2.91E-16$
Sum Sq. Dev.	$5.22E+08$	0.191214
Observations	176	176

Table 56 – Residuals descriptive stats - FDI and ULC

Null hypothesis: No serial correlation at lag h

Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	15.34003	9	0.0820	1.728930	(9, 289.8)	0.0820
2	14.00321	9	0.1222	1.574638	(9, 289.8)	0.1223
3	6.122696	9	0.7276	0.679246	(9, 289.8)	0.7276
4	5.305727	9	0.8069	0.587791	(9, 289.8)	0.8069
5	10.69618	9	0.2971	1.195958	(9, 289.8)	0.2972
6	10.34278	9	0.3235	1.155743	(9, 289.8)	0.3235
7	6.399251	9	0.6994	0.710263	(9, 289.8)	0.6994
8	5.712432	9	0.7683	0.633287	(9, 289.8)	0.7683
9	15.70030	9	0.0734	1.770632	(9, 289.8)	0.0734
10	14.31722	9	0.1115	1.610817	(9, 289.8)	0.1115
11	10.80483	9	0.2893	1.208331	(9, 289.8)	0.2894
12	7.763780	9	0.5581	0.863729	(9, 289.8)	0.5582
13	15.56670	9	0.0765	1.755161	(9, 289.8)	0.0765
14	10.35848	9	0.3223	1.157528	(9, 289.8)	0.3223
15	13.71798	9	0.1327	1.541809	(9, 289.8)	0.1328
16	10.08663	9	0.3435	1.126624	(9, 289.8)	0.3436
17	15.20255	9	0.0855	1.713029	(9, 289.8)	0.0856
18	1.583377	9	0.9965	0.174301	(9, 289.8)	0.9965
19	12.22271	9	0.2010	1.370227	(9, 289.8)	0.2011
20	2.052017	9	0.9906	0.226071	(9, 289.8)	0.9906

Table 57 – Autocorrelation LM test - FDI, trade balance and ULC

	D(IDPPC) resid	D(BC) resid	D(LULC) resid
Mean	$-2.57E-13$	$1.44E-13$	$6.49E-19$
Median	-79.38282	-51.00011	0.001152
Maximum	4967.599	2856.688	0.090611
Minimum	-6323.171	-2540.837	-0.100077
Std. Dev.	1568.979	962.6035	0.030725
Skewness	-0.410127	-0.015372	-0.089413
Kurtosis	5.500453	2.819790	3.400047
Jarque-Bera	49.34122	0.238124	1.368114
Probability	0.000000	0.887753	0.504566
Sum	$-4.77E-11$	$1.64E-11$	$5.55E-17$
Sum Sq. Dev.	$4.18E+08$	$1.58E+08$	0.160485
Observations	171	171	171

Table 58 – Residuals descriptive stats - FDI, trade balance and ULC

Null hypothesis: No serial correlation at lag h

Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	14.80099	9	0.0965	1.666631	(9, 289.8)	0.0966
2	14.12413	9	0.1180	1.588565	(9, 289.8)	0.1180
3	6.617264	9	0.6769	0.734735	(9, 289.8)	0.6769
4	6.763462	9	0.6617	0.751155	(9, 289.8)	0.6618
5	4.992064	9	0.8350	0.552745	(9, 289.8)	0.8350
6	7.433464	9	0.5921	0.826514	(9, 289.8)	0.5921
7	6.900430	9	0.6475	0.766547	(9, 289.8)	0.6475
8	4.724522	9	0.8576	0.522882	(9, 289.8)	0.8577
9	18.61135	9	0.0287	2.109476	(9, 289.8)	0.0287
10	14.98445	9	0.0914	1.687821	(9, 289.8)	0.0914
11	10.03419	9	0.3477	1.120667	(9, 289.8)	0.3478
12	9.161783	9	0.4225	1.021703	(9, 289.8)	0.4225
13	14.03295	9	0.1212	1.578063	(9, 289.8)	0.1212
14	12.74974	9	0.1743	1.430603	(9, 289.8)	0.1743
15	14.77510	9	0.0973	1.663642	(9, 289.8)	0.0973
16	6.465861	9	0.6925	0.717738	(9, 289.8)	0.6926
17	15.44710	9	0.0794	1.741318	(9, 289.8)	0.0794
18	2.785153	9	0.9722	0.307225	(9, 289.8)	0.9722
19	11.26457	9	0.2580	1.260739	(9, 289.8)	0.2581
20	2.411068	9	0.9832	0.265790	(9, 289.8)	0.9832

Table 59 – Autocorrelation LM test - FDI, trade and services balance and ULC

	D(IDPPC) resid	D(BCS) resid	D(LULC) resid
Mean	$-2.93E-13$	$-2.21E-13$	$4.87E-19$
Median	−98.47475	28.07900	0.000593
Maximum	5156.414	2897.172	0.088086
Minimum	−6717.899	−2726.780	−0.089920
Std. Dev.	1585.882	1067.600	0.030328
Skewness	−0.469612	−0.046458	−0.052532
Kurtosis	5.964407	2.690030	3.247995
Jarque-Bera	68.89768	0.746094	0.516848
Probability	0.000000	0.688633	0.772268
Sum	$-4.82E-11$	$-3.46E-11$	$-1.39E-17$
Sum Sq. Dev.	$4.28E+08$	$1.94E+08$	0.156365
Observations	171	171	171

Table 60 – Residuals descriptive stats - FDI, trade and services balance and ULC

Null hypothesis: No serial correlation at lag h

Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	9.372320	4	0.0524	2.370045	(4, 322.0)	0.0524
2	8.781887	4	0.0668	2.218700	(4, 322.0)	0.0668
3	2.769668	4	0.5971	0.693241	(4, 322.0)	0.5971
4	3.564163	4	0.4682	0.893201	(4, 322.0)	0.4682
5	3.051914	4	0.5492	0.764221	(4, 322.0)	0.5492
6	5.600223	4	0.2311	1.407891	(4, 322.0)	0.2311
7	11.08415	4	0.0256	2.810405	(4, 322.0)	0.0256
8	0.705267	4	0.9507	0.175963	(4, 322.0)	0.9507
9	5.486894	4	0.2409	1.379158	(4, 322.0)	0.2409
10	4.140055	4	0.3874	1.038450	(4, 322.0)	0.3874
11	0.236168	4	0.9936	0.058881	(4, 322.0)	0.9936
12	3.390734	4	0.4947	0.849510	(4, 322.0)	0.4947
13	3.927359	4	0.4159	0.984775	(4, 322.0)	0.4159
14	3.332531	4	0.5038	0.834853	(4, 322.0)	0.5038
15	7.248588	4	0.1233	1.826960	(4, 322.0)	0.1233
16	3.093077	4	0.5424	0.774578	(4, 322.0)	0.5424
17	1.532169	4	0.8209	0.382763	(4, 322.0)	0.8209
18	6.312310	4	0.1770	1.588665	(4, 322.0)	0.1770
19	6.154036	4	0.1879	1.548450	(4, 322.0)	0.1879
20	1.403257	4	0.8436	0.350489	(4, 322.0)	0.8436

Table 61 – Autocorrelation LM test - FDI and GFCF

	D(IDPPC) resid	D(LFBKF) resid
Mean	$1.44E-13$	$2.38E-18$
Median	-218.1935	0.004551
Maximum	6594.660	0.099344
Minimum	-6567.521	-0.110674
Std. Dev.	1808.383	0.032171
Skewness	0.228135	-0.473599
Kurtosis	5.154363	4.487613
Jarque-Bera	36.57301	23.45589
Probability	0.000000	0.000008
Sum	$1.86E-11$	$4.86E-16$
Sum Sq. Dev.	$5.89E+08$	0.186291
Observations	181	181

Table 62 – Residuals descriptive stats - FDI and GFCF

Null hypothesis: No serial correlation at lag h

Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	4.393206	4	0.3554	1.102459	(4, 316.0)	0.3554
2	12.29628	4	0.0153	3.124583	(4, 316.0)	0.0153
3	6.736041	4	0.1505	1.696661	(4, 316.0)	0.1505
4	4.185200	4	0.3815	1.049915	(4, 316.0)	0.3815
5	5.029082	4	0.2843	1.263299	(4, 316.0)	0.2843
6	5.950367	4	0.2029	1.496904	(4, 316.0)	0.2029
7	11.20039	4	0.0244	2.841161	(4, 316.0)	0.0244
8	5.655890	4	0.2264	1.422161	(4, 316.0)	0.2264
9	6.790359	4	0.1474	1.710489	(4, 316.0)	0.1474
10	1.416006	4	0.8414	0.353674	(4, 316.0)	0.8414
11	0.775867	4	0.9417	0.193592	(4, 316.0)	0.9417
12	1.198140	4	0.8784	0.299155	(4, 316.0)	0.8784
13	6.671021	4	0.1543	1.680111	(4, 316.0)	0.1543
14	7.961459	4	0.0930	2.009211	(4, 316.0)	0.0930
15	7.037308	4	0.1339	1.773389	(4, 316.0)	0.1339
16	5.129182	4	0.2743	1.288648	(4, 316.0)	0.2743
17	5.193444	4	0.2680	1.304925	(4, 316.0)	0.2680
18	2.506596	4	0.6435	0.627149	(4, 316.0)	0.6435
19	2.555687	4	0.6347	0.639481	(4, 316.0)	0.6347
20	1.338977	4	0.8547	0.334394	(4, 316.0)	0.8547

Table 63 – Autocorrelation LM test - FDI and IBC-BR

	D(IDPPC) resid	D(LIBCBR) resid
Mean	$-2.02E-14$	$5.40E-19$
Median	-206.9144	$-3.35E-05$
Maximum	6347.364	0.030179
Minimum	-6660.508	-0.042662
Std. Dev.	1784.403	0.008595
Skewness	0.121518	-1.039362
Kurtosis	5.183434	8.078484
Jarque-Bera	36.19838	225.8407
Probability	0.000000	0.000000
Sum	$-1.82E-12$	$6.25E-17$
Sum Sq. Dev.	$5.70E+08$	0.013224
Observations	180	180

Table 64 – Residuals descriptive stats - FDI and IBC-BR

C.2 Annual data estimations

C.2.1 FDI and trade balance

Null hypothesis: No serial correlation at lag h

Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	2.275606	4	0.6852	0.570036	(4, 66.0)	0.6853
2	2.714223	4	0.6067	0.682152	(4, 66.0)	0.6068
3	2.053942	4	0.7258	0.513655	(4, 66.0)	0.7259
4	2.501520	4	0.6444	0.627691	(4, 66.0)	0.6444
5	5.849771	4	0.2107	1.505376	(4, 66.0)	0.2108
6	0.996026	4	0.9104	0.247122	(4, 66.0)	0.9104
7	3.382251	4	0.4960	0.854325	(4, 66.0)	0.4961
8	3.435505	4	0.4878	0.868124	(4, 66.0)	0.4878
9	7.659301	4	0.1049	1.998290	(4, 66.0)	0.1050
10	5.952048	4	0.2028	1.532883	(4, 66.0)	0.2029
11	6.671371	4	0.1543	1.727530	(4, 66.0)	0.1544
12	1.767137	4	0.7785	0.440980	(4, 66.0)	0.7785
13	5.776283	4	0.2165	1.485638	(4, 66.0)	0.2166
14	6.233903	4	0.1823	1.608903	(4, 66.0)	0.1824
15	3.895534	4	0.4203	0.987786	(4, 66.0)	0.4204

Table 65 – Autocorrelation LM test (annual) - FDI and trade balance

	D(LIDPPC) resid	D(BC) resid
Mean	$-2.25E-17$	$3.84E-13$
Median	-0.016544	859.0083
Maximum	0.975091	11547.15
Minimum	-1.316232	-13733.39
Std. Dev.	0.492999	5879.593
Skewness	-0.103003	-0.576394
Kurtosis	3.070253	3.017078
Jarque-Bera	0.082904	2.326125
Probability	0.959395	0.312528
Sum	$-7.22E-16$	$8.19E-12$
Sum Sq. Dev.	9.964962	$1.42E+09$
Observations	42	42

Table 66 – Residuals descriptive stats (annual) - FDI and trade balance

Null hypothesis: No serial correlation at lag h

Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	6.711717	9	0.6671	0.742464	(9, 48.8)	0.6684
2	8.381739	9	0.4962	0.942481	(9, 48.8)	0.4979
3	6.655521	9	0.6729	0.735844	(9, 48.8)	0.6742
4	6.655904	9	0.6729	0.735889	(9, 48.8)	0.6742
5	11.21720	9	0.2611	1.297052	(9, 48.8)	0.2629
6	9.391516	9	0.4019	1.066556	(9, 48.8)	0.4037
7	1.915925	9	0.9927	0.202323	(9, 48.8)	0.9928
8	5.807994	9	0.7590	0.636858	(9, 48.8)	0.7600
9	9.241650	9	0.4153	1.047989	(9, 48.8)	0.4171
10	6.867716	9	0.6509	0.760879	(9, 48.8)	0.6523
11	4.768365	9	0.8540	0.517606	(9, 48.8)	0.8547
12	10.49934	9	0.3116	1.205460	(9, 48.8)	0.3134
13	5.294143	9	0.8080	0.577620	(9, 48.8)	0.8088
14	13.70930	9	0.1330	1.624951	(9, 48.8)	0.1344
15	16.14247	9	0.0640	1.960523	(9, 48.8)	0.0649

Table 67 – Autocorrelation LM test (annual) - FDI, exports and imports

D(LIDPPC resid)	D(LX) resid	D(LM) resid
$3.75E-17$	0.000000	0.000000
−0.013141	0.011043	−0.019621
0.749767	0.228173	0.302525
−0.950916	−0.334397	−0.368869
0.418639	0.099182	0.131378
−0.267293	−0.680471	0.099527
2.586615	5.160485	3.624998
0.761116	10.86643	0.717074
0.683480	0.004369	0.698698
$7.77E-16$	0.000000	0.000000
6.835091	0.383645	0.673145
40	40	40

Table 68 – Residuals descriptive stats (annual) - FDI, exports and imports

C.2.2 FDI and technological change

C.2.3 FDI and income distribution

C.2.4 FDI, trade balance and income distribution

C.2.5 FDI and economic growth

Null hypothesis: No serial correlation at lag h

Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	2.871128	4	0.5796	0.724142	(4, 48.0)	0.5798
2	5.947809	4	0.2031	1.548699	(4, 48.0)	0.2033
3	7.116003	4	0.1299	1.875590	(4, 48.0)	0.1300
4	4.574463	4	0.3338	1.174235	(4, 48.0)	0.3340
5	1.087245	4	0.8963	0.269240	(4, 48.0)	0.8963
6	9.553650	4	0.0487	2.583330	(4, 48.0)	0.0488
7	3.533255	4	0.4728	0.897247	(4, 48.0)	0.4730
8	8.610803	4	0.0716	2.305403	(4, 48.0)	0.0717
9	3.731369	4	0.4436	0.949498	(4, 48.0)	0.4438
10	2.373204	4	0.6675	0.595497	(4, 48.0)	0.6676
11	3.422203	4	0.4898	0.868050	(4, 48.0)	0.4900
12	2.148078	4	0.7085	0.537761	(4, 48.0)	0.7087
13	5.524509	4	0.2376	1.432159	(4, 48.0)	0.2378
14	2.735110	4	0.6031	0.688870	(4, 48.0)	0.6032
15	1.057449	4	0.9010	0.261782	(4, 48.0)	0.9010

Table 69 – Autocorrelation LM test (annual) - FDI and TFP

	D(LIDPPC) resid	D(LTFPNA) resid
Mean	$-1.39E-17$	$1.78E-18$
Median	-0.031318	-0.002403
Maximum	0.794898	0.048697
Minimum	-1.301171	-0.058544
Std. Dev.	0.455023	0.022598
Skewness	-0.267691	-0.178911
Kurtosis	3.219631	3.531968
Jarque-Bera	0.544165	0.667918
Probability	0.761791	0.716083
Sum	$-5.55E-16$	$4.16E-17$
Sum Sq. Dev.	7.867752	0.019405
Observations	39	39

Table 70 – Residuals descriptive stats (annual) - FDI and TFP

Null hypothesis: No serial correlation at lag h

Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	4.877582	4	0.3001	1.248662	(4, 60.0)	0.3002
2	1.401993	4	0.8438	0.348745	(4, 60.0)	0.8439
3	3.218191	4	0.5220	0.812605	(4, 60.0)	0.5221
4	5.069952	4	0.2802	1.299985	(4, 60.0)	0.2803
5	2.653650	4	0.6173	0.666938	(4, 60.0)	0.6174
6	4.468990	4	0.3462	1.140188	(4, 60.0)	0.3464
7	7.032289	4	0.1342	1.832872	(4, 60.0)	0.1343
8	7.438315	4	0.1145	1.945288	(4, 60.0)	0.1146
9	7.177772	4	0.1268	1.873065	(4, 60.0)	0.1269
10	3.342646	4	0.5022	0.844900	(4, 60.0)	0.5023
11	1.675198	4	0.7952	0.417642	(4, 60.0)	0.7953
12	2.950241	4	0.5662	0.743299	(4, 60.0)	0.5663
13	4.711039	4	0.3183	1.204360	(4, 60.0)	0.3184
14	2.320131	4	0.6771	0.581513	(4, 60.0)	0.6772
15	1.778137	4	0.7765	0.443682	(4, 60.0)	0.7765

Table 71 – Autocorrelation LM test (annual) - FDI and wage share

	D(LIDPPC) resid	D(LWSHARE) resid
Mean	$-2.30E-17$	$1.35E-18$
Median	-0.060449	-0.000483
Maximum	0.821823	0.079141
Minimum	-1.363100	-0.130814
Std. Dev.	0.445626	0.032363
Skewness	-0.606320	-1.215354
Kurtosis	3.950351	8.283056
Jarque-Bera	4.055007	57.77417
Probability	0.131664	0.000000
Sum	$-6.94E-16$	$3.82E-17$
Sum Sq. Dev.	7.943313	0.041895
Observations	41	41

Table 72 – Residuals descriptive stats (annual) - FDI and wage share

Null hypothesis: No serial correlation at lag h

Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	6.179304	4	0.1862	1.612860	(4, 48.0)	0.1863
2	1.563493	4	0.8153	0.389071	(4, 48.0)	0.8154
3	3.011623	4	0.5559	0.760677	(4, 48.0)	0.5560
4	1.347128	4	0.8533	0.334486	(4, 48.0)	0.8534
5	2.069014	4	0.7231	0.517547	(4, 48.0)	0.7232
6	8.611652	4	0.0716	2.305651	(4, 48.0)	0.0717
7	6.792824	4	0.1473	1.784375	(4, 48.0)	0.1474
8	1.982139	4	0.7390	0.495374	(4, 48.0)	0.7391
9	3.842757	4	0.4277	0.978969	(4, 48.0)	0.4279
10	2.489997	4	0.6464	0.625555	(4, 48.0)	0.6466
11	2.925665	4	0.5703	0.738311	(4, 48.0)	0.5705
12	0.405883	4	0.9820	0.099813	(4, 48.0)	0.9820
13	1.514929	4	0.8240	0.376798	(4, 48.0)	0.8241
14	0.739237	4	0.9464	0.182410	(4, 48.0)	0.9464
15	1.086761	4	0.8964	0.269119	(4, 48.0)	0.8964

Table 73 – Autocorrelation LM test (annual) - FDI and GINI index

	D(LIDPPC) resid	D(LGINI) resid
Mean	$3.45E-17$	$-1.98E-19$
Median	0.059181	−0.003257
Maximum	1.162330	0.032342
Minimum	−1.401588	−0.018634
Std. Dev.	0.555841	0.012332
Skewness	−0.038792	0.752056
Kurtosis	2.948485	3.124093
Jarque-Bera	0.012648	3.321719
Probability	0.993696	0.189976
Sum	$6.66E-16$	$-3.47E-18$
Sum Sq. Dev.	10.50459	0.005170
Observations	35	35

Table 74 – Residuals descriptive stats (annual) - FDI and GINI index

Null hypothesis: No serial correlation at lag h

Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	7.430687	9	0.5924	0.827628	(9, 58.6)	0.5934
2	6.976930	9	0.6395	0.774198	(9, 58.6)	0.6405
3	16.06107	9	0.0656	1.921896	(9, 58.6)	0.0663
4	5.519324	9	0.7869	0.605185	(9, 58.6)	0.7876
5	8.777439	9	0.4581	0.988527	(9, 58.6)	0.4593
6	3.621948	9	0.9345	0.391042	(9, 58.6)	0.9347
7	10.37180	9	0.3212	1.183579	(9, 58.6)	0.3225
8	13.08140	9	0.1590	1.526779	(9, 58.6)	0.1600
9	16.64886	9	0.0545	2.002105	(9, 58.6)	0.0551
10	19.92166	9	0.0184	2.462866	(9, 58.6)	0.0187
11	17.43377	9	0.0423	2.110403	(9, 58.6)	0.0429
12	7.611858	9	0.5737	0.849070	(9, 58.6)	0.5748
13	10.55652	9	0.3073	1.206502	(9, 58.6)	0.3086
14	16.31975	9	0.0605	1.957101	(9, 58.6)	0.0611
15	4.965581	9	0.8373	0.542010	(9, 58.6)	0.8378

Table 75 – Autocorrelation LM test (annual) - FDI, trade balance and wage share

	D(LIDPPC) resid	D(BC) resid	D(LWSHARE) resid
Mean	$3.69E-13$	$-2.68E-13$	$-2.34E-18$
Median	−91.24496	97.69018	0.003801
Maximum	9188.465	9059.320	0.088134
Minimum	−8167.599	−8720.478	−0.087698
Std. Dev.	3291.275	4153.091	0.028416
Skewness	−0.006646	0.168416	−0.162440
Kurtosis	3.805231	2.580568	5.520256
Jarque-Bera	1.080956	0.482300	10.76207
Probability	0.582470	0.785724	0.004603
Sum	$1.05E-11$	$-8.19E-12$	$-1.54E-16$
Sum Sq. Dev.	$4.22E+08$	$6.73E+08$	0.031491
Observations	40	40	40

Table 76 – Residuals descriptive stats (annual) - FDI, trade balance and wage share

Null hypothesis: No serial correlation at lag h

Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	11.87080	9	0.2207	1.373770	(9, 56.1)	0.2220
2	7.103210	9	0.6264	0.788980	(9, 56.1)	0.6275
3	9.447557	9	0.3970	1.070695	(9, 56.1)	0.3984
4	5.475883	9	0.7910	0.599839	(9, 56.1)	0.7917
5	4.276561	9	0.8923	0.463712	(9, 56.1)	0.8927
6	8.289880	9	0.5052	0.930195	(9, 56.1)	0.5065
7	9.873933	9	0.3608	1.123133	(9, 56.1)	0.3622
8	6.678018	9	0.6706	0.739062	(9, 56.1)	0.6716
9	7.134682	9	0.6231	0.792689	(9, 56.1)	0.6242
10	8.495342	9	0.4851	0.954932	(9, 56.1)	0.4864
11	14.63113	9	0.1016	1.734349	(9, 56.1)	0.1025
12	4.622207	9	0.8659	0.502664	(9, 56.1)	0.8664
13	11.38849	9	0.2500	1.312462	(9, 56.1)	0.2514
14	4.009788	9	0.9108	0.433803	(9, 56.1)	0.9111
15	3.626364	9	0.9342	0.391049	(9, 56.1)	0.9345

Table 77 – Autocorrelation LM test (annual) - FDI, trade balance and GINI index

	D(LIDPPC) resid	D(LGINI) resid	D(BC) resid
Mean	$-4.01E-17$	$1.66E-18$	$9.97E-14$
Median	0.063606	−0.003590	627.9346
Maximum	0.921028	0.041326	11482.81
Minimum	−1.366822	−0.026301	−12319.36
Std. Dev.	0.515430	0.013487	6048.819
Skewness	−0.213018	1.129408	−0.406321
Kurtosis	2.971598	4.868492	2.591189
Jarque-Bera	0.273469	12.89027	1.241271
Probability	0.872202	0.001588	0.537603
Sum	$-7.77E-16$	$3.47E-17$	$1.82E-12$
Sum Sq. Dev.	9.298390	0.006367	$1.28E+09$
Observations	36	36	36

Table 78 – Residuals descriptive stats (annual) - FDI, trade balance and GINI index

Null hypothesis: No serial correlation at lag h

Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	2.032733	4	0.7297	0.508270	(4, 66.0)	0.7298
2	2.391335	4	0.6642	0.599547	(4, 66.0)	0.6643
3	3.527692	4	0.4737	0.892038	(4, 66.0)	0.4738
4	3.371664	4	0.4977	0.851583	(4, 66.0)	0.4978
5	4.272747	4	0.3704	1.086520	(4, 66.0)	0.3705
6	6.180503	4	0.1861	1.594476	(4, 66.0)	0.1862
7	3.145719	4	0.5337	0.793166	(4, 66.0)	0.5338
8	2.090679	4	0.7191	0.522986	(4, 66.0)	0.7191
9	1.501835	4	0.8263	0.374031	(4, 66.0)	0.8264
10	0.820556	4	0.9357	0.203320	(4, 66.0)	0.9357
11	5.642148	4	0.2275	1.449667	(4, 66.0)	0.2276
12	4.158971	4	0.3849	1.056681	(4, 66.0)	0.3850
13	5.201863	4	0.2672	1.332099	(4, 66.0)	0.2673
14	0.474404	4	0.9759	0.117245	(4, 66.0)	0.9759
15	0.354355	4	0.9860	0.087498	(4, 66.0)	0.9860

Table 79 – Autocorrelation LM test (annual) - FDI and real GDP growth

	D(LIDPPC) resid	RGDPG resid
Mean	$-2.85E-18$	$-2.75E-16$
Median	-0.031637	-0.010500
Maximum	1.009107	5.409358
Minimum	-1.602931	-6.496511
Std. Dev.	0.512713	2.922332
Skewness	-0.338943	-0.225663
Kurtosis	3.846114	2.801165
Jarque-Bera	2.057016	0.425652
Probability	0.357540	0.808297
Sum	$3.89E-16$	$-7.99E-15$
Sum Sq. Dev.	10.77786	350.1409
Observations	42	42

Table 80 – Residuals descriptive stats (annual) - FDI and real GDP growth

Null hypothesis: No serial correlation at lag h

Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	6.986344	9	0.6385	0.774449	(9, 41.5)	0.6404
2	11.60664	9	0.2364	1.356747	(9, 41.5)	0.2387
3	10.57792	9	0.3058	1.221878	(9, 41.5)	0.3082
4	10.37025	9	0.3214	1.195023	(9, 41.5)	0.3238
5	7.863413	9	0.5480	0.880441	(9, 41.5)	0.5501
6	7.536894	9	0.5814	0.840740	(9, 41.5)	0.5835
7	2.769655	9	0.9727	0.292728	(9, 41.5)	0.9729
8	5.693050	9	0.7702	0.621876	(9, 41.5)	0.7715
9	7.937633	9	0.5404	0.889505	(9, 41.5)	0.5426
10	10.84696	9	0.2863	1.256852	(9, 41.5)	0.2888
11	11.74886	9	0.2278	1.375636	(9, 41.5)	0.2301
12	11.61908	9	0.2356	1.358396	(9, 41.5)	0.2380
13	16.92823	9	0.0499	2.105826	(9, 41.5)	0.0510
14	5.352352	9	0.8026	0.582407	(9, 41.5)	0.8037
15	6.225158	9	0.7172	0.684120	(9, 41.5)	0.7188

Table 81 – Autocorrelation LM test (annual) - FDI, TFP and real GDP growth

	D(LIDPPC) resid	RGDPG resid	D(LTFPNA) resid
Mean	$9.93E-17$	$-4.55E-17$	$-5.78E-18$
Median	0.072988	−0.216611	0.000698
Maximum	0.606708	5.102258	0.049633
Minimum	−0.791233	−4.365217	−0.037248
Std. Dev.	0.347753	2.135180	0.017845
Skewness	−0.333085	0.147774	0.170030
Kurtosis	2.602164	2.605841	3.529949
Jarque-Bera	0.978339	0.394404	0.644291
Probability	0.613135	0.821025	0.724593
Sum	$4.94E-15$	$-2.66E-15$	$-2.32E-16$
Sum Sq. Dev.	4.595409	173.2417	0.012101
Observations	39	39	39

Table 82 – Residuals descriptive stats (annual) - FDI, TFP and real GDP growth