RESEARCH ON THE "COST OF NON-EUROPE"

BASIC FINDINGS

VOLUME 11

THE EC 92 AUTOMOBILE SECTOR

Document

COMMISSION OF THE EUROPEAN COMMUNITIES

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VOLUME 11

THE EC 92 AUTOMOBILE SECTOR

by

Ludvigsen Associates Ltd

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The EC 92 Automobile Sector

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Report to the Commission
of the European Communities

THE EC92 AUTOMOBILE SECTOR

Ludvigsen Associates Limited
March 1988

EXECUTIVE SUMMARY

P150

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THE EC92 AUTOMOBILE SECTOR

EXECUTIVE SUMMARY

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I. OBJECTIVE AND WORKPLAN

A. OBJECTIVE

The objective of the work undertaken by Ludvigsen Associates Limited (LAL) under contract to the Commission of the European Communities is the identification and quantification of the economic benefits that will accrue to the EC automobile industry and to its customers through the removal of the fiscal, physical and technical internal barriers that now divide the Community's Member States.

The project has the aim of 'assessing the specific costs imposed on the Community automotive industries as indeed on consumers as a result of the currently fragmented nature of the EC automobile market.' The sector studied is defined as including the design and manufacture of volume-produced passenger cars in the European Community, the sale of such EC-built cars abroad, and the sale within the Community of passenger cars from all sources.

The principal focus of the work is on two phases of auto industry activity: design and engineering, and manufacturing and assembly. These were selected in consultation with the Commission as having the potential to make important contributions to the benfit of EC92, especially in the area of scale economies, and also because they are of continuing interest and value to the Community and the Commission.

Also referenced in the project are selected findings from a Preliminary Study that LAL conducted under contract to the Commission from January to April 1987. This encompassed a comprehensive search of the existing knowledge on the cost of Non-Europe in the auto industry. In parallel LAL carried out a study of the principal influences on the evolution of the open internal market in automobiles in the United States. A summary of the findings is provided in Section II.A.

B. WORKPLAN

The main elements of the workplan are reported upon in this Summary in the Sections indicated. They are as follows:

A. A programme of questionnaires and interviewing of auto manufacturers and suppliers to ensure that the findings are current and in conformity with industry practice. The results are summarised in Sections II and IV.
B. Determination of the overall economic dimensions and constitution of the sector in the Community in the study base year 1985. Findings are reported in Section III.
C. Specific study of the design and engineering costs in the industry, reported and analysed in Section IV.
D. Research into the cost structure and the economies of scale of the production of components and assembly of cars in the EC industry, as described in Section V.
E. Computation in cost and price terms of the immediate direct effects, deferred direct effects and indirect dynamic effects of the changes caused by the postulated EC92 conditions, reported in Sections VI and VII.

II. BACKGROUND STUDIES AND EC92 PARAMETERS

As background elements to the present study this section provides reports on three aspects of the work: a summary of the findings of the US market investigation carried out in the Preliminary Study, an overview of the types of barriers experienced in EC85 by the auto industry, and the parameters for EC92 that have been used in the conduct of this study.

A. US INTERNAL MARKET CHARACTERISTICS

The United States automobile industry distributes its products today in essentially the same open integrated market that the industry entered when it was founded at the beginning of the 20th Century. For its first thirty years the American motor industry had the benefit of a laissez-faire attitude on the part of the expansionist federal government.

Federal regulation was imposed on the USA motor industry concerning certain of its business, marketing and labour practices during the Great Depression. The industry adapted successfully to these, and indeed was able to turn some of those regulations to its advantage. For example, it secured the suppression of internal technical barriers when state vehicle design laws were essentially superseded by the introduction of federal motor vehicle safety regulations.

The USA motor industry experienced a substantial technical disruption of its national market as a result of the adoption of emissions control. This occurred as a consequence of the state of California's success in convincing the federal government that for specific health reasons it should be allowed to have stricter exhaust rules than the federally-established standards of the other states. Subsequently the values of the standards have converged and the technical requirements across the nation have become similar.

It has been evident from the study that the provision of the USA Constitution giving the federal government the power 'to regulate commerce...among the several states' has played a key role in ensuring the maintenance of an open internal American market, especially as that provision has since been interpreted and extended by the courts.

Also important, according to the study, is the ease with which a company in one American state can register to do business in other states. This facilitated the evolution of enterprises that thought and acted in national terms.

The USA study has shown that an open internal market is effectively maintained although the states retain significant legal and economic powers. These include the power to impose taxes on businesses and individuals resident in the state in order to pay for those services that the state renders. The states impose taxes in significantly different ways, including sales taxes that range from nought to 7 percent and vehicle use taxes that are based on differing criteria.

The ability of Americans to think and act in national terms has been enhanced by excellent low-cost communications. This has included the rail system, an efficient national telephone system, an integrated highway network, and a competitive deregulated airline system. Without this infrastructure the establishment and operation of national networks of design, production and sales would have been much more difficult in all industries, including the motor industry.

In the USA the trend of legislation has led to a relatively balanced relationship between the manufacturer and the dealer in the auto franchise system. This has given more freedom to the dealers, and less power to the car makers and importers, than is generally granted in Europe.

Best viewed as a form of modified selective distribution, the relationship between maker and dealer in the USA is such that a highly competitive open market exists for both new and used cars that offers the consumer a very wide choice. The Federal Trade Commission is active at the national level to ensure the maintenance of that freedom of choice.

B. EXISTING INTERNAL BARRIERS

As a consequence of the substantial extent to which it is an integral part of the lives of all the citizens of the Member States, the automobile industry is presently affected by a very broad spectrum of internal Community barriers. These barriers were defined and researched as part of the Preliminary Study and the current project to provide a basis for the work and a reference to the assumptions on which it is founded.

LAL's researches undertaken among Community auto industry suppliers and manufacturers provided detailed information on many internal barriers in the three categories that are dealt with in the Commission White Paper on the internal market: fiscal, physical and technical barriers. In this Executive Summary some specific barriers are indicated in selective outline form according to those categories, as follows:

1. Fiscal Barriers

* Taxation levels on car sales that differ in virtually all of the EC Member States, from 12 percent in Luxembourg to 200+ percent in Denmark and Greece.
* Policies on the refunding of VAT for company purchases of vehicles that differ from country to country.
* Maintenance by some Member States of price regulations and/or margin controls.
* Distortion of competitive conditions by excessive aid to 'national champion' producers in the form of Member State grants, loans, equity injections and debt writeoffs.
* Inconsistent application of standards for imposition of annual use taxes on cars, and differing tax levels.
* Use of fiscal incentives in some Member States (West Germany, Netherlands) to encourage sales of vehicles built to differing emissions and noise standards.
* Inconsistent levels of taxes on motor fuels.

2. Physical Barriers

* Border crossing documentary and inspection requirements, with attendant delays having consequences in the loss of time and money in the shipping of components and vehicles.
* Customs and immigration checks on personal movements within the Community.
* High cost of regulated air travel within the Community, imposing an implicit physical barrier on the volume of travel for business purposes.
* Differences in communications standards between Member States that present physical barriers to cooperation in vehicle development and production.

3. Technical Barriers

* Lack of a single EC-wide Type Approval procedure, requiring costly and time-consuming duplication of cars and tests.
* Exhaust emissions standards which are not definitively fixed at a common level with agreed dates for implementation.
* Unique national vehicle equipment requirements such as side repeater flasher lights in Italy, reclining driver's seat in West Germany, dim-dip lighting in the UK, yellow headlamp bulbs in France and unique rear reflectors in West Germany.
* Maximum speed test required for some but noy all Member States (West Germany, Italy, Spain).

C. PROJECT PARAMETERS FOR EC92

To provide a basis for study, LAL drew upon the research findings to set the assumptions and parameters for the work; these are published in full in the Final Report. The intent in this Executive Summary is to provide highlights of those key points which have had a significant effect upon the findings. They include as well some of the project assumptions concerning events that will occur as a consequence of EC92. The summary highlights are as follows:

The EC negotiates agreements and understandings with its global trade partners as an unified entity. These **unified external trade policies** are arrived at so that national restraints, regulations, agreements and understandings on auto imports may be phased out progressively. The level of **local content** that qualifies an automobile to be considered EC-produced is assumed to be 70 percent of the factory cost by value (project assumption).

A new regime permits **EC-wide business operations** by a single corporate entity. EC member governments cease providing **extraordinary aid** to 'national champions'. **National and local aid** to enterprises is still permitted, but brought by EC actions within ranges that do not threaten to distort trade. **Competition policies** and activities in the Community are strengthened and refined to ensure that EC92 does not lead to the formation of monopolies that will tend to defeat the achievement of higher scale efficiencies.

Unilateral use of **price controls** by Member States is suppressed by legislative actions taken by Community members in response to requirements of internal market completion. **VAT applicable to the sale of autos** is approximated at levels ranging from 14 percent to 20 percent. The application of **VAT on the sale of used cars** is harmonised.

Vehicle use taxes are approximated by the EC at a level which does not distort trade. An EC action achieves harmonisation of **taxes on motor fuel** throughout the Community at levels per 1,000 litres of 340 Ecu for leaded petrol, 310 Ecu for unleaded petrol, 177 Ecu for diesel fuel and 85 Ecu for liquid petroleum gas (project assumption).

Future technical regulations directly affecting the design of autos are phased in simultaneously by all EC Member States, with adequate lead time, at values agreed either unanimously or by majority under the Single European Act.

Testing and certification standards and procedures for automobiles to be sold in the Community take effect EC-wide and permit EC Type Approval to be achieved through a single national application. Tests and standards for **acceptability of replacement parts** are harmonised among Member States.

Flexibility of use of **hire purchase** of automobiles is enhanced throughout the Community by EC measures taken to liberalise competition in services. Liability **insurance** requirements are consistent among Member States. Procedures for **registering** in one Member State a vehicle purchased in another are made routine, as are terms for **temporary vehicle use** in other than the state of registration.

Research and development activities take place using **technical standards and communications** that are common to all the EC industry suppliers and manufacturers. Standards are agreed and implemented throughout the Community, among the assemblers and suppliers, for the **CAD systems** that are used in the design and engineering of vehicles and parts. Manufacturers and their suppliers reach agreement on a protocol for the **coordination of in-factory electronics** throughout EC vehicle production plants.

Car **marketing patterns** in Community countries shift under the influence of the new tax regimes and the phasing out of internal market limitations on third-country BU imports. Vehicle makers and distributors exert central control of their **sales and marketing** for all of the Community from a single headquarters.

Parts distribution is streamlined and centrally controlled. All **dealer training** activities, including service training, are conducted on a pan-European basis. Vehicle makers provide a **Eurowarranty**, fully valid at all their EC dealers.

III. DIMENSIONS AND CHARACTERISTICS OF THE EUROPEAN MOTOR INDUSTRY

Broadly EC auto manufacturers account for in excess of 85 percent of registrations in their home market. In 1985 Europe was the world's second-largest car market, and by 1986 it had overtaken the USA to become the largest single market. In 1985 the EC manufacturers accounted for 37 percent of world passenger car production.

While the EC car and component manufacturers have shed significant amounts of labour in recent years to gain competitiveness, they still directly employ in excess of 1.7 million people across the Community. The EC motor industry absorbs between 5 and 8 percent of all industrial output and accounts for approximately 20 percent of production of steel and machine tools, 15 percent of rubber production and 5 percent of all glass output.

A. INDUSTRY ECONOMIC VOLUME

In view of the very substantial economic role on the part of the EC auto industry, it was judged necessary to make a fresh determination of the industry's dimensions in the study base year of 1985, the most recent for which adequate EC-wide data are available. An analysis was conducted to determine the retail value of the car markets in Europe, net and gross of tax, and the retail value of car and car component production in the various producing countries.

The findings of the analysis are summarised in separate tables for cars and components. One shows the volumes of cars produced (Table 1). Another defines the total value of this production in billions of Ecu for both retail and wholesale markets (Table 2). Another table defines the value in billions of Ecu of European component production, showing also the value of components used for national production (Table 3).

Table 1: AUTOMOBILE VOLUMES (1985)

Units: millions	**PRODUCTION**	**%**	**SALES**	**%**	**VARIANCE**
Germany	4.17	35.9	2.38	24.9	1.79
France	2.63	22.6	1.77	18.5	0.86
Italy	1.39	11.9	1.75	18.3	(0.36)
Spain	1.23	10.6	0.56	5.9	0.67
UK	1.05	9.0	1.83	19.1	(0.78)
Belgium	0.99	8.5	0.39	4.1	0.60
Netherlands	0.11	1.0	0.49	5.1	(0.38)
Portugal	0.06	0.5	0.10	1.0	(0.04)
Denmark	0.00	0.0	0.16	1.7	(0.16)
Greece	0.00	0.0	0.08	0.8	(0.08)
Eire	0.00	0.0	0.06	0.6	(0.06)
Total	**11.63**	**100**	**9.57**	**100**	**2.06**

Table 2: AUTOMOBILE VALUES

All in billion Ecu

COUNTRY	PRODUCTION	----MARKET-----	
		Retail	Wholesale
Germany	34.6	19.3	16.1
France	13.9	12.9	12.2
UK	7.3	14.6	12.3
Italy	6.6	12.0	9.2
Bel/Lux	7.1	2.3	2.6
Spain	5.2	4.2	2.9
Netherlands	0.8	3.5	2.4
Denmark	1.1	0.9	-
Eire	0.8	0.6	-
Greece	1.1	0.9	-
Portugal	-	0.6	0.4
Non-Add	(3.5)*		
Total	**72.0**	**72.4**	**60.5**

* Allowance for double-counting of production, i.e. completed cars shown in both Belgian and German figures.

Table 3: COMPONENT VALUES

All in billion Ecu

COUNTRY	TOTAL PRODUCTION	LOCAL USE
Germany	19.7	19.0
France	10.0	8.3
UK	4.7	4.5
Italy	3.8	3.6
Bel/Lux	2.4	5.2
Spain	2.6	3.1
Netherlands	0.5	0.6
Denmark	-	-
Eire	-	-
Greece	-	-
Portugal	-	-
Total	**43.7**	**44.3**

One of the principal findings of this analysis is the substantial importance and dimension of the German car and component industry within the EC. The value of German car production at 34.6 bn Ecu represents over 48 percent of the total EC output. This reflects the high-value mix of German production and the relatively low-value mix of French, Spanish and Italian production. The total value of the German production of components, at 19.7 bn Ecu, represents 45 percent of the total European output.

The production values of the French car and component industries are also of significant size at 13.9 bn Ecu and 10.0 bn Ecu, representing 19.3 percent and 22.9 percent of their respective EC markets.

B. TRADE FLOWS

In 1985 the EC manufacturers exported 2.01 million cars to external markets worth 19.1 billion Ecu. The major markets for these were the EFTA countries with 0.69 million, closely followed by the USA with 0.64 million vehicles. The EC countries imported 1.1 million cars worth 5.41 billion Ecu. The major exporter to the EC was Japan with 0.8 million cars.

The graphs below show that the dominance of Germany in production/sales terms was also reflected in 1985 in terms of both intra- and extra-EC trade. The high value mix of German cars is especially marked in terms of extra-EC exports, in which Germany accounts for 67 percent by value of total EC exports.

Figure 1

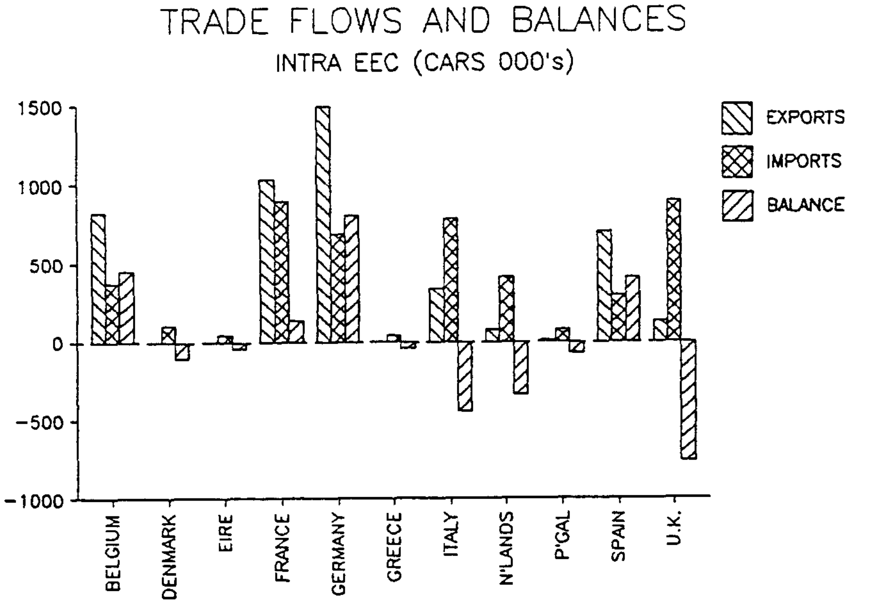
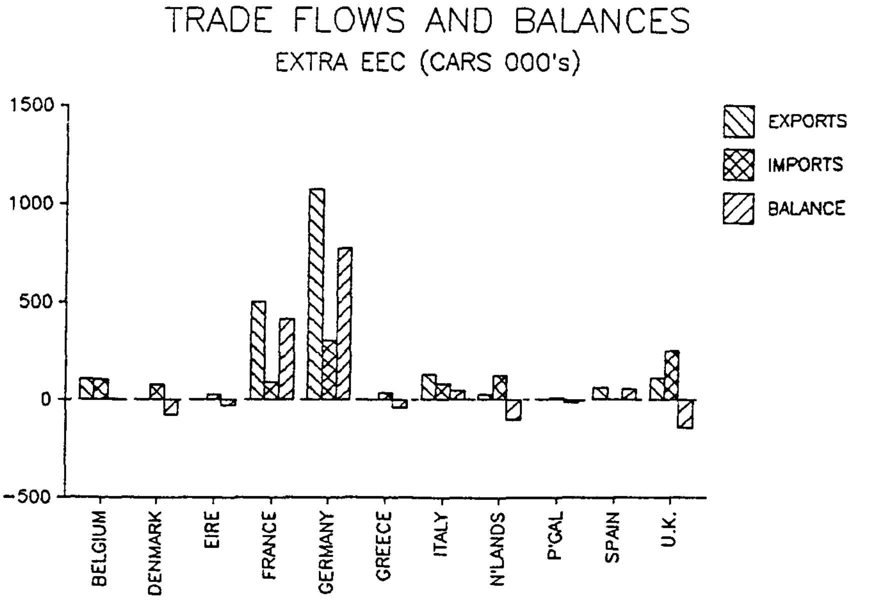


Figure 2



IV. DESIGN AND ENGINEERING COSTS AND SAVINGS

As shown in the Section V.A analysis of car cost structure, the overall cost of designing and engineering a vehicle to the production-ready stage is a small proportion -- typically 5 percent -- of the total cost of building the production vehicle. The proportion tends to fall to a lower level for cars that are in very large-scale production, and for cars of relatively simple design.

Four distinct phases exist within the design and engineering process: project definition, detail design, engineering development, and submission for homologation and type approval. In each of these four areas a potential effect on costs arises from the changes in legislative workload that will derive from the creation of EC92.

The cost of project definition is relatively extremely small, since it involves only a few people. The cost of detail design is inevitably greater, although it is still essentially a question of paying for man-hours. The more complex the issues of technical legislation that must be addressed, the higher will be the cost of detail design. It is unlikely, however, that technical conformity alone will absorb more than 15 percent of the total detail design effort and thus cost.

Costs increase rapidly when vehicle engineering enters the stage of development, since, for the first time, a significant investment is required in hardware, in the form of component test rigs and operating prototypes.

EC92 implies a common set of technical regulations, and common procedures for vehicle homologation and type approval, applied uniformly throughout the Community. A benefit of such complete technical harmonisation will be the simplification of homologation and type approval procedures.

Given common technical regulations throughout the EC, the submission of vehicles and data to the type approval authorities in each member state would constitute needless duplication. Current type approval exercises frequently require more than 100 prototype and pilot-build vehicles. A typical cost for a hand-built prototype passenger car is 100,000 Ecu. In manufacturer interviews, it was suggested that a saving of at least 20 such prototypes could be made if type approval could be applied for and obtained in a single country. This would result in a direct cost saving of at least 1 million Ecu, plus further savings in manpower.

Estimates of the staff reductions which might become possible in the event of 'unified' homologation, by whatever method, varied from 15 to 40 percent, among department staffs numbering from 50 to 100 engineers.

The design and engineering cost savings which can be achieved through technical and regulatory harmonisation (including EC-wide homologation) will depend on the level at which such harmonisation takes place. For example, to harmonise

Community technical requirements on the basis of a 'highest common factor' which includes all current national requirements (other than those which are mutually exclusive) would increase car unit costs by 2 to 5 percent, according to manufacturer interviews. The cost impact would be relatively the highest on the smallest, simplest and cheapest cars.

The larger proportion of the added cost in this case -- as for the car production process as a whole -- would be accounted for by the higher direct cost of purchasing the extra components needed. According to the interviews, an added cost would also be generated by the need to design and engineer all the elements of every car model to the 'highest common factor' of Community standards. Such cost increases would, however, be offset in whole or in part by savings achieved through simplified homologation and type approval procedures.

Investigation of the design and engineering cost aspects has shown several ways in which EC92 can contribute to savings in this area. EC harmonisation to encourage design cost reduction could proceed along two principal lines, as follows:

One line would be a move toward harmonisation of the national technical 'break points' in fiscal regulations. At present, design and engineering (and production) efforts are forced to be divided among too many specialised car versions by the many 'break points' created by different national fiscal approaches to car purchase and ownership taken by EC member states. A more nearly harmonised fiscal approach could substantially reduce the design and engineering load on the major EC car producers, permitting a smaller number of variants to be engineered to higher standards.

A second line of action suggested by the design and engineering interviews should be in the removal of fiscal and customs barriers, to ease the process by which car manufacturers could exchange common components across internal European borders. This is part of the study findings relating to variable cost savings; it is seen as having a potential for engineering cost reduction as well.

This section of the study showed opportunities for design and engineering cost savings in EC92, as well as certain possible offsetting cost increases. The net effect of the savings is estimated to be 10 percent of the design and engineering cost, or 0.5 percent of the vehicle cost. This saving is incorporated in the calculations in Section V.C.

It should also be noted here that LAL assumes in this study that the EC car industry will reinvest part of the savings achieved in EC92 in more active advanced R&D to keep European cars at the forefront of world technological trends. The amount and disposition of this reinvestment, assumed to be one percent of costs, is addressed in Section VI.I.

V. AUTOMOBILE PRODUCTION SCALE ECONOMY

The research and analysis undertaken in this project have shown relatively few instances of immediate direct effects of the implementation of EC92 that are unique and distinctive to the auto industry. The removal of border controls, for example, will reduce transportation costs, an effect which is generic to EC industry as a whole and which, as such, is covered by separate Commission research.

The principal auto industry effects are those which will be delayed in their implementation, because they will only be realised after the industry has taken actions that the improved internal market conditions will facilitate.

Important cost reductions are expected from the improvements in production economies of scale that will occur when EC92 conditions permit more extensive transborder interpenetration of individual parts, components and assemblies, and built-up vehicles. The levels of scale efficiency achieved in the industries of the USA and Japan have been referred to in this work, as have the best levels currently achieved in Europe.

In this section of the Executive Summary the topic of production scale economies is addressed in three elements. The first element (Section V.A) establishes the segments being studied and the variable and fixed costs of a typical car in each segment. It also discusses the research and findings that show the variations in cost with changing production volume that occur in the making of these cars.

In the second element (Section V.B), the concept of car platforms is introduced as a means of analysing the differences between the annual production volumes of EC85 and EC92. The findings of the platform study and the cost variations are combined in the third element (Section V.C), together with the engineering findings and other fixed cost considerations, to show the overall savings achieved in EC92.

A. VEHICLE COST STRUCTURE

The essential linkage in the production cost element of the study between the cost of components and the economies of scale that are achievable with built-up vehicles is the factory cost structure of the vehicle itself. Because the distribution of passenger car costs differs significantly according to the size and category of the vehicle, separate structures were evolved to suit the five main volume segments for cars that are made and marketed in Europe. The segments, and typical vehicles in each of them, are as follows:

Utility	Small	Lower Medium	Upper Medium	Large
Panda	VW Polo	VW Golf	Peugeot 405	GM Omega
Renault 4	Fiesta	Escort	Sierra	Renault 25
Cit. 2CV	Renault 5	Fiat Ritmo		Fiat Croma

The total cost structure is divided into variable cost and fixed cost elements. These are discussed in the following sections of this Executive Summary.

1. Variable Costs

The variable cost benefit of EC92 at the supplier level was researched and analysed by means of two parallel programmes. One programme consisted of a direct sourcing and pricing activity, gathering data on price/volume relationships of a comprehensive menu of parts used in automobiles. The other programme made use of structured interviews of component producers to gain insight into their actions and attitudes.

a. Component Cost Research and Analysis

A professional automotive component purchasing organisation was engaged to contact European suppliers to obtain price quotes on the supply of their products at annual volumes of 50,000, 100,000, 200,000, 300,000, 500,000 and 1,000,000 car sets. Approximately ninety items were selected for this research, as being representative of the range of components and sub-assemblies found in European cars.

A study finding was that the incremental volumes used for the research appear, at the high end of the volume scale, to represent the maximum potential output per component now prevailing in Europe. The European supply industry was found to be not tooled or equipped to provide many of the major components at rates beyond levels of 500,000 sets per annum.

An immediate impetus toward greater volume would be generated if car makers were to curtail the practise of awarding the supply of a single part or assembly to several suppliers. The research shows, however, a continuing reluctance among EC auto makers to source major componentry from a sole supplier.

b. Car Variable Cost Structure and Volume Variation

For the purpose of this research the variable cost element of a car has been divided into seven categories, using groupings that are in accord with motor industry practise. The categories are power train, body in white, electrical, chassis, interior, exterior, and paint and assembly.

Although a strict definition would include indirect labour as an element of fixed cost, a necessary simplification has been the decision to show all labour as an element of variable cost. Thus labour is included in the variable cost of producing each group of components shown, with the exception of the separate paint and assembly category.

Making use of industry data and research findings, as detailed in the full report, a base variable cost structure for each of the five segments was established. This is shown in tabular form (Table 4).

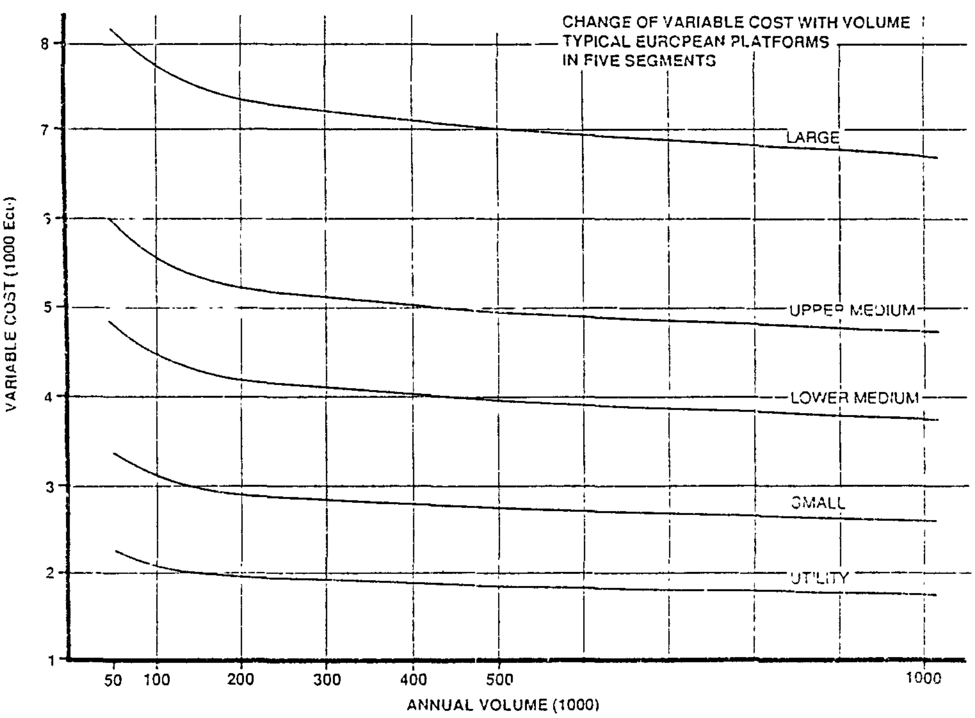
Table 4

UNIT VARIABLE COST STRUCTURES IN FIVE EUROPEAN SEGMENTS

Variable Cost Element (Status: Ecu 1985)	**Utility**	**Small**	**Lower Med.**	**Upper Med.**	**Large**
Engine and Transmission	575	715	810	1040	1550
Electrical	130	225	450	680	1160
Chassis	355	540	855	1040	1545
Interior	250	370	610	835	1235
Exterior	70	110	205	315	465
Body in White	445	535	550	730	925
Paint and Assembly	255	340	485	575	850
Total Variable Cost	**2080**	**2835**	**3965**	**5215**	**7730**

From the base costs, the component cost/volume data researched and other industry data have been employed to obtain a view of the typical overall scale volume effects on the costs of volume-produced passenger cars in each of the five study segments. The changes in the variable costs in each segment that occur with changing annual volume are shown in graphical form (Figure 3).

Figure 3



2. Fixed Costs

Again following EC auto industry practise, the fixed costs associated with car production have been researched under seven categories, as follows: tooling, engineering, warranty, marketing, selling, administration and other fixed costs. Base typical fixed costs for the five EC car segments have been established, and are shown in tabular form (Table 5).

Table 5

UNIT FIXED COST STRUCTURES IN FIVE EUROPEAN SEGMENTS

Fixed Cost Element (Status: Ecu 1985)	**Utility**	**Small**	**Lower Med.**	**Upper Med.**	**Large**
Tooling	265	350	305	580	680
Engineering	160	210	275	360	505
Warranty	90	135	175	265	355
Marketing, Selling, Administration, Other	655	680	710	755	830
Total Fixed Cost	**1170**	**1375**	**1465**	**1960**	**2370**

B. ANALYSIS OF PRODUCTION BY PLATFORMS

1. Platform Survey

The vehicle platform was selected as the basic analysis parameter for the study of vehicle variable costs. An unique 'platform' is defined by the motor industry as a single vehicle floorpan design to which common components are attached in the areas of running gear, suspension, and steering. With relatively minor changes, the floorpan may be varied in length without departing from the concept of an unique platform.

It was determined during the research that the analysis of car production according to platforms offers the only method that provides a direct correlation with the data obtained on the cost/volume relationships of car components. In principle, the most tooling-intensive parts of a platform are common to it and to the vehicles built on it. Thus in theory all the mechanical parts of a platform will be alike in all the car models it carries, making component volume equal to platform volume. This provides a direct and clear relationship that is not possible with the study of either marque or model output.

In this phase of the work the base-year 1985 European market was analysed in terms of the typical number of platforms produced in each segment and the number of car production facilities that are required to reach the total industry volume. This aspect of the platform analysis is detailed in full in the Final Report.

An EC85 basis for comparison with EC92 conditions was obtained by selecting platform volumes achieved by the typical car models that prevail in each segment, and adjusting for non-typical volume factors. The selected method has generated platform numbers and volumes that are taken for the purposes of this study as being representative of industry practise in EC85 (Table 6).

Table 6

EC85 PLATFORM PRODUCTION VOLUMES BY SEGMENT

Segment	Number of Platforms	Volume Per Platform	Total Production
Utility	3	110,000	330,000
Small	6	440,000	2,640,000
Lower Medium	6	525,000	3,150,000
Upper Medium	6	315,000	1,890,000
Large A	6	140,000	840,000
Large B	3	70,000	210,000
Total	**30**		**9,060,000**

2. Factors Affecting Changes in Platform Production Volumes in EC92

In the preceding section, analysis has been conducted of EC85 platform production volumes by segment and typical platform production volumes in EC85. In EC92 the European platforms will be produced according to a different pattern, as a consequence of two main factors: sharing of platforms between makers, and strong specialisation in particular segments by producers.

EC92 conditions will substantially facilitate the sharing of platforms between and among makers, following trends that are already evident and that are forecast to prevail in EC92 (industry interviews). The elimination of physical barriers to joint engineering work, the establishment of common production protocols, the greater ease and lower cost of travel by engineers and executives, and the more rapid and assured movement of parts and assemblies throughout Europe will contribute to this sharing of platforms.

In addition, in EC92 conditions car and component makers will be able to implement more fully a policy of specialising in particular product segments to gain longer annual production runs and hence higher manufacturing efficiency. Such trends are already evident among EC car producers in vehicles such as the Fiat Uno in the Small segment and the VW Golf in the Lower Medium segment.

Taking into account the factors described, and extrapolating from current trends by considering the best performances being achieved by manufacturers in EC87 in the various segments, LAL has forecast the EC92 conditions for platform numbers and volumes (Table 7). To permit direct comparison with EC85 conditions in the subsequent calculations, the total production volumes for both sets of platforms are held at the same level.

Table 7

EC92 PLATFORM PRODUCTION VOLUMES BY SEGMENT

Segment	Number of Platforms	Volume Per Platform	Total Production
Utility	2	160,000	320,000
Small	4	650,000	2,600,000
Lower Medium	4	800,000	3,200,000
Upper Medium	5	380,000	1,900,000
Large A	4	220,000	880,000
Large B	2	80,000	160,000
Total	**21**		**9,060,000**

C. AUTO PRODUCTION ECONOMIES OF SCALE

This section describes the methodologies that have been employed for the analysis of the economies of scale and, subsequently, the automobile cost and price changes that are forecast to occur in the change from EC85 to EC92 conditions.

The work described in this section is based on the assumption that no change in overall industry volume occurs in the first iteration of the effects of EC92. Volume changes in later iterations are possible according to the indirect dynamic effects experienced, described and quantified in Section VII.

1. Variable Costs

By applying the findings concerning EC92 platform volumes to the trend data established on variable costs, the total level of car variable cost under EC92 conditions has been established. The change from EC85 thus established can be attributed to the direct effects of EC92, because the overall level of Community production is assumed to remain static. Thus the identified cost savings arise from the structural changes in production for which the catalyst and prime mover is the introduction of EC92 conditions.

The cost/volume graph of variable cost (Figure 3) has been used to establish the levels of variable cost per unit that are applicable at the platform volumes postulated to prevail when EC92 conditions are in existence. The findings, detailed in tables in the full report, show that overall the change to EC92 produces a 2.36 percent reduction in aggregate variable costs, valued at 898.9 million Ecu.

2. Fixed Costs

The selected approach to quantifying the impact of EC92 on fixed costs is to apply to the fixed cost structure the findings on platform volumes, and to establish the impact that these changes in production methods will have on overheads and fixed costs. The specific effects of the projected EC92 platform changes on the fixed cost categories are outlined in the following sections on tooling costs, engineering costs, warranty and other fixed costs.

a. Tooling Costs

The principal tooling cost savings will result from the economies of scale caused by higher platform volumes in EC92. These savings will take effect at both the component and car producer/assembler levels.

It is envisaged that the development of large basic parts suppliers capable of an order of magnitude higher production volume will be accelerated by EC92. The economies of scale associated with this development will reduce fixed as well as variable costs.

In EC92 the automobile manufacturers will continue to produce a large number of superficially different models, with discrete external sheet metal, while at the same time they share more common platforms. For this study it has been assumed that approximately 50 percent of tooling costs relate to areas which can be commonised, and thus where direct economies of scale will be realised.

Table 8: TOOLING COST COMPARISON

	Utility	**Small**	**Lower Medium**	**Upper Medium**	**Large**
EC85 Unit Cost (Ecu)	265	350	305	580	680
EC92 Unit Cost (Ecu)	221	291	250	525	551 (a)
					631 (b)

Total Tooling Costs

	Utility	**Small**	**Medium**	**Lower Medium**	**Upper Large**	**Total**
EC85	87,450	924,000	960,750	1,096,200	714,000	3,782,400
EC92	70,720	756,600	800,000	997,500	585,840	3,210,660

COST SAVING (000 Ecu) **571,740**

b. Engineering

As a consequence of the move to EC92 the benefits in terms of engineering fixed cost reductions are threefold, as follows:

(1) Scale Economy Improvements

As a direct result of the reduction in the number of platforms being utilised, the fixed cost element of engineering will be spread over a higher production volume per platform, bringing about economies of scale. The relevant saving will be reduced by the approximately 50 percent of the componentry of the automobile that is in those areas which will continue to be differentiated.

(2) Component Commonisation

An indirect consequence is forecast to flow from the greater use of common components. This will occur because the actual cost of designing the automobile will fall as a 'learning curve effect' is experienced by using already tried and tested components/designs.

It may be taken from the preceding elements of this study that up to 20 percent of automobile components could be commonised. If the use of common engineering design and testing for these components yields a 25 percent saving in terms of design time/costs, the total engineering cost saving will be in the region of 5 percent.

(3) Staff/Overhead Savings

An element of the fixed cost of engineering which must be borne by the finished vehicle is the cost of retaining an in-house engineering/product maintenance department. As a result of the simplification of type approval procedures and the greater use of common components it would be reasonable to expect some savings in this area, as discussed in Section IV. These savings would be in the order of 0.5 percent.

Table 9: ENGINEERING COST COMPARISON

Fixed Engineering Cost Per Unit	**Utility**	**Small**	**Lower Medium**	**Upper Medium**	**Large**
EC85 (Ecu)	160	210	275	360	505
EC92 (Ecu)	127	166	215	311	390 (a) 447 (b)

Total Fixed Engineering Cost

	Utility	**Small**	**Lower Medium**	**Upper Medium**	**Large**	**Total**
EC85	52,800	554,400	866,250	680,400	530,250	2,684,100
EC92	40,640	431,600	688,000	408,500	414,720	1,983,460
COST SAVING (000 Ecu)						**700,640**

c. Warranty

The cost of providing warranty cover on automobiles should be reduced by the effects of the change to EC92, as a result of three factors. First, the longer annual production runs should enable the cost of any service failures to be spread more widely, resulting in a lower unit cost. Second, the use of well tried and tested common components and designs should further reduce such failures, especially during the warranty or early-life failure period of a vehicle.

Third, in EC92 the direct communication between dealer and manufacturer will remove a tier of administration in dealing with warranty claims, and also remove an added administrative cost on the sale of warranty parts in cases where the manufacturer deals directly instead of through a national importer. Overall warranty cost savings in the region of 10 percent could therefore be expected.

Table 10: WARRANTY COST COMPARISON

Warranty per Unit	**Utility**	**Small**	**Lower Medium**	**Upper Medium**	**Large**
EC85 (Ecu)	90	135	175	265	355
EC92 (Ecu)	81	122	158	239	320

Total Warranty Provision

	Utility	**Small**	**Lower Medium**	**Upper Medium**	**Large**	**Total**
EC85	29,700	356,400	551,250	500,850	372,750	1,810,950
EC92	25,920	317,200	505,600	454,100	332,800	1,635,320
COST SAVING (000 Ecu)						**175,330**

d. Other Fixed Costs

(1) Administration and Other Overheads

At present the manufacturers indirectly finance the costs that dealers incur by holding stocks of their automobiles. This is because the national importers, which are often owned and run (albeit with a degree of autonomy) by the manufacturers, directly finance the dealers' inventory. Since the cost of finance is an overhead to be borne by productive output, any steps which are taken to reduce these stocks and the resulting finance costs will reduce the overhead cost of producing automobiles.

If by exploiting the potential of EC92 for improved shipping and communications the manufacturers and the national importers succeed in reducing the stock inventory period in Europe by one month, the saving to the producers, in their cost of financing, could be as much as 213,333,000 Ecu.

(2) Selling and Marketing

An immediate cost reduction in sales and marketing will be a consequence of the increased interpenetration of the market by car makes and models in EC92. The model ranges offered by makers throughout the EC will differ country-by-country less than they do in EC85. This will allow increased pan-European advertising, promotion and launching of automobiles, which in turn will allow the fixed cost element of preparing the relevant promotional material to be reduced.

It is estimated that a saving of 5 percent in the cost of advertising could be obtained by the centralisation of advertising/marketing budgets and the greater use of common material. This is expected to generate savings in the region of 42,476,000 Ecu.

Table 11: SUMMARY OF FACTORY FIXED COST SAVINGS (000 Ecu)

Tooling	571,740
Engineering	700,640
Warranty Provision	175,330
Administration/Finance Costs	213,333
Advertising	42,476
COST SAVING	**1,703,519**

The total saving thus achieved represents 11.5% of total factory fixed costs.

3. Non-Factory Costs/Overheads

Other costs, including those of distributing vehicles from the factory to the marketplace, have an impact on the price at which the car is sold to the dealer and eventually to the consumer. Though not a principal focus of the study requested by the Commission, such costs require a brief review.

The principal overhead in this category is the cost of maintaining national importer organisations in the respective EC Member States. The direct business relations between manufacturer and dealer which will be stimulated by EC92 conditions will significantly reduce this cost to the manufacturer by allowing relatively slimmed-down national offices to replace national sales companies. An initial costing of the magnitude of the potential savings in this area suggests a level of 1,600 million Ecu.

Potential savings also derive from an attribute of the current delivery chain, from producer to consumer, which directly impacts upon the retail price. Referred to is the practise of adding a company charge at each point of transfer. In addition to the variable and fixed cost savings on ex-factory costs/prices already discussed, a company cost is also incurred as part of the delivery charge from the storage compound to the customer.

In EC92 the direct communication between dealer and producer will lead to the dealer taking up functions that were previously within the domain of the national importer. This is likely to include order and payment for vehicles in advance at the factory gate and dockside collection where required. The removal of the intermediate role of the national importer will reduce this layer of cost, which under EC85 conditions has a magnitude of more than 400 million Ecu.

VI. DIRECT/DEFERRED EFFECTS OF EC92

The findings of the project have been organised in accord with a specified EC Commission format, which provides for responses showing the effects of given topic areas in key EC countries and in the Community as a whole. The study findings reported in this section are organised according to the Commission format.

A. SHARE OF VALUE ADDED IN FINAL DEMAND

This establishes the percentage of the retail value of car and component sales within the EC and Member States that is represented by the value added by the home country producers.

Table 12 (percentages)	West Germany	France	Italy	UK	Other	Total
	31.6	21.1	20.2	17.9	4.2	20.6

The findings were determined by applying the gross value added (GVA) percentage to the retail value of production retained within each home market and comparing the resulting value to the retail value of total sales in that market.

The results show clearly that the high GVA percentage applicable to West German production, when combined with the low value of import penetration, gives a relatively high percentage of GVA in final demand for Germany.

B. SHARE OF VALUE OF PRODUCTION IN TOTAL DEMAND

This establishes the share of retail sales in the home market that is accounted for by home production.

Table 13 (percentages)	West Germany	France	Italy	UK	Other	Total
	79.5	71.2	60.2	51.2	15.8	59.1

C. SHARE OF VALUE ADDED EXPORTED

This establishes what percentage of value added is exported.

Table 14 (percentages)	West Germany	France	Italy	UK	Other	Total
	48.6	38.9	26.0	28.4	79.5	46.5

The findings confirm that West Germany is very export-orientated and also that the other EC producing countries, which are dominated by Belgium and Spain, produce principally for the export market. It also shows the very important role the home market plays for UK and Italian producers and thus the threat which further import penetration would pose to the home producers in these countries.

D. CHANGE IN UNIT COST OF PRODUCTIVE LABOUR

Table 15 (percentage reduction)	West Germany	France	Italy	UK	Other	Total
	8.9	12.3	13.3	9.7	12.2	11.00

The LAL study of automobile costs indicates that under EC85 conditions labour accounts for approximately 22 percent of variable costs. Although considerable variation between individual countries does exist, it is anticipated, on the basis of interview findings and LAL analysis, that the introduction of EC92 conditions will further enhance trends in labour utilisation which are already being observed, such as the use of robotics and the increased automation of previously manually performed tasks. LAL concludes that under EC92 conditions the share of vehicle variable cost attributable to labour will fall from 22 to 20 percent across the car segments.

By analysing the manner in which variable costs move in the transition from EC85 to EC92 across the five car segments, and by weighting this change by reference to the significance of each segment in the total production of each country, the above reductions in unit labour costs have been established.

E. CHANGE IN DIRECT UNIT COST OF PRODUCTION

Total unit cost of production has been taken as including variable cost plus those fixed costs directly attributable to production.

Table 16	West Germany	France	Italy	UK	Other	Total
Reduction (%)	2.93	4.49	4.94	3.09	4.25	3.50
Attributable to:						
Labour savings	1.55	2.53	2.84	1.75	2.49	1.97
Intermediate	0.15	0.32	0.34	0.01	0.12	0.17
Tooling savings	1.23	1.64	1.76	1.33	1.64	1.36

The total cost saving in percentage terms is a consequence of those reductions in labour unit costs, lower costs of producing and/or procuring components, and also to those reductions directly attributable to the changes in platform volumes.

The greatest change occurs in the Italian automobile industry, where a high level of labour content gives greatest scope for productivity gains and also where output is heavily concentrated in those product segments where considerable scope for economies of scope occur.

F. CHANGE IN TOTAL UNIT COST OF PRODUCTION

This finding reflects the total EC92 change in unit costs/prices. It includes those fixed costs/overheads that are not directly attributable to production, but are included within the ex-factory cost of vehicles in each segment.

Table 17 (percentage reduction)	West Germany	France	Italy	UK	Other	Total
Total	4.34	5.54	5.68	4.30	5.32	5.00
Attributable to:						
Pure Cost	4.80	4.90	5.00	4.80	4.90	5.09
Restructuring	(0.46)	0.64	0.68	(0.50)	0.42	(0.09)

The magnitude of change is greater than for production costs alone because the fixed cost element of total unit costs experiences a higher percentage change in the transition from EC85 to EC92 conditions. However the change differential between countries is lower because the segments exhibit similar platform volume behavior from one country to another.

Pure cost savings are defined as those savings which would occur as a result of the development of platform sharing, technical advances and other changes brought about by the move to EC92. This excludes the changes in overall segment volumes brought about by a restructuring of production. The overall impact of the restructuring has been to reduce the potential benefits because the restructuring involves a shift in emphasis towards the high-volume lower and upper medium segments. The greatest pure cost reductions occur in the lower volume segments, where the potential economies of scale are greatest. The variations between countries reflects the different segment mixes in their car production.

G. CHANGE IN LABOUR PRODUCTIVITY

Table 18 (percentage improvement)	West Germany	France	Italy	UK	Other	Total
	9.93	14.42	15.76	10.87	14.09	12.58

Labour productivity is defined as output of vehicles per person employed in the industry. The change in labour cost per unit produced, outlined above, is assumed to occur as a result of the reduction of manning levels. Given the underlying assumption of static production volumes, this brings about the improvements shown in labour productivity.

H. CHANGE IN CAPITAL PRODUCTIVITY

Table 19 (percentage improvement)	West Germany	France	Italy	UK	Other	Total
	16.64	17.63	19.33	18.50	17.41	17.48

Tooling costs have been used as a proxy for productive capital investment. This is judged to be valid because the tooling cost per unit is effectively the aggregate capital investment amortised over the number of automobiles a manufacturer produces. Given that the study assumption at this stage is that the volume produced remains static, any changes in tooling cost per unit reflect the change in aggregate capital invested and thus in productivity.

I. CHANGE IN PRODUCTIVE INVESTMENTS

Productive investments are taken as consisting of the book value of tangible fixed assets plus the level of research and development expenditure. Reductions in the level of capital investment will be possible in EC92 because the increased level of platform sharing will facilitate more efficient utilisation of plant and machinery. To produce the same volumes and model variations in EC92 as those achieved in EC85, fewer production machines will be required.

Table 20 (percentage reduction)	West Germany	France	Italy	UK	Other	Total
Scenario A	14.95	16.73	18.30	16.97	16.12	16.15
Scenario B	12.90	14.90	17.30	14.20	14.90	14.30

In Scenario A, R&D expenditure stays at constant levels. In this Scenario, the change in productive investments will be the change in capital productivity weighted for the importance of tangible fixed assets. In Scenario B, auto manufacturers will take advantage of the cost savings arising from the move to EC92 conditions to invest one percent of total costs in advanced research and development in order to maintain their products at a high level of international technological competitiveness.

Amounting to 600 million Ecu, the resulting R&D funding is assumed to be distributed amongst producing countries in proportion to the total costs which each accounted for in EC85.

R&D development expenditure has two effects which can be classified into direct and deferred. The direct effect of such expenditure is to reduce auto manufacturers profits, raise ex-factory prices and depress demand. There is, however, a deferred consequence which encourages such expenditure to take place. This is the R&D

expenditure which can lead to improvements in the utilisation of both raw materials and machinery, reducing the unit cost of production, reducing the price of the car and hence increasing demand in the longer term.

As R&D is an ongoing process it is not usually possible to identify a specific cost benefit as stemming from a defined item of expenditure. Because many of the benefits of R&D are qualitative it is very difficult to quantify its impact on demand.

J. EC MARKET VOLUMES

Table 21 (absolute increases in units sold)	West Germany	France	Italy	UK	Other	Total
Domestic market:						
Scenario 1 (000)	72.3	42.8	45.2	35.3	24.8	220.4
Scenario 2 (000)	51.7	32.9	41.1	29.6	17.8	173.1
EC-XII market: (excluding domestic)						
Scenario 1 (000)	70.3	63.9	21.9	5.7	76.7	238.5
Scenario 2 (000)	45.6	53.4	14.5	2.9	54.3	170.7
Extra-EC-XII market:						
Scenario 1 (000)	55.9	33.4	8.7	5.8	12.5	116.3
Scenario 2 (000)	38.7	21.6	5.1	2.9	8.4	76.7
EC-Producer Totals:						
Scenario 1 (000)	198.6	140.2	75.9	46.8	113.9	575.4
Scenario 2 (000)	136.0	107.9	60.7	35.4	80.5	420.5

The changes shown for Scenario 1 in units sold in the home market, the EC-XII market (excluding home country sales) and the Extra-EC-XII market are a consequence of the application of an elasticity of demand factor to the percentage change in production prices calculated above.

The changes shown in Scenario 2 in units sold assume that the non-EC producers will respond to the new EC market conditions and reduce their own prices. Their price reductions are expected to be mid-way between the EC85 position and that calculated for EC92.

Studies of demand behaviour have indicated that the automotive elasticity of demand factor for the European Community countries is typically in the region of -1.2 (Ref. Prof G Rhys). This factor has been employed for the purposes of this study.

Strictly speaking this factor may not be appropriate when applied to exports of automobiles outside the EC. This is due to the fact that each export market will have a different elasticity of demand for imports from the EC.

In the absence of specific information on the elasticity of demand in foreign markets, LAL consider the application of the -1.2 factor is preferable to not providing results for this important source of sales.

In Scenario 1, to assist in the quantification of the effects of price changes on the structure of consumer demand in the EC, recourse has been made to the following assumptions:

1. That Extra-EC producers of automobiles are unable or unwilling to respond to EC producer price decreases.

2. That a process of substitution of demand takes place in favour of EC automobile producers so that existing purchasers of non-EC produced cars will change their purchase decision to EC-produced cars in proportion to the percentage decline in their prices.

K. CHANGES IN NON-EC IMPORTS

Table 22 (percentage reduction in sales)	West Germany	France	Italy	UK	Other	Total
Scenario 1	39	100	100	35	23	42
Scenario 2	24	84	90	19	13	28

The findings for both pricing scenarios shown in Table 21 illustrate that the price reduction in EC-produced cars developed above for EC92 has the effect of reducing the sales volumes of non-EC producers' imports. The percentage reduction in sales for Scenario 2 is lower due to the non-EC producers responding to EC92 by reducing their prices.

The largest degree of change is forecast in those countries where non-EC imports represent a small percentage of sales in EC85. Thus the effect is most notable in France and Italy, where non-EC imports would effectively cease to hold any meaningful market share.

Full appreciation of the basis for this forecast may be derived from a study of the market conditions that obtain in the affected countries. In Italy, non-EC imports account for only 9 percent of total imports and less than 5 percent of sales. Of the non-EC imports, 60 percent are from East European producers and a further 33 percent are from the developing countries. These producers, often utilising antiquated technology, compete chiefly on price. Thus it is reasonable to postulate the virtually complete elimination of such demand.

France is another country with a low percentage of non-EC imports and a significant East European content in those imports. Thus similar results to those of Italy will occur.

The 'other' EC countries have a high non-EC import penetration; in Scenario 1, 26 percent of all imports are from outside the EC-XII, of which 76 percent are from Japan and a further 4 percent from EFTA countries. These producers are not competing solely on price and therefore the reduction in imports from those sources in response to EC price reductions will be less marked.

In respect of France and Italy it is possible that the impact of price reductions may be overstated. This is because the import quotas for Japanese automobiles may distort the pattern of demand. In the absence of a specific study on the impact of such quotas it would be prudent to regard the results as the best estimates of what is achievable.

VII. DYNAMIC EFFECTS OF EC92

The cost savings described and computed in Sections V and VI consist of the deferred direct consequences of introducing EC92 conditions. They are the savings/efficiencies that result from the actions taken by the auto industry to make full use of the potential of EC92. As noted they have been calculated on the basis that total EC market volume remains static; thus they omit the dynamic effects that are a consequence of the price reductions that the lower manufacturing costs make possible.

In this section, the dynamic consequences are analysed and discussed. In a sense, the dynamic consequences are infinitely iterative. Each dynamic improvement has the potential to reduce costs further, and thus to trigger a further dynamic improvement. In order to simplify analysis, LAL eschewed the creation of a multi-period dynamic model of single-market Europe because beyond the initial period it would be increasingly difficult to distinguish between direct EC92 consequences and those effects that stem from secondary developments.

It is evident that as a result of the initial direct benefits of EC92 a multiplier effect will be triggered that will be felt for a number of years. In successive stages this multiplier effect will take the following form:

1. The EC92 conditions liberalise internal trade and stimulate commonisation of parts and platforms, leading to lower costs.

2. Due to intense competition and underutilised total industry capacity, the cost savings will be passed on to the consumer through lower real prices, less an allowance for intensified advanced R&D activity.

3. The increased price competitiveness of EC-produced automobiles vis-a-vis non-EC production leads to increased demand for vehicles from EC production, both inside and outside the Community.

4. The greater EC volumes produced as a result of (3) will allow additional economies of scale to be achieved and exploited and, as a result, a further stimulation of demand will occur.

A domestic direct/dynamic cycle very similar to this, built on an initial advantage of lower net labour costs, allowed the Japanese motor industry to make the inroads into world markets that it achieved, beginning in the 1970s. Now, however, the Japanese compete more on quality, style, technology and reliability than on the price differential that gave them their market entree.

In part as a consequence of the appreciation of the Yen, Japanese makers have restructured their product lines for export. As a result their penetration has been steadily moving up-market, well into the lower and upper medium segments, and is forecast to be directed even higher. Thus it is conceivable that under EC92 conditions the European volume producers will be able to regain the grip on the 'value for money' auto market that seemed, in the early 1980s, to be lost to them forever.

For these effects to take place as outlined, the demand for EC automobiles must be sufficiently price elastic to give the manufacturers and their distributors an incentive to pass on cost savings to the retail level. Studies by Prof Garel Rhys of University College at Cardiff, Wales indicate that the European market price elasticity of demand is approximately -1.2 to -1.3 for consumer goods and for automobiles is in the range of -1.0 to -1.5.

LAL has elected to take a prudent view by selecting a figure of -1.2 for auto price elasticity across the EC market. On this basis, for every 1.0 percent decline in price, demand will increase by 1.2 percent. This price elasticity factor was employed in generating the responses to EC Commission requirements as described in Section VI. It triggered significant changes in the pattern of demand/trade.

The dynamic effects are also highly relevant with respect to the total impact of EC92 on auto industry employment. The response in Section VI dealing with labour productivity in EC92 envisaged that improved labour productivity would occur, with a concomitant reduction in the labour requirement. This finding, however, was based on the direct effect assumption that production remained static in the move to EC92.

As the dynamic effects of EC92 are realised, a proportional increase in the requirement for labour will occur. The price elasticity calculation indicates that the 5 percent reduction in price arrived at as a result of the direct effects will (multiplied by the 1.2 elasticity) increase demand for vehicles produced in the EC by at least 6 percent initially. If employment is recouped at the same rate, the employment reduction that would be assumed from the productivity improvement of EC92, would be approximately halved.

A further recoupment of employment is seen as having the potential to occur in EC92. It will be accelerated as the multiplier process outlined earlier begins to take effect. In EC92 demand may prove to be more price elastic than the -1.2 factor taken for this calculation. Also, the improved export potential of EC production resulting from the price reduction may outperform the selected price elasticity factor.

In concert, these considerations offer the potential for a European car industry in EC92 which is a substantially more rationalised and vigorous international competitor, and which at the same time maintains a level of employment that is little changed from the present.

Annexe I

SUMMARY OF QUANTITATIVE RESULTS

HYPOTHETICAL CHANGE IN UNIT COSTS

1. Variable Cost savings can be broken down as follows:

	Million Ecu
Labour Cost	826.6
Other variable Cost	72.3
Total	898.9

This reflects the positive impact of improved labour productivity on variable costs despite representing only approximately 20 percent of variable costs, and highlights the difficulties of reducing costs in an area with a high raw material content.

2. Fixed Cost savings can be broken down as follows:

	Million Ecu
Tooling	571.7
Engineering	700.7
Warranty Provision	175.3
Administration/Finance	213.3
Advertising	42.5
Total	1 703.5

The Engineering total includes savings that result from rationalised type-approval procedures.

3.

	Million Ecu	% of Category
Variable Cost Saving	898.9	2.36
Fixed Cost Saving	1703.5	11.50

This indicates that it is in the area of fixed costs that the benefits of the completion of the internal market will be most significant through economies of scale.

4.

(percentage reduction)	West Germany	France	Italy	UK	Other	Total
Total	4.34	5.54	5.68	4.30	5.32	5.00
Attributable to:						
Variable Cost	1.44	2.16	2.37	1.42	1.97	1.73
Fixed Cost	2.90	3.38	3.31	2.88	3.35	3.27

This represents a saving in value terms of **2602.4** million Ecu.

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Report to the Commission of the European Communities

THE BENEFIT OF EC92 IN THE AUTOMOBILE SECTOR

Ludvigsen Associates Limited
February 1988

FULL REPORT

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I. OBJECTIVE AND WORKPLAN

A. OBJECTIVE

The objective of the work undertaken by Ludvigsen Associates Limited (LAL) under contract to the Commission of the European Communities is the identification and quantification of the economic benefits that will accrue to the EC automobile industry and to its customers through the removal of the fiscal, physical and technical internal barriers that now divide the Community's Member States. The economic differential that is forecast to be generated is referred to in this report as the benefit of EC92.

The project has the aim of 'assessing the specific costs imposed on the Community automotive industries as indeed on consumers as a result of the currently fragmented nature of the EC automobile market.' The sector studied is defined as including the design and manufacture of volume-produced passenger cars in the European Community, the sale of such EC-built cars abroad, and the sale within the Community of passenger cars from all sources. Thus the work is chiefly directed at the automobile sector, although some overlap with the commercial vehicle sector has inevitably been experienced.

The principal focus of the work is on two phases of auto industry activity: design and engineering, and manufacturing and assembly. These were selected in consultation with the Commission as having the potential to make important contributions to the benfit of EC92, especially in the area of scale economies, and also because they are of continuing interest and value to the Community and the Commission.

The two key areas of design and production were also identified as potentially significant in the Preliminary Study that LAL conducted on behalf of the Commission from

January to April 1987. Referenced in the project are selected findings from this Preliminary Study. This encompassed a comprehensive search of the existing knowledge on the topic, in parallel with a study of the important influences on the evolution of the open internal market in automobiles in the United States. Further researches in the literature were carried out in support of this project. A summary of the findings is provided in Section II.A.

B. WORKPLAN

The main elements of the workplan are reported upon in this Summary in the Sections indicated. They are as follows:

A. A programme of questionnaires and interviewing of auto manufacturers and suppliers to ensure that the findings are current and in conformity with industry practice. The results are reported in Sections II and IV.

B. Determination of the overall economic dimensions and composition of the sector in the Community in the study base year 1985, referred to in the text as EC85. Findings are reported in Section III.

C. Specific study of the design and engineering costs in the industry, reported and analysed in Section IV.

D. Research into the cost structure and the economies of scale of the production of components and assembly of cars in the EC industry, as described in Section V.

E. Computation in automobile cost and price terms of the immediate direct effects, deferred direct effects and indirect dynamic effects of the changes caused by the postulated EC92 conditions, reported in Sections VI and VII.

II. BACKGROUND STUDIES AND EC92 PARAMETERS

As a consequence of the substantial extent to which it is an integral part of the lives of all the citizens of the Member States, the automobile industry is affected by a broad spectrum of fiscal, physical, technical and cultural factors. These factors were researched and defined as part of the study to provide a foundation for the work and a reference to the terms and assumptions on which it is founded.

The purpose of this section of the Report is to provide background elements to the study, with reports on three aspects of the work. In Section A a summary of the findings of the US market investigation carried out in the Preliminary Study is reported. Section B provides an overview of the types of barriers experienced in EC85 by the auto industry.

Section C provides a single master reference defining and describing the conditions that will exist in EC92 that will have an impact on the activities of the auto industry. The parameters and conditions described are those used by LAL in its study of the economic effects that EC92 will have on the auto industry. They have been derived from study of the Commission White Paper entitled 'Completing the Internal Market' and from discussions with EC officials and members of the LAL research team.

In some instances LAL has made its own assumptions of the conditions that will prevail. Such assumptions for the purpose of the project are so identified.

Also listed are some of the key assumptions that LAL has made concerning the events and actions within the auto industry that will flow from the completion of the internal market. These assumptions are derived principally from the study of existing information in this sphere undertaken by LAL from January to April 1987.

The information presented in Section C is organised according to the categories used by DGII in its analysis of the findings of the overall EC92 study, as follows:

1. Community Measures
2. Immediate Direct Effects
3. Deferred Direct Effects
4. Indirect Dynamic Effects

A. US INTERNAL MARKET CHARACTERISTICS

The United States automobile industry distributes its products today in essentially the same open integrated market that the industry entered when it was founded at the beginning of the 20th Century. For its first thirty years the American motor industry had the benefit of a laissez-faire attitude on the part of an expansionist federal government.

Federal regulation was imposed on the USA motor industry concerning certain of its business, marketing and labour practices during the Great Depression. The industry adapted successfully to these, and indeed was able to turn some of those regulations to its advantage. For example, it secured the suppression of internal technical barriers when state vehicle design laws were essentially superseded by the introduction of federal motor vehicle safety regulations.

The USA motor industry experienced a substantial technical disruption of its national market as a result of the adoption of emissions control. This occurred as a consequence of the state of California's success in convincing the federal government that for specific health reasons it should be allowed to have stricter exhaust rules than the federally-established standards of the other states. Subsequently the values of the standards have converged and the technical requirements across the nation have become similar.

It has been evident from the study that the provision of the USA Constitution giving the federal government the power 'to regulate commerce...among the several states' has played a key role in ensuring the maintenance of an open internal American market, especially as that provision has since been interpreted and extended by the courts.

Also important, according to the study, is the ease with which a company in one American state can register to do business in other states. This facilitated the evolution of enterprises that thought and acted in national terms.

The USA study has shown that an open internal market is effectively maintained although the states retain significant legal and economic powers. These include the power to impose taxes on businesses and individuals resident in the state in order to pay for those services that the state renders. The states impose taxes in significantly different ways, including sales taxes that range from nought to 7 percent and vehicle use taxes that are based on differing criteria.

The ability of Americans to think and act in national terms has been enhanced by excellent low-cost communications. This has included the rail system, an efficient national telephone system, an integrated highway network, and a competitive deregulated airline system. Without this infrastructure the establishment and operation of national networks of design, production and sales would have been much more difficult in all industries, including the motor industry.

In the USA the trend of legislation has led to a relatively balanced relationship between the manufacturer and the dealer in the auto franchise system. This has given more freedom to the dealers, and less power to the car makers and importers, than is generally granted in Europe.

Best viewed as a form of modified selective distribution, the relationship between maker and dealer in the USA is such that a highly competitive open market exists for both new and used cars that offers the consumer a very wide choice. The Federal Trade Commission is active at the national level to ensure the maintenance of that freedom of choice.

B. EXISTING INTERNAL BARRIERS

LAL's researches undertaken among Community auto industry suppliers and manufacturers provided detailed information on many internal barriers in the three categories that are dealt with in the Commission White Paper on the internal market: fiscal, physical and technical barriers. In this Section some specific barriers are indicated in selective outline form according to those categories, as follows:

1. Fiscal Barriers

-- Taxation levels on car sales that differ in virtually all of the EC Member States, from 12 percent in Luxembourg to 200+ percent in Denmark and Greece.

-- Policies on the refunding of VAT for company purchases of vehicles that differ from country to country.

-- Maintenance by some Member States of price regulations and/or margin controls.

-- Distortion of competitive conditions by excessive aid to 'national champion' producers in the form of Member State grants, loans, equity injections and debt writeoffs.

-- Inconsistent application of standards for imposition of annual use taxes on cars, and differing tax levels.

-- Use of fiscal incentives in some Member States (West Germany, Netherlands) to encourage sales of vehicles built to differing emissions and noise standards.

-- Inconsistent levels of taxes on motor fuels.

2. Physical Barriers

-- Border crossing documentary and inspection requirements, with attendant delays having consequences in the loss of time and money in the shipping of components and vehicles.

-- Customs and immigration checks on personal movements within the Community.

-- High cost of regulated air travel within the Community, imposing an implicit physical barrier on the volume of travel for business purposes.

-- Differences in communications standards between Member States that present physical barriers to cooperation in vehicle development and production.

3. Technical Barriers

-- Lack of a single EC-wide Type Approval procedure, requiring costly and time-consuming duplication of cars and tests.

-- Exhaust emissions standards which are not definitively fixed at a common level with agreed dates for implementation.

-- Unique national vehicle equipment requirements such as side repeater flasher lights in Italy, reclining driver's seat in West Germany, dim-dip lighting in the UK, yellow headlamp bulbs in France and unique rear reflectors in West Germany.

-- Maximum speed test required for some but not all Member States (West Germany, Italy, Spain).

C. PROJECT PARAMETERS FOR EC92

This section describes the conditions that are taken as prevailing in the EC in general and in its motor industry in particular, for the purposes of this study.

1. Community Measures

a. EC Trade Policy

The EC negotiates agreements and understandings with its global trade partners as an unified entity. Specific understandings concerning levels of built-up auto imports into the EC are negotiated and agreed, possibly in the form of quotas. These **unified external trade policies** are arrived at so that national restraints, regulations, agreements and understandings on auto imports may be eliminated.

Derogations permit the various **national restraints on auto imports** to be phased out progressively over an agreed period. This study assumes that they have already been phased out.

The issue of the **level of local content** that qualifies an automobile to be considered EC-produced, and thus free of any restraints imposed on built-up imports, is clarified, as to level and method of measurement, by EC regulation. For the purpose of this study the relevant local content level for automobiles is assumed to be 70 percent of the factory cost by value, (project assumption).

b. EC Internal Regulations

i. Measures Affecting Industry in General

A new regime permits **EC-wide business operations** by a single corporate entity. Rather than create 'European companies', legislation may follow the USA example by permitting a company formed and established in one EC Member State to register to do business in other states, without the necessity of having to form separate local companies in each Member State. The principle is similar to that of 'Home Country Control' proposed by the EC for service businesses. This facilitates the development of true pan-European enterprises.

EC member governments cease providing **extraordinary aid** to 'national champions'. All European enterprises, regardless of their ownership status, qualify equally for such assistance and support as may be available from the EC, and from their own national and local sources, keeping within community guidelines.

National and local aid to enterprises is still permitted, but brought by EC regulations within ranges that do not threaten to distort trade and commercial activity, following the example of the USA, where the individual states are still able to offer economic and other incentives.

Competition policies and activities in the Community are strengthened and refined to ensure that EC92 does not lead to the formation of monopolies that will tend to defeat the achievement of higher scale efficiencies. Also, EC guidelines are established that achieve coordination of Member State competition powers to encourage the pan-European combinations that will needed to meet the goals set for EC92.

Additional funding and support strengthen the **EC funds** that are available to support structural change in the Community, recognising that the changing internal market will bring shifts in employment and economic activity.

Unilateral use of **price controls** by Member States is suppressed by legislative actions taken by Community members in response to requirements of internal market completion.

External exchange rates continue to vary as at present against the EMS. For the purpose of this study, however, it is assumed that no change in such rates occurs (project assumption).

Inflation-corrected **internal exchange rate** stability is established and maintained through linkages among all Community currencies through a strengthened EMS that includes all EC Member States. No assumption is made that all currencies are replaced by the Ecu; local currencies continue to be used.

For the purpose of this study, **internal EC exchange rate flexibility** is assumed to be unaffected by the internal market (project assumption). It is unlikely that extensive reference to internal exchange rates will be required, since the EC92 study is to be made in terms of the same exchange conditions for both pre- and post-1992 European circumstances.

Should they be required for analytical purposes, the relevant Member State **exchange rates** against the Ecu are assumed to be as they were on average in the first quarter of 1987, as follows:

1 Ecu	=	42.87 Belgian francs
		7.81 Danish kroner
		2.07 Deutschmarks
		151.1 Greek drachma
		145.0 Spanish pesetas
		6.89 French francs
		0.775 Irish punts
		1469 Italian lire
		2.33 Dutch florins
		159.4 Portuguese escudos
		0.729 Pounds Sterling

Sales tax (VAT) regimes are approximated in their levels to positions within a specific band. Following the USA state sales tax example, the band would have a differential in VAT values of 7 percent. A Commission proposal envisages a possible 6 percent differential. The latter is taken as the assumption for the study, foreseeing base VAT levels applicable to products in general over a range of values from 14 percent to 20 percent.

ii. Measures Specifically Affecting the Auto Industry

Taxation:

As noted in the previous section, base VAT levels in the Community applicable to transactions in general are approximated within a band of 14 percent to 20 percent. **VAT applicable to the sale of autos** is approximated to fall within this band to accommodate the revenue requirements of Member States.

Based on current levels of VAT levied by Member States, the EC92 **automobile VAT levels** are as follows by country (project assumption):

	EC92	EC85
Belgium	23%	25%
Denmark	22	22
France	23	28
Germany	15	14
Greece	23	36
Ireland	23	23
Italy	23	20-38
Luxembourg	15	12
Netherlands	19	19
Portugal	23	30
Spain	23	33
United Kingdom	15	15

The application of **VAT on the sales of used cars** is harmonised. The harmonised practice follows the pattern of the EC Seventh Directive on VAT: VAT is imposed on the full value of a used car transaction, but a credit of 80 percent of the selling price of the car is given. Thus VAT is effective on 20 percent of the selling price.

Vehicle use taxes are approximated by the EC at the level of the sales-weighed average of those now existing within the Member States. Use taxes are made consistent in the manner in which they discriminate between car types with respect to vehicle design characteristics such as engine size.

For the purpose of this study it is assumed that **annual use taxes** in EC Member States will be graduated in three categories according to engine size, rising at the EC emissions category break points of 1.4 and 2.0 litres. The tax levels for the three classes are a maximum of 100 Ecu for 1.4 litres, a maximum of 175 Ecu for 2.0 litres, and a maximum of 350 Ecu for cars with engines above 2.0 litres (project assumption).

With the longer-term objective of achieving lower differentials among motor fuel prices in Member States, an EC action achieves harmonisation of **taxes on motor fuel** throughout the Community. The harmonised tax levels are 340 Ecu per 1,000 litres of leaded petrol, 310 Ecu per 1,000 litres of unleaded fuel, 177 Ecu per 1,000 litres of diesel fuel and 85 Ecu per 1,000 litres of Liquid Petroleum Gas.

Technical Regulations:

Future regulations directly affecting the design of motor vehicles are phased in simultaneously by all EC member states, with adequate lead time, at values agreed either unanimously or by majority under the Single European Act.

A single equipment level for all EC passenger cars that can be taken as meeting the **base level of the current regulatory requirements** is postulated for this project to be used for comparison costing purposes against the forecast EC92 pattern of standards (project assumption).

EC action achieves approximation of those Member State **vehicle use regulations** that have an effect on vehicle design and specification. Examples of such regulations are highway speed limits and periodic inspection requirements.

Testing and certification procedures for products to be sold in the Community will take effect EC-wide as a result of a programme of mutual recognition of such procedures by Member States.

The base case taken for this project assumes that regulatory harmony as described is achieved within the EC. In response to requests made by the motor industry, which has stressed the importance of **the EFTA markets**, an effort will also be made to determine the effects on vehicle design that would occur if regulations were harmonised in their effect throughout both the Community and EFTA. (project assumption)

Market Data:

Member States compile **data on vehicle registrations** on a consistent country-to-country basis, using agreed vehicle classifications. This continues to be funded by national vehicle use taxes.

Member States provide the data to a **central Community source** for coordination, analysis as needed and dissemination in a timely manner. This is carried out by the EC with centralised funding.

Data on **used car sales and movements** is compiled on a consistent basis for the EC as a whole.

Sales and After-Sales:

Public procurement of vehicles is liberalised to permit intra-Community sourcing of vehicles purchased by national and local administrative authorities. This is achieved by introducing greater transparency into public purchasing, including prior information of intent to buy, publication of procedures and contract awards, and better and more frequent statistical data on public purchases.

Flexibility of use of **hire purchase** is enhanced throughout the Community by EC measures taken to liberalise competition in services. This permits a loan obtained in one Member State to be used to purchase a car in another Member State.

Liability **insurance** minimum requirements are consistent among Member States. EC legislation achieves freedom for insurance companies to meet motor insurance requirements on a competitive basis throughout the EC. Home-state insurance is uniformly accepted in all Community countries. (Insurance as a whole is the subject of a separate EC study.)

Procedures for **registering** in one Member State a vehicle purchased in another are routine and straightforward, as are terms for **temporary vehicle use** in other than the state of registration. The United States model is applicable.

Tests for **acceptability of replacement parts** are harmonised among Member States, by mutual recognition of testing and certification procedures.

Other Considerations:

Border posts and their associated delays are eliminated. The necessary reporting for tax and trade flow purposes is generated by shippers and purchasers.

Registration of **patents and trade marks** is achieved by a single application to achieve protection in all Member States.

2. Immediate Direct Effects

Vehicle transportation costs are reduced by elimination of border formalities and by higher levels of Community competition in transport. For the same reasons **component transportation costs** are reduced.

Motor industry **advertising and promotion** on a pan-European basis are facilitated by the achievement of a common market for broadcasting, providing an opportunity for economies of scale. This includes approximation of Member State policies on television satellite and cable advertising.

Cost of management personnel movement intra-Community is reduced by **air fare deregulation**, but net company costs are not reduced proportionally because personnel travel between headquarters and the field increases to fulfil EC company missions.

Staffs for dealing with **residence problems** of both white-collar and blue-collar EC employees are cut back as national bureaucratic procedures are reduced or eliminated.

Note: This section is not intended to show all immediate direct effects. It includes rather those that arise from changes that have not been highlighted in other sections of these parameters.

3. Deferred Direct Effects

Research and development activities take place using **technical standards and communications** that are common to all the EC industry suppliers and manufacturers.

Common standards are agreed and implemented throughout the Community, among the assemblers and suppliers, for the **CAD systems** that are used in the design and engineering of vehicles and parts.

Assisted by the new EC provisions for pan-European company organisation and activity, **component manufacturers** operate more consistently on a Community-wide scale.

Auto makers accept the recommendations of component makers to reduce costs significantly by making some **components common among makes and models**, allowing higher scale economies to be achieved.

Elimination of border delays facilitates greater use of **JIT parts deliveries** on an intra-Community basis.

Agreement is reached on the methods and standards for the **quality validation systems** to be applied by all EC producers to production parts.

Machine tool design standards in the Community are unified, and makers of such equipment are put in an optimum condition to compete for business on a Community-wide basis. (Machine tool activities are the subject of a separate EC research study.)

Manufacturers and their suppliers reach agreement on a protocol, such as MAP or CNMA, for the **coordination of in-factory electronics** throughout EC vehicle production plants.

Production economies are improved by **reductions in complexity** permitted by unified regulations and reduction of individual market requirements.

Car **marketing patterns** in Community countries shift under the influence of the new tax regimes and the phasing out of internal market limitations on third-country BU imports.

Vehicle makers and distributors exert central control of their **sales and marketing** for all of the Community from a single headquarters, setting up regions and zones throughout the EC in place of the present sales company system.

Vehicle makers provide a **Eurowarranty**, which is fully valid at all their EC dealers.

Parts distribution is streamlined and centrally controlled.

All **dealer training** activities, including service training, are conducted on a pan-European basis.

4. Indirect Dynamic Effects

After analysis of new total production and distribution costs and shifts in vehicle sales patterns brought about by the new EC92 market conditions, car assembly companies shift **production centres and volumes** to gain maximum net cost advantages and efficiencies.
Structure of EC industry alters as member governments cease providing extraordinary aid to 'national champions'. This permits the strongest major manufacturers to achieve the production level of 2 million units a year that is seen as a minimum for the achievement of best scale economies.

The base case for the study is that no significant change in the **dealer structure** occurs in EC92. As a contingency event, the study assumes that selective distribution as it is now practised in Europe is modified to a more flexible franchise system as an indirect dynamic effect of the open internal market. This permits, as an example, dealers to have outlets with more than one car franchise. The model for EC92 retail operations to be used in this contingency study is the franchise system as it currently operates in the United States.

EC producers are more effective **extra-Community competitors**, benefitting from higher efficiencies, lower costs and reduced administrative burdens at home. This also has an indirect dynamic effect, in a positive sense, on their economies of scale.

III. DIMENSIONS AND CHARACTERISTICS OF THE EUROPEAN MOTOR INDUSTRY

A. INTRODUCTION

Broadly EC auto manufacturers account for in excess of 85 percent of registrations in their home market. In 1985 Europe was the world's second-largest car market, and by 1986 it had overtaken the USA to become the largest single market. In 1985 the EC manufacturers accounted for 37 percent of world passenger car production.

While the EC car and component manufacturers have shed significant amounts of labour in recent years to gain competitiveness, they still directly employ in excess of 1.7 million people across the Community. The EC motor industry absorbs between 5 and 8 percent of all industrial output and accounts for approximately 20 percent of production of steel and machine tools, 15 percent of rubber production and 5 percent of all glass output.

B. INDUSTRY ECONOMIC VOLUME

In view of the very substantial economic role on the part of the EC auto industry, it was judged necessary to make a fresh determination of the industry's dimensions in the study base year of 1985, the most recent for which adequate EC-wide data are available.

As one of the fundamental elements of this study an analysis was conducted to determine:

-- The retail value of the car markets in Europe, net and gross of tax.

-- The retail value of car and car component production in the various producing countries.

-- The values of trade flows of both cars and components.

The findings of the analysis are summarised in separate tables for cars and components. One shows the volumes of cars produced (Table III.1). Another defines the total value of this production in billions of Ecu for both retail and wholesale markets (Table III.2). Another table defines the value in billions of Ecu of European component production, showing also the value of components used for national production (Table III.3).

Detailed reports on these elements of the study are provided as annexes to this report. These contain an analysis by country, including a breakdown of production into the product segments used for study throughout the project -- i.e. utility, small, lower-medium and large cars. Also included is information on retail sales volumes, typical unit prices, total revenues by segment, and total market revenue values, including and excluding taxes.

Table III.1 **AUTOMOBILE VOLUMES (1985)**

Units: millions	**PRODUCTION**	**%**	**SALES**	**%**	**VARIANCE**
Germany	4.17	35.9	2.38	24.9	1.79
France	2.63	22.6	1.77	18.5	0.86
Italy	1.39	11.9	1.75	18.3	(0.36)
Spain	1.23	10.6	0.56	5.9	0.67
UK	1.05	9.0	1.83	19.1	(0.78)
Belgium	0.99	8.5	0.39	4.1	0.60
Netherlands	0.11	1.0	0.49	5.1	(0.38)
Portugal	0.06	0.5	0.10	1.0	(0.04)
Denmark	0.00	0.0	0.16	1.7	(0.16)
Greece	0.00	0.0	0.08	0.8	(0.08)
Eire	0.00	0.0	0.06	0.6	(0.06)
Total	**11.63**	**100**	**9.57**	**100**	**2.06**

Table III.2 **AUTOMOBILE VALUES**

Units: billion Ecu

COUNTRY	**PRODUCTION**	**----MARKET-----**	
		Retail	Wholesale
Germany	34.6	19.3	16.1
France	13.9	12.9	12.2
UK	7.3	14.6	12.3
Italy	6.6	12.0	9.2
Bel/Lux	7.1	2.3	2.6
Spain	5.2	4.2	2.9
Netherlands	0.8	3.5	2.4
Denmark	1.1	0.9	-
Eire	0.8	0.6	-
Greece	1.1	0.9	-
Portugal	-	0.6	0.4
Non-Add	(3.5)*		
Total	**72.0**	**72.4**	**60.5**

* Allowance for double-counting of production, i.e. completed cars shown in both Belgian and German figures.

Table III.3 **COMPONENT VALUES**

Units: billion Ecu

COUNTRY	TOTAL PRODUCTION	LOCAL USE
Germany	19.7	19.0
France	10.0	8.3
UK	4.7	4.5
Italy	3.8	3.6
Bel/Lux	2.4	5.2
Spain	2.6	3.1
Netherlands	0.5	0.6
Denmark	-	-
Eire	-	-
Greece	-	-
Portugal	-	-
Total	**43.7**	**44.3**

One of the principal findings of this analysis is the substantial importance and dimension of the German car and component industry within the EC. The value of German car production at 34.6 bn Ecu represents over 48 percent of the total EC output. This reflects the high-value mix of German production and the relatively low-value mix of French, Spanish and Italian production. The total value of the German production of components, at 19.7 bn Ecu, represents 45 percent of the total European output.

The production values of the French car and component industries are also of significant size at 13.9 bn Ecu and 10.0 bn Ecu, representing 19.3 percent and 22.9 percent of their respective EC markets.

C. TRADE FLOWS

In 1985 the EC manufacturers exported 2.01 million cars to external markets worth 19.1 billion Ecu. The major markets for these were the EFTA countries with 0.69 million, closely followed by the USA with 0.64 million vehicles. The EC countries imported 1.1 million cars worth 5.41 billion Ecu. The major exporter to the EC was Japan with 0.8 million cars.

The graphs on the following pages show that the dominance of Germany in production/sales terms was also reflected in 1985 in terms of both intra- and extra-EC trade. The high-value mix of German cars is especially marked in terms of extra-EC exports, in which Germany accounts for 67 percent by value of total EC exports.

Figure 1

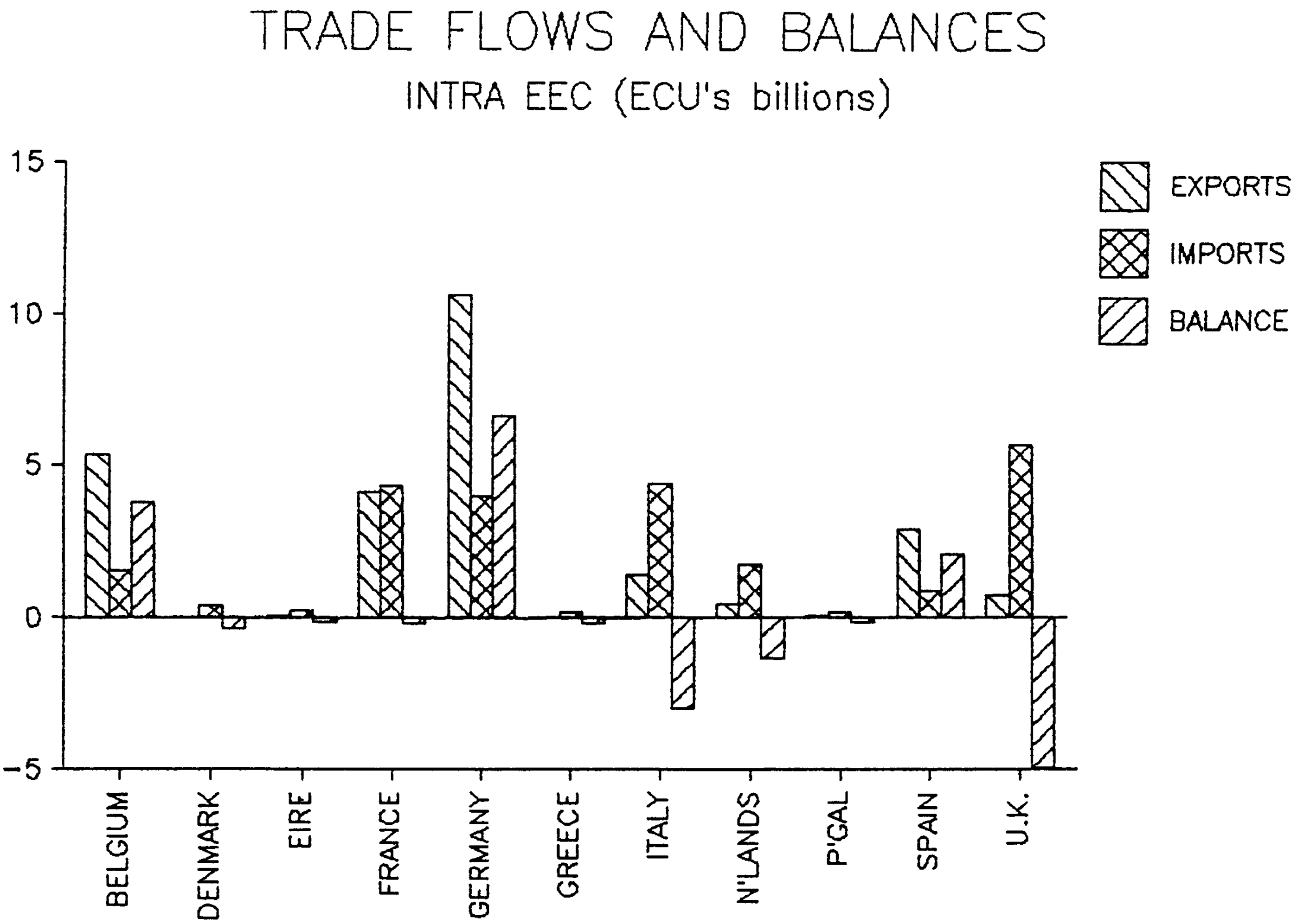
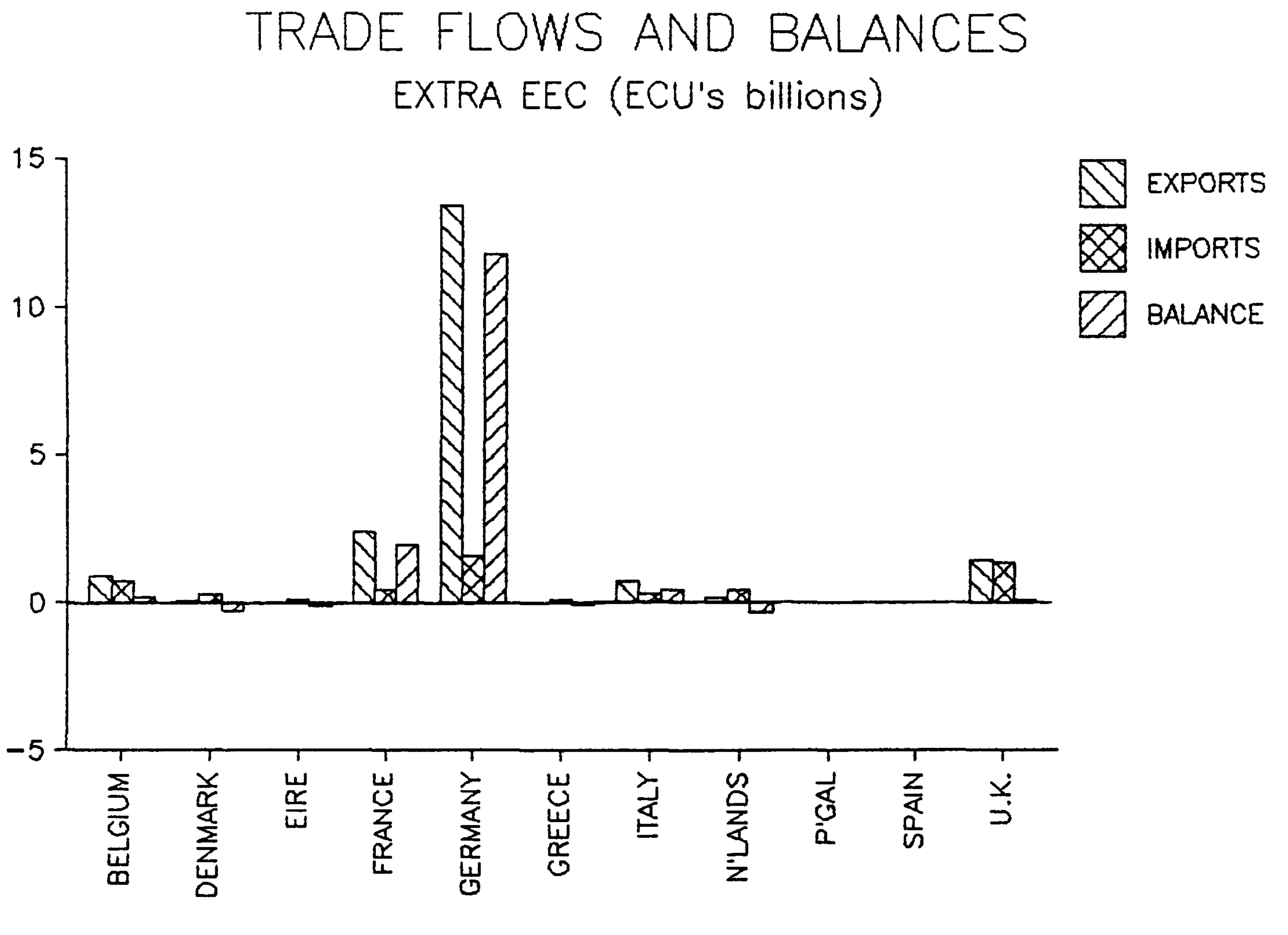

TRADE FLOWS AND BALANCES
INTRA EEC (ECU's billions)
15
10
5
0
-5
EXPORTS
IMPORTS
BALANCE
BELGIUM
DENMARK
EIRE
FRANCE
GERMANY
GREECE
ITALY
N'LANDS
P'GAL
SPAIN
U.K.

Figure 2


TRADE FLOWS AND BALANCES
EXTRA EEC (ECU's billions)
15
10
5
0
-5
EXPORTS
IMPORTS
BALANCE
BELGIUM
DENMARK
EIRE
FRANCE
GERMANY
GREECE
ITALY
N'LANDS
P'GAL
SPAIN
U.K.

The conclusions reached are the result of research and analysis according to the five segments defined and discussed in greater detail in Section V.B of the Report. LAL computed the volumes sold by model line for the major manufacturers in each market, providing a total volume per segment.

A calculation is also made of the average price of models by segment, to provide the underlying data from which the revenue for each segment is derived. Combining the total segment volumes with revenue, the size and value of the overall retail market are then determined. The revenue figure is estimated net and gross of tax, and for each market the data is converted into Ecu. The base year for the study data is 1985.

For the UK, a country for which it has been possible to obtain similar data derived independently from actual trade transactions, this analysis approach produced trade findings that agreed with those published in government statistics within the limits of rounding error.

To derive the value of car production, LAL has used data on both volume and value of exports. In general terms, exports are made at the lowest prices possible, but Customs generally require that they are declared above production value. To estimate the total value of production, official published data have been employed, suitably adjusted to reflect the differing make-up of production as between export and domestic consumption.

The total ex-factory cost of production is assessed by taking the calculated average retail price data, subtracting for each market the VAT and special car taxes pertaining there. From this pre-tax figure, the average dealer and wholesale margin per manufacturer and car segment are also subtracted for each market, giving the ex-factory cost per segment total.

Comparing this method of calculating car production value with the estimate of trade value, LAL arrives at a value which is broadly similar, confirming the overall accuracy of the approach.

To identify the integration level of each producer, some adjustment has been necessary to the data derived from annual reports so as to take into account non-vehicle-related elements in the bought-out cost of components, such as advertising, property costs, etc.

IV. DESIGN AND ENGINEERING COSTS AND SAVINGS

As shown in the analysis of cost structure in Section V of this study, the overall cost of designing and engineering a vehicle to the production-ready stage is a small proportion -- typically 5 percent -- of the total cost of building the production vehicle. The proportion tends to fall to a lower level for cars that are in very large-scale production, and for cars of relatively simple design.

Since design and engineering represents a relatively small proportion of the total vehicle cost, changes in the EC physical, fiscal and technical structure which relate to the engineering process can have only a limited effect on overall vehicle costs. Nevertheless it is judged to be important to review the effects of these barriers as part of this project.

The design/engineering cost review is needed because it is hoped that EC92 will help liberate design creativity among European motor companies. It is also needed because it is hoped that savings will be achieved that will permit a higher proportion of revenue to be reinvested in the advanced research and development that is required to keep European cars up to the rate of acceleration of world automotive technological progress.

This section reviews the nature of automobile design cost, and covers points raised concerning EC impact on such costs during interviews with European motor vehicle producers.

A. COST CHARACTERISTICS OF AUTOMOBILE DESIGN

Four distinct phases exist within the design and engineering process: project definition, detail design, engineering development, and submission for homologation and type approval. In each of these four areas there is a potential effect on costs arising from the changes in legislative workload that will derive from the creation of EC92.

The cost impact of the legislative framework within which the car must operate increases from stage to stage. Project definition typically concerns itself only with ensuring, among many other considerations, that the vehicle is potentially capable of meeting all the technical regulations to which it will be subjected. In the detail design stage, the designer must -- among many other constraints -- ensure that the vehicle meets such regulations, item by item.

In engineering development, the emphasis shifts to proving regulatory conformity among many other vehicle aspects (such as durability and performance). Finally, type approval activities are concerned entirely with the question of conformity with the relevant technical regulations.

The cost of project definition is relatively extremely small, since it involves only a few people. The cost of detail design is inevitably greater, although it is still essentially a question of paying for man-hours. The more complex are the issues of technical legislation which have to be addressed, the higher will be the cost of detail design. It is most unlikely, however, that technical conformity alone will absorb more than 15 percent of the total detail design effort and thus cost.

Costs increase rapidly when vehicle engineering enters the stage of development, since, for the first time, a significant investment in hardware is made, in the form of component test rigs and operating prototypes. A typical cost for a hand-built prototype passenger car is 100,000 Ecu.

A major new-car programme will involve up to 100 such prototype vehicles, together with the human cost of operating and testing them and analysing the resulting data. While the proportion of engineering development effort relating to technical conformity is unlikely to exceed the 15 percent noted in the detail design stage, the absolute cost of that development effort will be much higher.

The actual process of homologation and type approval, whose object is entirely to demonstrate technical conformity, can also be expensive in terms of hardware. Prototypes of pre-production vehicles built to various predetermined (by the inspecting authority) specifications must be offered for inspection together with all supporting data.

Since approval today takes place on a country-by-country basis, such homologation vehicle fleets must either be duplicated or must be taken from one approving authority to the next, across national borders. Simultaneous type approval may involve up to six fleets; sequential approval with a single fleet may result in a new type of vehicle being offered for sale in some EC member states before it is type-approved for sale in others -- a state of affairs which may itself have legal implications relating to cross-border Community trading.

B. EFFECTS OF EC BARRIERS ON COSTS

In studying the areas where EC85 costs are presently incurred, it is apparent that some aspects of the creation of EC92 must have a larger effect than others on auto design and engineering costs. It is also clear that significant savings can only be achieved in those stages of the overall design and engineering process which are themselves high-cost operations. Thus the areas most deserving investigation are those of engineering development and type approval.

1. Savings Through Technical Harmonisation

EC92 implies a common set of technical regulations, and common procedures for vehicle homologation and type approval, applied uniformly throughout the Community.

An initial assumption may be, and has been in the past, that this will result in savings in design and engineering cost because cars can be designed and built to a single standard rather than to a number of different standards for different countries. This hypothesis, founded on the concept that manufacturers of all products will be motivated to select EC standards where available for reasons of economies of scale, has been investigated in depth in the course of the field research undertaken for this project. The findings are commented upon in the sections that follow.

a. Staff and Facility Aspects

Car manufacturers questioned for this study pointed out that technical test and development facilities such as emissions laboratories and crash test rigs are (at least in the short term) fixed and finite assets which cannot be commissioned and disposed of to order. To an extent, in a Europe in which social provisions limit staff flexibility, the same is true of the engineering development staffs which operate them.

In view of these limitations the tendency is to meet variations in technical demands by adjusting the volume of work passing through the facilities. Any increase in technical workload (as happened for example with the introduction of more severe exhaust emission requirements) is balanced by reducing the number of variants submitted for test, and the cost to the consumer is the direct one of more limited choice in the market.

In the same way, any reduction in workload due to EEC technical harmonisation would in the first instance be likely to result in the indirect consumer benefit of greater choice among car models. Direct cost benefits would only occur in the longer term when and if the car manufacturers decided to dispense with staff and facilities that were felt to be no longer necessary.

b. Effects of Marketing Requirements

Car variants will continue to be developed for specific European markets under the influence of marketing, rather than technical, influences. In this context it is worth noting that even large manufacturers quote very low 'break-even' annual production rates of only 200 to 500 units per year for special versions differing from standard only in details of equipment and appearance; for a version with fundamental technical differences, the 'break-even' figure rises rapidly to 10,000 per year or more.

Among the most important marketing influences are different fiscal systems, notably those which impose 'break points' at different car weights or engine sizes, beyond which higher sales and operating tax rates are levied. All the car manufacturers inverviewed for this study expressed the opinion that unless the Community arrives at a common fiscal system, expecially where annual use taxes are concerned, the harmonisation of technical requirements alone would result in minimal benefits so far as the reduction in the number of car variants, and consequent economies of scale, are concerned.

c. Current Effects of Scale Economies

Even in the present situation, where national technical requirements differ, a tendency does exist in the industry to standardise features across the product range where they have a demonstrable technical or feature benefit, or where cost considerations prevail.

For example, although laminated windscreens and side indicator repeater lights are not presently required under the technical regulations of all EC member states, they have tended to be fitted to all production cars except, in some cases, the most price-sensitive base models.

In the same way, all European manufacturers now produce cars in the larger size classes with floorpans capable of accepting catalytic exhaust converters. Even though these are not required by all markets, the cost of tooling up to produce two different floorpans instead of a single standard pressing would be prohibitive.

In effect, therefore, a combination of marketing and scale economy considerations has already resulted in a semi-harmonised technical approach, reducing the scope available for further savings.

d. Design Differences Already Considered

Many technical differences between car variants are catered for at the design stage and thus have no impact on production costs, which form by far the larger part of a car's overall cost. For example, all volume manufacturers design cars to be built with either left- or right-hand drive without the need for extra production equipment or assembly operations.

Again therefore, apart from extra effort required in the initial design stage, which as already observed involves relatively little cost, a semi-harmonised situation already exists which reduces the scope for further savings.

e. Design for Non-EC/EFTA Markets

Even if harmonisation is achieved within the Community (and perhaps also EFTA) car manufacturers will still have to design and engineer different variants to meet the needs of other overseas markets.

To follow the preceding example, most manufactuers point to the need to continue the design, engineering and production of right-hand-drive cars -- for Japan and Australia for instance -- even if the United Kingdom and the Irish Republic were to change to driving on the right. Such an apparent (and dramatic) move toward European harmonisation would therefore have only a negligible effect on design and engineering costs.

The only beneficiaries in Europe in this instance would be the American-owned multinational manufacturers who supply other right-hand-drive markets from sources other than Europe, and who therefore experience incremental costs in building right-hand-drive cars for the UK and Ireland. The same will apply in the future to the Japanese-owned car companies, when they begin to supply both the UK and the Continent.

f. Effect of Selected Harmonisation Level

The nature of the effect of harmonisation on car production costs will depend on the level at which such harmonisation takes place. For example, to harmonise Community technical requirements on the basis of a 'highest common factor' which includes all current national requirements (other than those which are mutually exclusive) would certainly result in higher rather than lower unit variable costs.

All the manufacturers interviewed suggested that full technical harmonisation at the highest level, even on the basis of current EC Directives (including those still in preparation) would increase car unit costs by 2 to 5 percent. The cost impact would be relatively the highest on the smallest, simplest and cheapest cars.

The larger proportion of the added cost in this case -- as for the car production process as a whole -- would be accounted for by the higher direct cost of purchasing the extra components needed. There would, according to the interviews, also be an added engineering cost as a result of the need to design and engineer car elements to a wider range of more stringent requirements.

g. Simplification of Type Approval Procedures

A probable benefit of complete technical harmonisation would be the simplification of homologation and type approval procedures. This has been highlighted in industry interviews as one of the most potentially fruitful areas for cost reduction in EC92.

Given common technical regulations throughout the EC, the submission of vehicles and data to the type approval authorities in each member state would constitute pointless duplication. Current type approval exercises frequently require more than 100 prototype and pilot-build vehicles. This number would be substantially reduced if the nation of design and/or manufacture were able to issue EC-wide type approval.

Manufacturer estimates of the potential direct cost savings vary considerably but are always substantial. A saving of 20 vehicles in a major type approval exercise (the lowest figure suggested in interviews) would result in a direct cost saving of at least 1 million Ecu, plus further savings in manpower.

The manufacturers point out that type approval procedures could relatively easily be harmonised in this way without waiting for full technical harmonisation to be achieved. This could occur if each national approving authority were to be recognised by all EC member states as competent to issue national certificates of conformity in respect of vehicles built in that country.

Manufacturers' estimates of the staff reductions which might become possible in the event of 'unified' homologation, by whatever method, varied from 15 to 40 percent, among department staffs numbering from 50 to 100 engineers.

h. Electronic Data Processing

The manufacturers interviewed felt that useful savings in time and manpower at the homologation stage would be achieved if the national approval authorities, and similar bodies, were to agree on the use of electronic data exchange and processing rather than the current paper-based system.

It was pointed out, for example, that the checking of a car interior for illegally sharp projections could be carried out in minutes by applying the appropriate program to a computer-stored database. Carrying out the same analysis using the equivalent 'paper' process is reported to involve at least several hours of checking and comparing section drawings.

2. Savings Through Fiscal and Customs Harmonisation

Discussions with the engineering staffs of European motor companies included the potential for savings that are related to those covered in the scale economy elements of this study. They referred to savings that are likely to be achieved through those actions which reduce the overall amount of design and engineering effort per unit of production -- in other words to the adopting of policies which encourage greater design commonality among superficially different makes and models of cars.

Already evident is a trend among the major European car manufacturers to simplify the engineering and production situation. Actions are being taken to reduce the total amount of design and engineering effort needed to bring a car to the production-ready stage. As detailed in Section V, such actions also have the potential to reduce unit variable costs very substantially.

Some of the methods being employed are the following:

a. Common Platforms and Internal Panels

Superficially dissimilar car models are increasingly cross-linked beneath the external skin by having common internal body panels, especially the extremely expensive floorpan and associated structure. In the European Large segment, the Fiat Croma, Lancia Thema and Alfa Romeo 164 (and to some extent the Saab 9000) are internally related in this manner.

b. Platform Stretching

Families of car models are being developed in which a larger model is a 'stretched' version of a smaller one, in a manner resembling (in principle rather than detail) the way airliners are often enlarged in power and seating capacity. A good example of this approach in cars is the development of the Peugeot 309 from the smaller 205.

c. Major Mechanical Component Sharing

Car manufacturers are beginning to share the development costs and the production of major mechanical components. This trend was begun with transmissions (such as the automatic transmission for small-medium cars being designed and built as a joint Renault/ Volkswagen project) and seems certain to spread to engines and other important components.

3. Design Cost Saving Opportunities

The design and engineering savings which can be achieved through technical and regulatory harmonisation (including EC-wide homologation) are seen as being small though likely, on balance, to be in favour of reduced costs and prices. For each opportunity the study tends to show a counterbalancing risk.

The most crucial influencing factor is seen as being the technical level at which regulatory harmonisation is achieved. Given the possibility that it would be set higher than any single national level, it is seen as being likely that the result of technical harmonisation would be to increase car unit costs slightly. This effect might, however, be offset in whole or in part by savings achieved through simplified homologation and type approval procedures.

Investigation of the design and engineering cost aspects has shown several ways in which EC92 can contribute to savings in this area. EC harmonisation to encourage design cost reduction could proceed along two principal lines.

One line would be a move toward harmonisation of the national technical 'break points' in fiscal regulations. At present, design and engineering (and production) efforts are forced to divide themselves artificially among too many specialised car versions by the many 'break points' created by different national fiscal approaches to car purchase and ownership among EC member states.

A harmonised, or more nearly harmonised, fiscal approach that reduces the number of differing and conflicting 'break points' could substantially reduce the design and engineering load on the major EC car producers. It would permit a smaller number of variants to be engineered to higher standards.

Any such harmonisation would certainly take account of the two significant engine capacity 'break points' at 1.4 and 2.0 litres, effectively imposed by the exhaust emission requirements of the Luxembourg compromise. Indeed one of the assumptions of this project has been that these engine sizes will be used as the dividing lines for harmonised EC-wide passenger car use taxes.

A second line of action suggested by the design and engineering interviews should be the removal of fiscal and customs barriers, to ease the process by which car manufacturers could exchange common components across internal European borders. This is part of the study findings relating to variable cost savings; it is seen as having a potential for engineering cost reduction as well.

With a few exceptions, today's component commonality programmes operate within company groups, for example within Fiat Auto (Fiat-Autobianchi-Lancia-Alfa Romeo) and within PSA (Peugeot-Citroen). Much greater benefits are seen by the engineers as being forthcoming when the reduction and elimination of EC internal barriers can lead to greater cross-border inter-company collaboration among major EC car manufacturers.

V. AUTOMOBILE PRODUCTION SCALE ECONOMY

The research and analysis undertaken in this project have shown relatively few instances of immediate direct effects of the implementation of EC92 that are unique and distinctive to the auto industry. The removal of border controls, for example, will reduce transportation costs, an effect which is generic to EC industry as a whole and which, as such, is covered by separate Commission research.

The principal auto industry effects are those which will be delayed in their implementation, because they will only be realised after the industry has taken actions that the improved internal market conditions will facilitate.

Important cost reductions are expected from the improvements in production economies of scale that will occur when EC92 conditions permit more extensive transborder interpenetration of individual parts, components and assemblies, and built-up vehicles. The levels of scale efficiency achieved in the industries of the USA and Japan have been referred to in this work, as have the best levels currently achieved in Europe.

In this section of the Report the topic of production scale economies is addressed in three elements. The first element (Section V.A) establishes the segments being studied and the variable and fixed costs of a typical car in each segment. It also discusses the research and findings that show the variations in cost with changing production volume that occur in the making of these cars.

In the second element (Section V.B), the concept of car platforms is introduced as a means of analysing the differences between the annual production volumes of EC85 and EC92. The findings of the platform study and the cost variations are combined in the third element (Section V.C), together with the engineering findings and other fixed cost considerations, to show the overall savings achieved in EC92.

A. VEHICLE COST STRUCTURE

The essential linkage in the production cost element of the study between the cost of components and the economies of scale that are achievable with built-up vehicles is the factory cost structure of the vehicle itself. Such a structure has been created on the basis of the project research to serve as one of the fundamental tools of the project.

Perhaps it may have been desirable for the sake of simplicity to develop a single standardised and universal cost structure. Such an approach was seen as constituting unwarranted oversimplification. This is because the distribution of passenger car costs differs significantly according to the size and category of the vehicle. Separate structures were evolved to suit the five main volume segments for cars that are made and marketed in Europe. The segments, and typical vehicles in each of them, are as follows:

Utility	**Small**	**Lower Medium**	**Upper Medium**	**Large**
Fiat Panda	VW Polo	VW Golf	GM Ascona	GM Omega
Renault 4	Ford Fiesta	Ford Escort	Ford Sierra	Renault 25
Citroen 2CV	Renault 5	Fiat Ritmo	Renault 21	Fiat Croma

Concentration on these segments omits consideration of the influence on EC92 of cost structures of such specialised vehicles as sports cars and luxury/exotic models, but this is judged to be a necessary and acceptable level of simplification, because the vehicles studied comprise by far the majority of the European market and production volume.

By carrying out a survey of mid-range dealer prices of models that are typical entrants in each segment LAL has been able to derive an arithmetic price average for each segment within the four main markets and a weighted price average for the EC. (Table V.1).

Table V.1

SALES-WEIGHTED MEAN EX-FACTORY PRICES OF EUROPEAN PASSENGER CARS IN FOUR MAIN MARKETS AS DERIVED FROM RETAIL PRICES

Status: Ecu, 1987 conditions for raw prices and 1985 conditions for findings

MARKET	UTILITY		SMALL		LOWER MEDIUM		UPPER MEDIUM		LARGE	
	Net Price	Sales (1000)	Net Price	Sales (1000)	Net Price	Sales (1000)	Net Price	Sales (1000)	Net Price	Sales (1000)
France	3990	167	4892	885	6524	753	8458	556	12155	353
Great Britain	3360	35	4915	219	6640	246	9693	338	13800	65
Italy	4120	251	5659	513	6812	558	9890	44	11447	57
West Germany	3934	-	6024	292	7341	1413	9290	741	13115	1344
EC PRICE TO DEALER * Includes profit margin and delivery	4013	453	5274	1909	6976	2970	9111	1679	12901	1819
EC EX-FACTORY PRICE 1987 Excludes delivery and profit margin	3652		4730		6214		8062		11348	
EC EX-FACTORY PRICE 1985 Based on 6% pa inflation 1986/87	3250		4210		5530		7175		10100	

Note: Prices used for analysis in each segment are an arithmetic average of mid-range prices of models that are typical entries in the segment. National market prices as shown are net of relevant VAT and other sales taxes and dealer retail profit provisions.

* Sales weighted mean of national average.

The prices to dealers thus derived include the delivery cost from factory to dealer and a profit margin for the manufacturer. Using information obtained from the major motor car shippers and from company accounts, LAL has established an ex-factory cost for a 'typical car' in each segment for the EC.

Using the average rate of inflation applicable to this sector (reference prognos) LAL has discounted back the 1987 prices to obtain a 1985 ex-factory cost.

The following sources of data were used to derive the cost structure used in the research:

-- Manufacturer breakdowns of fixed and variable costs of particular models.

-- Variable cost differentials between models in different segments produced by the same manufacturer.

-- Research findings on manufacturer levels of purchasing and in-house sourcing, including annual report statistics.

-- A part-by-part costing of the principal components of a particular automobile model.

-- Comparative data on engine costs for a wide range of European passenger car models.

Using the above sources LAL has established the existing cost structure of the 'typical car' in each segment. LAL has then established how these constituent costs change at different levels of production/procurement.

This information is used later in the study in conjunction with LAL's findings on platform volumes and economics to establish the quantitative impact of the move to EC92 conditions.

The final cost structure format is divided into variable cost and fixed cost elements. These are dealt with in sections V.1 and V.2 respectively. At this stage of the work a necessary simplification has been the decision to show all labour as an element of variable cost, although a strict definition would include indirect labour as an element of fixed cost. Thus labour is included in the variable cost of producing each group of components, with the exception of the separate paint and assembly category.

The cost structures and factory cost findings thus obtained were computed across the European production volumes in the typical segments in 1985 to provide a wholesale factory revenue figure. This correlated satisfactorily with LAL's findings in Section III regarding the economic dimensions of the EC auto industry.

The typical cost structures in Ecu under 1985 conditions for cars in the five segments are incorporated in the project at

Table V.2

FACTORY COSTS AT TYPICAL ANNUAL VOLUMES OF CAR MODELS IN FIVE EUROPEAN SEGMENTS

Status: Ecu 1985 conditions

	UTILITY	SMALL	LOWER MEDIUM	UPPER MEDIUM	LARGE
AVERAGE VOLUME (000)	119	350	505	243	100
VARIABLE COST	**COST**	**COST**	**COST**	**COST**	**COST**
Engine and transmission	575	715	810	1,040	1,550
Electrical	130	225	450	680	1,160
Chassis	355	540	855	1,040	1,545
Interior	250	370	610	835	1,235
Exterior	70	110	205	315	465
Body in White	445	535	550	730	925
Paint and Assembly	255	340	485	575	850
Sub-total	2080	2835	3965	5215	7730
FIXED COST	**1170**	**1375**	**1465**	**1960**	**2370**
TOTAL FACTORY COST	3,250	4,210	5,430	7,175	10,100

Source: Analysis based on total factory cost for each segment, divided between variable and fixed costs by industry interview findings and separate analysis. Variable and fixed cost structures and levels established with reference to analysis findings.

1. Variable Costs

The variable cost benefit of EC92 at the supplier level was researched and analysed by means of two parallel programmes. One programme consisted of a direct sourcing and pricing activity, which gathered data on the price/volume relationships of a comprehensive menu of parts used in automobiles. The other programme made use of structured interviews of component producers to gain insight into their actions and attitudes.

a. Component Cost Research and Analysis

In this programme, a professional automotive component purchasing organisation was engaged to contact European suppliers to obtain price quotes on the supply of their products at annual volumes of 50,000, 100,000, 200,000, 300,000, 500,000 and 1,000,000 car sets. Approximately ninety items were selected for this research, as being representative of the full range of components and sub-assemblies found in European cars.

The piece-cost data obtained in this research is shown in outline form, expressed in Ecu, at the end of this section, and the detailed report is contained as an annexe to the Final Report. It is believed to comprise the first direct probing to have been conducted of the component cost variations with volume that are experienced by the European auto industry. Analysis of the data has revealed distinctive cost/volume profiles for six sub-groups of components. These are reviewed in detail on the following pages.

i. Components whose cost is inversely proportional to the quantity manufactured

In the most straightforward examples, unit cost savings for components are directly related to the number produced. The majority of the components considered in this study showed a fall in unit cost as production quantities increased.

Rates of cost decrease varied according to the types of components and their production systems. Labour-intensive items, such as the soft trim for seats, showed only small reductions with volume, as a consequence of the majority of the saving coming from reductions in material costs.

Items manufactured from quantities of basic raw materials show their largest savings at the highest volumes. The steel tubing for seat frames, for example, is manufactured in high volumes to meet demand that is greater in other industries than the automotive; consequently savings in raw materials are achieved only when very large quantities (for the motor industry) are required. Items where significant commonality exists and production is automated -- such as interior mirrors and shock absorbers -- exhibit a steady drop in cost with volume.

ii. Components which fall in cost up to a limiting level, then stabilise in cost

Certain categories of components exhibit a cost reduction with volume which reaches a point of essentially zero returns. An example is rubber mouldings. The research shows that a tool for a simple moulding can produce several million components per annum. More complex mouldings may limit maximum annual production to 200,000 units per annum; manufacturers report that above this level the needed higher investment in tooling would mean that further savings would be minimal. In another example, economies of scale are reported to have been maximised for steel and aluminium forgings once output levels have reached a figure as low as 10,000 per annum.

iii. Components whose levels of production are already approaching the highest levels under consideration

Certain groups of components are currently being produced in the highest volumes covered by this research. The design of door locks and latches is shown as an area in which major manufacturers already commonalise across their range. The resulting volume for a large European auto company, for example, is 600,000 to 700,000 basically identical lock/latch car sets annually.

Other products exhibiting much commonality across models ranges, and consequently being manufactured at high volume rates, are constant-velocity universal joints, components of the brake system, and many proprietary components such as motors, bearings and oil seals.

iv. Components where competition among suppliers is already very substantial for standardised items

This fourth category of component is found to be virtually unaffected by changes in the volume required by the car manufacturer. The most significant example is provided by motor vehicle tyres. The tyre industry reports that it is unlikely that any scale economy improvements would influence the cost of tyres. Manufacture currently is stated to be running at extremely low, and in some cases negative, profit margins for original equipment supply.

The main source of profit in the tyre industry is reported to be derived from the replacement market. Tyre manufacturers indicated that an opportunity to be a sole supplier to an OE manufacturer for, for example, 100,000 vehicle sets, would in all probability be unattractive at the profit margins under which they would be obliged to operate.

The tyre industry considers that there will be little likelihood of vehicle manufacturers pressing for single sourcing of their products. Traditionally the mould tooling costs are absorbed by the tyre manufacturer; multi-sourcing does not therefore readily appear to increase the investment levels required.

v. Components with a technical rationale for limiting the quantities produced

Increased production of certain components is reported to be impractical on technical grounds. For example the number of European steering gear manufacturers is relatively low, and the largest firms can readily cope with the manufacture of 1,000,000 units to a single specification. TRW Cam Gears, for example, is currently viewed as the sole source of Ford and Austin Rover gears, and is therefore producing well over one million steering gears per annum at present.

However, technically it is felt that steering gears have limited potential for commonisation between car models. A steering gear tends by nature to be designed specifically for an individual model, and compromise on crucial dimensions would affect vehicle handling adversely. Equally, because of the high cost penalty they impose, power-assisted steering gears are likely to remain the domain of 'up-market' car models.

vi. Components with a cosmetic rationale for limiting the quantities produced

The component industry considers that certain items will be unlikely to be produced in higher volumes than at present, largely for cosmetic reasons. It appears unlikely that a single style of door mirror, for example, will be produced in such volumes as to reach the higher levels under consideration. Though the internal mechanism of such a mirror could be common across a range of vehicles, the mirror case (the major tooling cost of the assembly) is considered to be a major identifying feature of a model. Vehicle instrumentation and styled aluminium wheels also fall into this category. Thus, though savings are said to be possible with larger volumes, the demand by the industry for such volumes is thought to be low.

The incremental volumes used for the research appear, at the high end of the volume scale, to represent the maximum potential output per component now prevailing in Europe. The research indicates that the European supply industry is not tooled or accustomed to provide many of the major vehicle components at rates beyond levels of 500,000 car sets per annum.

An impetus toward greater volume would be generated if car makers were to reduce the degree to which they allot the supply of a single part or assembly to several suppliers. The research shows, however, a continuing reluctance among many motor manufacturers to single-source major componentry.

b. Car Variable Cost Structure and Volume Variation

For the purpose of the research the variable cost element of a car has been divided into seven categories, using groupings that are in accord with motor industry practise. These are outlined in Table A3. Shown are some of the components included within each category, and an indication of the relative contribution that each category makes to total variable costs.

Table V.3

SHARE OF CAR VARIABLE COST ACCORDING TO COMPONENT GROUPS

Basis: European Volume - produced sedan in lower medium segment

GROUP	SHARE OF COST	TREND OF SHARE WITH INCREASE IN CAR SIZE
Power train Engine and 5-speed transaxle	19%	Upward
Body in white	16	Downward
Paint and assembly	12	Level/downward
Electrical Instruments, harness, wipers, lights, switches, ICE, clock, horn, battery	11	Upward
Chassis Drive shafts, suspension, brakes, steering, fuel tank, exhaust, engine mounts, door mechanisms, wheels and tyres	22	Level
Interior Seats, mouldings, fascia, carpets, steering wheel, heating (no A/C)	15	Upward
Exterior Bumpers, mouldings, styling elements	5	Upward
TOTAL	100%	

Note: Labour required, both direct and indirect, is included in each component group.

Source: Manufacturer interview.

i. Power Train

Analysis of cost vs. volume shows a slight correlation, as in the following example of three power trains in the small segment:

Ecu cost (1987)	**Annual Production**
754	490,000
770	472,000
888	430,000

The difference in content among the engines is judged to be too great to permit these suggested scale economies to be taken as valid. Power trains are shared among platforms and their economics are based on the viability of a given production module. In other words, a car manufacturer will organise his engine applications in various vehicle platforms in such a way as to ensure the maintenance of an annual production in the range of 400,000 to 600,000 units of each type of power train to justify the highly automated tooling required. Thus for analysis purposes the power train is taken as not changing in cost with changes in vehicle output volume.

TYPICAL POWER TRAIN COST BY SEGMENT
(Ecu)

Utility	**Small**	**Lower Medium**	**Upper Medium**	**Large**
859	936	953	994	1116+
	888	919	993	1083+
	813	900	983	
	770		931	
	754		900	

Source: LAL Investigation

Based on the preceeding table, the following figures are taken as valid for analysis on a 1985 price basis:

Utility	**Small**	**Lower Medium**	**Upper Medium**	**Large**
575	715	810	1040	1550

Available data on a limited section of power trains is shown, taken as 75 percent of the sales prices quoted by four major volume producers. Data has been scaled proportionally to arrive at the cost levels selected for analysis.

ii. Body in White

Body in white production reaches adequate scale efficiencies at annual volumes of 250,000, the size of a typical vehicle assembly module. An empirical example suggests that at low volumes costs increase sharply. For the levels investigated the following cost indices are judged by LAL to be applicable:

Annual Volume	**Index**
50,000	100
100,000	75
200,000	60
300,000	56
500,000	50
1,000,000	40

The cost of body in white at the lowest volume for each segment is outlined in the following table. The above percentage cost/volume reductions apply to these figures as the production volume increases.

Segment	Ecu
Utility	593
Small	955
Lower Medium	1100
Upper Medium	1217
Large	1233

iii. Paint and Assembly

At the current state of the art the assembly of a car is labour-intensive, the cost being in direct proportion to the vehicle complexity and expressed in hours per car. Interviews have shown that the variation with volume is not great, nor is the cost variation for painting substantial. Thus these costs are held constant over volume.

The cost of paint and assembly for a typical car in each segment is as follows:

Segment	Ecu
Utility	255
Small	340
Lower Medium	485
Upper Medium	575
Large	850

The cost/volume effects on the various components utilised in the electrical, chassis, interior and exterior of an automobile are detailed in Table A4.

Table V.4:

VARIATION OF VEHICLE COMPONENT COST
WITH CHANGES IN PRODUCTION VOLUME

Status: Ecu, 1987 component costs

	PRODUCTION VOLUME					
	50,000	100,000	200,000	300,000	500,000	1,000,000
COMPONENT COST						
Electrical						
Head lamp	32.93	31.28	29.72	29.13	28.55	28.26
Tail lamp	18.17	17.29	16.46	16.12	15.81	15.64
Cooling motor	6.31	6.31	5.87	5.87	5.41	4.87
Wiring harness	150.92	142.52	139.67	139.67	138.27	136.88
Instrument cluster	38.42	35.67	32.24	30.18	28.81	27.66
Wiper motor, linkage	20.31	20.31	20.31	19.76	19.76	19.21
Screen wash system	6.50	6.50	6.31	6.31	6.31	6.12
Battery	19.89	19.70	19.51	19.32	19.13	18.93
Total	**293.44**	**279.59**	**270.09**	**266.36**	**262.04**	**257.58**

	PRODUCTION VOLUME					
	50,000	100,000	200,000	300,000	500,000	1,000,000
Chassis						
Tyres	102.90	102.90	102.90	102.90	102.90	102.90
Rubber mouldings	0.69	0.68	0.65	0.65	0.61	0.61
Rubber extrusions	1.37	1.37	1.37	1.37	1.37	1.23
Locks and latches	6.86	6.86	6.69	6.52	6.38	6.17
Latch/striker set	22.23	21.38	20.53	19.67	17.44	16.74
Bonnet cable/release	1.92	1.92	1.82	1.73	1.73	1.54
Brake cable assembly	8.23	8.07	7.83	7.60	7.24	7.08
Aluminium forgings	10.52	10.42	10.31	10.21	10.10	10.00
Steel forgings	4.62	4.51	4.53	4.49	4.44	4.39
Radiators	27.44	26.89	23.32	23.32	21.95	20.58
Condenser	24.89	24.39	21.22	21.22	19.95	18.76
Oil cooler	24.04	23.56	20.50	20.50	19.26	18.11
Steel wheels (x5)	48.02	28.02	46.58	46.58	44.25	42.88
Steering rack (man.)	26.07	23.32	21.95	21.95	20.58	19.89
Repetition machinery	1.26	1.19	1.14	1.08	1.03	1.00
Brake disc	12.35	11.73	11.26	10.81	10.37	10.06
Anti-roll bar	7.55	7.55	7.27	7.07	6.86	5.83
Exhaust system	28.81	27.44	26.75	26.34	26.07	25.38
Coil road spring	8.92	8.92	8.58	8.37	8.16	6.86
Front dampers	27.44	26.07	25.55	25.04	24.53	24.04
Brake drum (pair)	27.44	27.17	26.89	26.48	26.07	25.38
Brake calipers	43.08	42.64	42.20	41.54	40.89	39.79
Master cylinder	14.41	14.26	14.10	13.88	13.67	13.29
Brake servo	17.15	16.97	16.79	16.53	16.27	15.83
Drive shaft/CV jnts	89.18	89.18	80.26	80.26	80.26	76.26
Oil seal	0.25	0.17	0.17	0.16	0.16	0.16
Crossmember	41.16	39.79	38.00	35.53	32.45	28.81
Pedals and pedal box	12.76	12.01	11.66	11.46	10.70	9.60
Fuel tank (pressed)	34.30	30.18	27.44	24.70	24.01	23.32
Rubber/metal bondings	0.92	0.89	0.66	0.63	0.63	0.60
Steering column ass'y	23.94	21.97	21.97	21.97	21.53	20.99
Window lift	0.41	0.40	0.40	0.40	0.38	0.39
Total	701.13	662.82	651.29	640.96	622.24	598.47

COMPONENT COST	PRODUCTION VOLUME					
	50,000	100,000	200,000	300,000	500,000	1,000,000
Interior						
Carpets	24.70	24.70	22.23	21.61	21.61	21.61
Rubber mouldings	0.69	0.68	0.65	0.65	0.62	0.56
Door seals	10.98	10.96	10.91	10.91	10.84	9.74
Interior mirror	3.91	3.83	3.77	3.73	3.63	3.62
Tubular seat frame	16.92	16.92	16.20	16.20	15.09	13.58
Moulded headlining	17.15	16.81	15.98	15.98	15.16	13.99
Large soft trim	109.76	107.70	105.64	103.59	100.84	96.73
Small soft trim	2.74	2.68	2.59	2.51	2.43	2.33
Sound insulation	16.46	16.46	16.05	16.05	15.89	15.81
Windscreen	23.32	23.09	22.86	22.86	21.49	21.49
Other glass	38.14	37.76	37.37	37.37	35.14	35.14
Heater	37.72	37.72	35.84	35.84	32.24	31.60
Steering wheel	12.35	12.01	11.66	11.39	10.98	10.98
Radio/cassette	112.50	109.76	107.70	102.90	102.90	02.90
Trunking and ducting	1.51	1.34	1.29	1.25	1.21	1.00
Safety belts (set)	50.35	45.67	41.60	38.03	35.01	32.34
Front squab foam	9.06	8.64	8.23	8.11	7.99	7.82
Front cushion foam	6.04	5.76	5.49	5.41	5.32	5.21
Rear squab foam	9.06	8.64	8.23	8.11	7.99	7.82
Rear cushion foam	10.56	10.08	9.60	9.45	9.32	9.12
Interior console	38.42	38.42	34.30	34.30	30.18	27.44
Rubber extrusion	1.37	1.37	1.37	1.37	1.37	1.23
Door pockets	4.12	4.12	3.70	3.70	3.43	3.09
Armrests	4.12	4.12	3.70	3.70	3.43	3.09
Glovebox	4.12	4.12	3.70	3.70	3.43	3.09
Sunvisors	4.12	4.12	3.70	3.70	3.43	3.09
Head restraints	8.23	8.23	7.41	7.41	6.86	6.17
A/B/C pillar trim	24.70	24.70	22.23	22.23	20.58	18.52
Dashboard panel pad	10.47	10.47	9.34	9.34	8.22	7.48
Front door trim	51.11	51.11	45.63	45.63	40.16	36.51
Total	**662.25**	**649.66**	**616.82**	**604.89**	**574.63**	**551.01**

	PRODUCTION VOLUME					
	50,000	100,000	200,000	300,000	500,000	1,000,000
COMPONENT COST						
Exterior						
Ext. mirror (man.)	11.31	11.09	10.92	10.81	10.48	10.48
PU RIM mouldings:						
bumper end cap	4.12	4.12	3.70	3.70	3.43	3.09
spoiler	16.46	16.46	14.82	14.82	13.77	12.40
bumper	54.88	54.88	49.39	49.39	45.93	41.34
Radiator grille	11.52	10.66	10.24	10.24	9.93	9.93
Wiper arms and blades	4.94	4.94	4.84	4.84	4.75	4.69
Total	**103.23**	**102.15**	**93.91**	**93.80**	**88.30**	**81.94**
Body in white						
Pressed door panel	9.80	9.71	9.55	9.41	9.18	8.79
Pressed headlamp brkt	0.19	0.19	0.19	0.19	0.19	0.19
Rolled roof panel	6.17	4.80	4.51	4.47	4.43	4.43
Total	**16.16**	**14.71**	**14.25**	**14.07**	**13.80**	**13.42**
Paint and assembly						
White paint	13.72	13.38	13.03	12.62	12.01	10.98

Notes

Source: Survey of European component manufacturers, commissioned by Ludvigsen Associates Limited for this report, September 1987.

Costs : Cost are typical costs for vehicle components, and are not necessarily representative of component costs for any particular vehicle.

The trend data on component costs at different volumes of production/procurement is by reference to a representative sample of components.

However, by its very nature the cost figure derived at a specific volume cannot be equally applicable to a car in the utility segment and also to a car in the large segment, as they utilise different components and have a different labour content.

The trend data remains relevant, however, because the known behaviour of cost at different volumes can be applied to the specific cost data provided by the manufacturers at 1985 conditions and volumes (Table V.2).

By applying the actual cost at actual average volume (Table V.2) to the next lowest production/order volume and comparing it to the component sample cost it has been possible to determine the percentage of the sample cost that is applicable to that segment. This then has been applied to the different production/order volumes to establish an individual cost-volume relationship for a each component group in each car segment.

This then has allowed the production of the trend information on the categories of cost for each segment.

Table V.5

VARIABLE COST OF COMPONENT GROUPS:
ANALYSIS OF COST AT ALTERNATIVE VOLUMES

Status: Ecu, 1987 conditions for current costs,
1985 conditions for cost at volume
Segment: Utility
Current Typical Annual Volume By Maker: 110,000

COMPONENT GROUP	ALTERNATIVE ANNUAL PRODUCTION VOLUME					
	50,000	100,000	200,000	300,000	500,000	1,000,000
Electrical						
Sample Cost	293.44	279.59	270.09	266.36	262.04	257.58
Segment Cost	136.44	130.00	125.58	123.85	121.84	119.77
Chassis						
Sample Cost	701.12	662.82	651.32	640.76	622.24	598.49
Segment Cost	375.52	355.00	348.82	343.18	333.27	320.53
Interior						
Sample Cost	662.25	649.66	616.82	604.89	575.63	551.01
Segment Cost	254.84	250.00	237.38	232.78	221.50	212.05
Exterior						
Sample Cost	103.23	102.15	93.91	93.80	88.30	81.94
Segment Cost	70.74	70.00	64.35	64.28	60.51	55.15

Source: Relationship between component cost variations with volume and car production quality, Table V.4.
Cost at volume is derived from component group costs (Table V.2) adjusted by the cost index.

Volume: Current typical annual volume is rounded to next lowest alternative production volume,which represents the price at which such a volume or components would be purchased.

Table V.6

**VARIABLE COST OF COMPONENT GROUPS:
ANALYSIS OF COST AT ALTERNATIVE VOLUMES**

Status: Ecu, 1987 conditions for current costs, 1985 conditions for cost at volume
Segment: Small
Current Typical Annual Volume By Maker: 435,000

	ALTERNATIVE ANNUAL PRODUCTION VOLUME					
COMPONENT GROUP	50,000	100,000	200,000	300,000	500,000	1,000,000
Electrical						
Sample Cost	293.44	279.59	270.09	266.36	262.04	257.58
Segment Cost	247.88	236.18	228.15	225.00	221.36	217.58
Chassis						
Sample Cost	701.12	662.82	651.32	640.76	622.24	598.49
Segment Cost	590.87	552.42	548.91	540.00	524.39	504.36
Interior						
Sample Cost	662.25	649.66	616.82	604.89	575.63	551.01
Segment Cost	405.08	397.38	377.29	370.00	352.09	337.03
Exterior						
Sample Cost	103.23	102.15	93.91	93.80	88.30	81.94
Segment Cost	121.06	119.79	110.13	110.00	103.55	96.10

Source: Relationship between component cost variations with volume and car production quality, Table V.4.
Cost at volume is derived from component group costs (Table V.2) adjusted by the cost index.

Volume: Current typical annual volume is rounded to next lowest alternative production volume, which represents the price at which such a volume or components would be purchased.

Table V.7

VARIABLE COST OF COMPONENT GROUPS:
ANALYSIS OF COST AT ALTERNATIVE VOLUMES

Status: Ecu, 1987 conditions for current costs,
1985 conditions for cost at volume
Segment: Lower Medium
Current Typical Annual Volume By Maker: 525,000

	ALTERNATIVE ANNUAL PRODUCTION VOLUME					
COMPONENT GROUP	50,000	100,000	200,000	300,000	500,000	1,000,000
Electrical						
Sample Cost	293.44	279.59	270.09	266.36	262.04	257.58
Segment Cost	503.91	480.15	463.82	457.43	450.00	442.35
Chassis						
Sample Cost	701.12	662.82	651.32	640.76	622.24	598.49
Segment Cost	963.41	910.75	894.93	880.48	855.00	822.34
Interior						
Sample Cost	662.25	649.66	616.82	604.89	575.63	551.01
Segment Cost	701.81	688.45	653.68	640.68	610.00	583.89
Exterior						
Sample Cost	103.23	102.15	93.91	93.80	88.30	81.94
Segment Cost	239.67	237.16	218.02	217.77	205.00	188.74

Source: Relationship between component cost variations with volume and car production quality, Table V.4.
Cost at volume is derived from component group costs (Table V.2) adjusted by the cost index.

Volume: Current typical annual volume is rounded to next lowest alternative production volume, which represents the price at which such a volume or components would be purchased.

Table V.8

VARIABLE COST OF COMPONENT GROUPS:
ANALYSIS OF COST AT ALTERNATIVE VOLUMES

Status: **Ecu, 1987 conditions for current costs,**
1985 conditions for cost at volume
Segment: Upper Medium
Current Typical Annual Volume By Maker: 255,000

	ALTERNATIVE ANNUAL PRODUCTION VOLUME					
COMPONENT GROUP	**50,000**	**100,000**	**200,000**	**300,000**	**500,000**	**1,000,000**
Electrical						
Sample Cost	293.44	279.59	270.09	266.36	262.04	257.58
Segment Cost	738.82	703.94	680.00	670.62	659.74	648.52
Chassis						
Sample Cost	701.12	662.82	651.32	640.76	622.24	598.49
Segment Cost	1119.56	1058.41	1040.00	1023.15	993.62	955.66
Interior						
Sample Cost	662.25	649.66	616.82	604.89	575.63	551.01
Segment Cost	896.54	879.42	835.00	818.88	779.22	745.91
Exterior						
Sample Cost	103.23	102.15	93.91	93.80	88.30	81.94
Segment Cost	346.35	342.63	315.00	314.62	296.19	274.84

Source: Relationship between component cost variations with volume and car production quality, Table V.4.
Cost at volume is derived from component group costs (Table V.2) adjusted by the cost index.

Volume: Current typical annual volume is rounded to next lowest alternative production volume, which represents the price at which such a volume or components would be purchased.

Table V.9

VARIABLE COST OF COMPONENT GROUPS:
ANALYSIS OF COST AT ALTERNATIVE VOLUMES

Status: Ecu, 1987 conditions for current costs, 1985 conditions for cost at volume
Segment: Large
Current Typical Annual Volume By Maker: 140000

	ALTERNATIVE ANNUAL PRODUCTION VOLUME					
COMPONENT GROUP	**50,000**	**100,000**	**200,000**	**300,000**	**500,000**	**1,000,000**
Electrical						
Sample Cost	293.44	279.59	270.09	266.36	262.04	257.58
Segment Cost	1217.42	1160.00	1120.56	1105.13	1087.15	1068.71
Chassis						
Sample Cost	701.12	662.82	651.32	640.76	622.24	598.49
Segment Cost	1634.30	1545.00	1518.12	1493.55	1450.45	1394.98
Interior						
Sample Cost	662.25	649.66	616.82	604.89	575.63	551.01
Segment Cost	1258.96	1235.00	1172.63	1149.91	1094.21	1047.53
Exterior						
Sample Cost	103.23	102.15	93.91	93.80	88.30	81.94
Segment Cost	469.93	465.00	426.13	427.01	401.95	373.02

Source: Relationship between component cost variations with volume and car production quality, Table V.4.
Cost at volume is derived from component group costs (Table V.2) adjusted by the cost index.

Volume: Current typical annual volume is rounded to next lowest alternative production volume, which represents the price at which such a volume or components would be purchased.

The next step in the analysis merged the vehicle cost structure with the findings of the individual component costing exercises. This merging was possible with a high degree of relevancy and accuracy in the variable cost categories containing electrical, chassis, interior and exterior components, each of which was well represented in the costing exercise.

In each of these four categories the component costs were scaled and apportioned to generate an overall trend of the variable cost with changes in production volume of a typical segment platform, according to the six volume datum points.

A separate analysis based on industry data was employed to develop a cost/volume gradient for the body in white. As noted earlier, for two categories, power train and paint and assembly, the costs were held constant through this phase of the analysis.

The integration of the component cost/volume data with the vehicle cost structures yielded the following trends of platform factory variable cost in 1985 Ecu with changing annual production volumes:

Table V.10

EFFECT OF PRODUCTION VOLUMES ON VARIABLE COSTS

Status: Ecu, 1985 Conditions
Segment: Utility
Current Typical Annual Volume = 110,000

	ANNUAL PRODUCTION VOLUME					
VARIABLE COSTS	50,000	100,000	200,000	300,000	500,000	1,000,000
Engine and Transmission	575	575	575	575	575	575
Electrical	136	130	126	124	122	120
Chassis	375	355	349	343	333	321
Interior	255	250	237	233	222	212
Exterior	71	70	64	64	61	55
Body in White	593	445	356	332	297	237
Paint and Assembly	255	255	255	255	255	255
TOTAL VARIABLE COST	**2260**	**2080**	**1962**	**1926**	**1865**	**1775**

Source: Factory costs at typical annual volumes (Table V.2) Adjusted by cost factor.

Table V.11

EFFECT OF PRODUCTION VOLUMES ON VARIABLE COSTS

Status: Ecu, 1985 Conditions
Segment: Small
Current Typical Annual Volume = 435,000

	ANNUAL PRODUCTION VOLUME					
VARIABLE COSTS	50,000	100,000	200,000	300,000	500,000	1,000,000
Engine and Transmission	715	715	715	715	715	715
Electrical	248	236	228	225	221	218
Chassis	591	552	549	540	524	504
Interior	405	397	377	370	352	337
Exterior	121	120	110	110	104	96
Body in White	955	717	573	535	478	382
Paint and Assembly	430	340	340	340	340	340
TOTAL VARIABLE COST	3375	3077	2892	2835	2734	2592

Source: Factory costs at typical annual volumes (Table V.2) Adjusted by cost factor.

Table V.12

EFFECT OF PRODUCTION VOLUMES ON VARIABLE COSTS

Status: Ecu, 1985 Conditions
Segment: Lower Medium
Current Typical Annual Volume = 525,000

	ANNUAL PRODUCTION VOLUME					
VARIABLE COSTS	50,000	100,000	200,000	300,000	500,000	1,000,000
Engine and Transmission	810	810	810	810	810	810
Electrical	504	480	464	457	450	442
Chassis	963	910	895	880	855	822
Interior	702	688	654	641	610	584
Exterior	240	237	218	218	205	189
Body in White	1,100	825	660	616	550	440
Paint and Assembly	485	485	485	485	485	485
TOTAL VARIABLE COST	4,804	4,437	4,186	4,107	3,965	3,772

Source: Factory costs at typical annual volumes (Table V.2) Adjusted by cost factor.

Table V.13

EFFECT OF PRODUCTION VOLUMES ON VARIABLE COSTS

Status : Ecu, 1985 Conditions
Segment: Upper Medium
Current Typical Annual Volume = 255,000

	ANNUAL PRODUCTION VOLUME					
VARIABLE COSTS	50,000	100,000	200,000	300,000	500,000	1,000,000
Engine and Transmission	1040	1040	1040	1040	1040	1040
Electrical	739	704	680	671	650	649
Chassis	1120	1058	1040	1023	994	956
Interior	897	897	835	819	779	746
Exterior	349	343	315	315	296	275
Body in White	1217	912	730	681	608	487
Paint and Assembly	575	575	575	575	575	575
TOTAL VARIABLE COST	5934	5511	5215	5124	4942	4728

Source: Factory costs at typical annual volumes (Table V.2) Adjusted by cost factor.

Table V.14

EFFECT OF PRODUCTION VOLUMES ON VARIABLE COSTS

Status: Ecu, 1985 Conditions
Segment: Large
Current Typical Annual Volume = 140,000

	ANNUAL PRODUCTION VOLUME					
VARIABLE COSTS	50,000	100,000	200,000	300,000	500,000	1,000,000
Engine and Transmission	1550	1550	1550	1550	1550	1550
Electrical	1217	1160	1121	1105	1087	1069
Chassis	1634	1545	1518	1496	1450	1395
Interior	897	897	835	819	779	746
Exterior	470	465	426	427	402	373
Body in White	1233	925	740	691	617	493
Paint and Assembly	850	850	850	850	850	850
TOTAL VARIABLE COST	8213	7730	7378	7262	7050	6778

Source: Factory costs at typical annual volumes (Table V.2) Adjusted by cost factor.

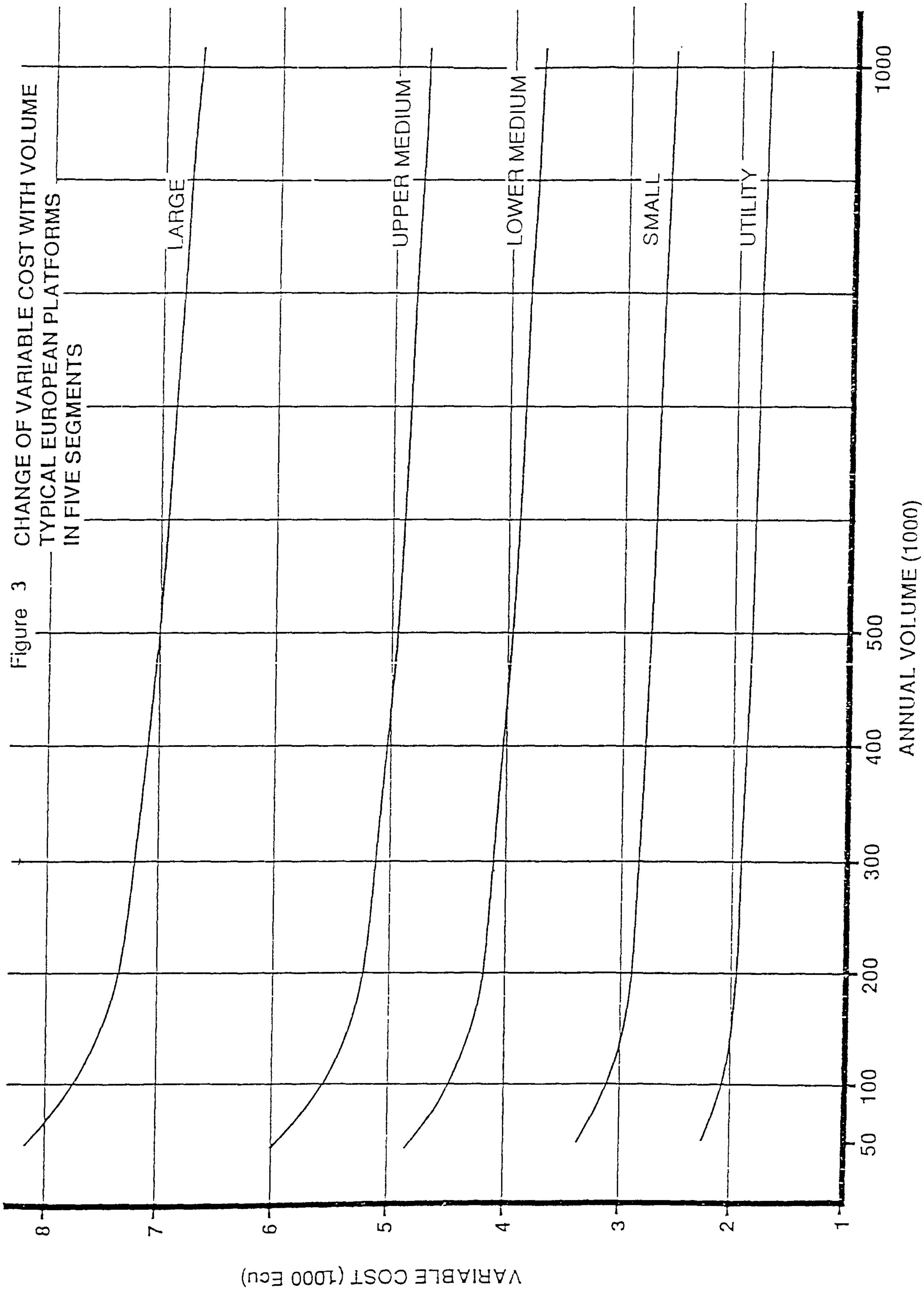


Figure 3
CHANGE OF VARIABLE COST WITH VOLUME
TYPICAL EUROPEAN PLATFORMS
IN FIVE SEGMENTS
LARGE
UPPER MEDIUM
LOWER MEDIUM
SMALL
UTILITY
VARIABLE COST (1000 Ecu)
1
2
3
4
5
6
7
8
ANNUAL VOLUME (1000)
50
100
200
300
400
500
1000

The Study has been limited to the quantification of those economic benefits which would result from the increased potential volume supply of componentry, which in turn could be made possible by the standardisation of legislative vehicle requirements throughout the Community, the elimination of internal trade barriers, and the collaboration between vehicle producing companies in order to achieve a greater commonisation of individual componentry.

Each group of componentry studied will be affected by criteria that are specific to them in terms of their long-term potential regarding commonisation. The factors likely to affect each product grouping have been researched, reported, and applied to the project conclusions.

It should be stated that the incremental volumes used in the component cost research appear, at the high end of the volume scale, to represent the maximum potential European output per component. It should be borne in mind that thevehicle producing companies are unlikely to single-source major componentry; by choosing two sources thay halve the potential scale volume of production.

As an example, a major producer is known to have dual-sourced an instrument cluster for reasons of safeguard of supply. One source is in fact a subsidiary company, where high confidence regarding parts availability is to be expected. Nonetheless, a duplicate set of high-investment tools was commissioned, an action which gives a clear indication of the industry's hesitant attitude toward single-sourcing.

While it is not possible to predict absolutely the likely nature of the supply base industry within Europe in the 1990s, it does seem significant that the major vehicle producing companies will be achieving their high volumes of output from a number of European factories -- e.g. GM in both Germany and the UK. Generally speaking, there would appear to be a capacity constraint within the supply industry on many of the major components beyond levels of 500,000 sets per annum. With a move towards 'Just in Time' (JIT) scheduling methods it could reasonably be expected that the more adventurous suppliers will become more European-orientated in terms of the choice of location for their manufacturing bases. If the supply potential does increase as expected, it is perhaps likely that the additional capacity required will be created by 'group' companies, strategically located close to the various European vehicle manufacturing plants.

c. Supplier Industry Research Findings

Interviews with component manufacturers indicate that the European component industry will need to adapt and adjust to meet the range of new demands that the vehicle producing companies are now making, and are likely to be making, in the future in EC92.

The new demands will include: continuing reductions in the overall number of supplier companies to any one manufacturer; the introduction of JIT delivery, and closer working relationships between component and vehicle manufacturers, with the component manufacturer taking considerably more responsibility for the design of components.

Vehicle producing companies are already moving towards smaller numbers of preferred suppliers. PSA had 2,000 suppliers in 1981, 1,229 in 1986 and expects to have 950 by the end of 1988. Renault had 1,415 suppliers in 1985 and now has 900. Austin Rover currently has 700 suppliers, a reduction from 1,200. Ford has reduced its suppliers from 2,500 to the current 900 in the past five years.

Rather than being national suppliers, component manufacturers will need to be European in the scope of their operations. Adaptation to meet these new conditions is expected to be achieved through mergers or co-operation arrangements with other European component suppliers. There is already some evidence from recent industry actions that this process is under way.

Interviews with supplier companies have shown that they are preoccupied by mergers and co-operative projects, and have as yet given little consideration to the other specific ways in which EC92 will influence their activities.

A UK transmission producer presents an example of a supplier that accounts for a large share of the European and worldwide markets in its product area, chiefly constant-velocity universal joints. Its universal joint design is currently used in about 65 percent of all European front-wheel-drive cars, and worldwide 30 percent of all vehicles are fitted with the design. Because this company is already trading Europe-wide on a substantial scale it is aware of little prospect of itself deriving significant direct cost benefits from EC92.

The EC cultural barriers are seen as significant by some suppliers. Two major componemt manufacturers -- both of which have plants in Britain and on the Continent -- make the point that in their view no legislation by the Community will break down the current high levels of nationalistic bias in purchasing in the short or even the medium term. Both companies referred to the difficulty of dealing with the French motor manufacturers, who prefer to buy only from other French companies.

Some concern was expressed that in at least two areas EC92 could result in added cost. Harmonisation of labour laws in EC92, it was felt, may encourage a pan-European trade union network of immense power. At present, unions in different countries do not in practice support one another.

With EC92 there is the additional concern among those interviewed that there may be a heightened possibility of the introduction of far more stringent product liability legislation along USA lines. If automobile manufacturers were obliged to label and identify each individual component, for example, suppliers felt that this would tend to increase costs.

As concerns scale economies, suppliers stated that in Europe production lines tend not to be dedicated to a single product. Sequences of different products are made on most lines. According to one major EC component manufacturer, there is much to be learned from the Japanese to improve such operations; they state that while currently it takes one hour to change tooling on their own line, it takes ten minutes to make the same change in a broadly equivalent Japanese components company. By contrast, production lines in the USA are dedicated to the continuous production of a single product.

The main dimension of scale seen as likely to affect the costs for component suppliers is the output of production groups. The source of economies of scale is stated to be the spreading over more units of fixed costs, particularly R&D. R&D costs may average 5 percent of total costs, and other fixed costs cover management and administration (the cost of marketing for supplier firms tends to be very small). If the fixed costs are 20 percent in total, this provides scope for economies for rationalisation in EC92.

A conclusion of the interviews is that the potential effects of EC92 are being underestimated by the components sector. In particular, each of the companies interviewed now maintains plants in a number of different countries, judging it necessary to do so in order to gain orders in different territories. Each feels that it will probably need to continue to maintain these plants with the advent of EC92, because each believes that little will occur in the short term to break down nationalistic prejudices.

As a model, the situation in the United States is that geography and regional issues are considered wholly unimportant provided that the supply of good-quality products is maintained. In time it is considered likely that component manufacturers in Europe will no longer feel obliged to produce in the car manufacturer's home country and will thus be able to set up larger centralised facilities on the USA model, allowing them to benefit from the greater efficiency afforded by longer production runs.

2. Fixed Costs

Again following EC auto industry practise, the fixed costs associated with automobile production have been researched under seven categories, as follows: tooling, engineering, warranty, marketing, selling, administration and other fixed costs. Having obtained the ex-factory cost of a typical car in each segment from the survey of dealers' prices, and having determined the variable cost element by reference to manufacturer information and the components survey, it follows that the difference between the two figures is attributable to the apportionment of fixed costs to individual units of production.

Within the total fixed costs apportioned to each unit of production it is possible to identify and specifically to quantify three of the seven elements. These are tooling, engineering and warranty. All figures shown are 1985 status Ecu.

Tooling cost per unit represents the cost to the car manufacturer of both his own tooling costs and those of his principal component suppliers spread over the lifetime of the production run.

This cost will increase with segment size, though in the large volume (Lower Medium) it will tend to decrease both as a percentage of total costs and absolutely per unit as a result of amortising the up-front expenditure over a larger volume of cars.

It is estimated that at EC85 conditions and volumes the cost per unit across the respective segments is as follows:

	Utility	**Small**	**Lower Medium**	**Upper Medium**	**Large**
Tooling (Ecu)	265	350	305	580	680

Engineering costs per unit principally represent the cost of initial design work on the motor vehicle. It is estimated that at EC85 volumes and conditions this will comprise approximately 5 percent of total cost. Thus the relevant costs are:

	Utility	**Small**	**Lower Medium**	**Upper Medium**	**Large**
Engineering (Ecu)	160	210	275	360	505

Warranty costs are the cost to the manufacturer of providing warranty cover on a vehicle. It includes the cost of repairs and of administering the warranty scheme through the dealer network.

Through interviews and other industry sources we have established that the following costs are broadly applicable.

	Utility	Small	Lower Medium	Upper Medium	Large
Warranty (Ecu)	90	135	175	265	355

Other fixed Costs, allocated to individual units, amount to:

	Utility	Small	Lower Medium	Upper Medium	Large
Other (Ecu)	655	680	710	755	830

These other fixed costs include overheads for which it is not possible to identify specific values per unit within other fixed costs we also have the following expenses:

Administration
Marketing
Selling

These costs are largely related to the presence of a company in the market place, and the manufacturers would adopt a specific cost plus margin approach to incorporating them.

Generally it is the existence of a manufacturing capacity and the presence of a company in the market place which jointly determine the level of fixed costs to be allocated to the productive output. Given that we are looking at the potential savings stemming from the introduction of EC92 conditions on a macro level, we are only interested in the savings in aggregate fixed costs, not in the fixed cost per unit.

Therefore only those factors which impact on the cost of maintaining a productive capability and a presence in the market place are relevant. These factors are the developments in platform volumes outlined in Section V.D. The specific impacts of these platform changes are defined in Section V.E, Auto Production Economies of Scale.

B. ANALYSIS OF PRODUCTION BY PLATFORMS

1. Platform Survey

Initially consideration was given to the analysis of auto industry cost efficiencies on what may be considered a classical method: the company-by-company basis. In fact substantial resources were dedicated to such research at the beginning of the project. These investigations, however, showed that this was not useful as a fundamental tool.

Comparisons between company results were found to be of only limited use because company production patterns differ so greatly. There is little in common on a company-wide basis between the products of a BMW, an ARG and a VAG. Instead, the vehicle platform was selected as a basic analysis parameter for the study of vehicle variable costs. Platform analysis is a relatively common technique in the USA industry but has hitherto seen little practical application in Europe.

The major European producers, to varying degrees, employ the common platform design technique to enable their model range to provide a broader market coverage without losing the advantages of high scale volume. They do this by designing a variety of body types and styles in such a way that they look different externally, but in fact can be built on a single or common platform.

Vehicles built on the platform may compete in a single segment. Alternatively the company may change vehicles built on the platform sufficiently to allow them to be marketed and classified in two or more different market segments. This greatly reduces development and tooling costs, and even enables companies such as Fiat and PSA to have different brands or marques sharing common platforms.

The vehicle platform was selected as the basic analysis parameter for the study of vehicle variable costs. An unique 'platform' is defined as a single vehicle floorpan design to which common components are attached in the areas of running gear, suspension, and steering. With relatively minor changes, the floorpan may be varied in length without departing from the concept of an unique platform.

An example of common platform utilisation is provided by the current PSA range. The platform and running gear for the Peugeot 205, introduced to the Small segment in 1984, is shared with the Lower Medium Peugeot 309 model. This same platform has recently also formed the basis for the new Small Citroen model, the AX.

A more extreme example of the use of common platforms and shared design costs is seen in the Type 4 project for the production of a new Large European car. This project allowed the Fiat Croma, Lancia Thema, Alfa Romeo 164 and Saab 9000 to share a common platform design, with provisions made during development for the spcific requirements of each model.

It was determined during the research that the analysis of car production according to platforms offers the only method that provides a direct correlation with the data obtained on the cost/volume relationships of car components. In principle, the most tooling-intensive parts of a platform are common to it and to vehicles built on it. Thus in theory all the mechanical parts of a platform will be alike in all the car models it carries, making component volume equal to platform volume. This provides a direct and clear relationship that is not possible with the study of either marque or output.

The analysis and study described in this section establish the typical platform volumes of all the principal European producers, irrespective of EC residence. Also indicated is the extent to which each maker employs designs that essentially use common components, and the degree to which they represent the achievement of certain economies of scale.

In the course of this work LAL contacted the European vehicle producers in order to determine the staus of their individual company platform usage. Discussions with the product planning and engineering departments of each company have established their complete model range structures and the degrees of platform and component commonality that are achieved.

In making such determinations it is essential to gain a clear understanding of the degree to which components are common. Reviewed were instances of platforms which were originally intended to be common, but which have gradually become 'polluted' by the introduction of specific components. Other important factors in the analysis of the scale efficiency of platform volumes are the number of body styles used on each platform and the market segment spread that each platform achieves.

In this phase of the work the base-year 1985 European market was analysed in terms of the typical number of platforms produced in each segment and the number of car production facilities that are required to reach the total industry volume. The analysis includes a detailed breakdown of the platform sales within each segment of individual European countries, and the volumes that are exported to countries outside Europe. The platform analysis provides an understanding of the typical production volumes for each European vehicle producer and also quantifies the European market by platform segment distribution.

The information in the following table (Table V.15) displays the extent to which the major European vehicle producers utilise common vehicle platforms in their model ranges. The information has been gathered from a variety of sorces and has been confirmed where possible by review with the individual manufacturers as discussed above.

In the tables, platforms are identified as being unique (U) to one model or common (C) to several models. Total platform volume is shown in bold type in the tables. Where the volume of several models is shown as contributing to the total platform volume, they are printed in normal type weight.

Table V.15

MANUFACTURER AND MODELS	PLATFORM STATUS	NUMBER B'STYLES	SEG.	1985 PLAT. VOL.
FORD:				
FIESTA	U	1	S	**380,795**
ESCORT	C	6	L	383,952
ORION				116,998
				500,590
SIERRA	U	5	M	**326,467**
CAPRI	U	1	M	**9,262**
SCORPIO	U	1	LA	**85,008**

Ford (Europe) has 5 unique platforms. The Scorpio was originally based on a modified Sierra platform, but Ford now considers it to be sufficiently different to constitute unique status.

MANUFACTURER AND MODELS	PLATFORM STATUS	NUMBER B'STYLES	SEG.	1985 PLAT. VOL.
GM:				
CORSA/NOVA	U	4	S	**277,101**
KADETT/ASTRA	U	6	L	**576,351**
ASCONA/CAVALIER	U	4	M	**340,504**
MANTA	U	2	M	**16,244**
REKORD/CARLTON	U	2	LA	**81,668**
SENATOR	C	1	LA	14,109
MONZA		1	LA	3,041
				17,150

GM (Europe) has 6 unique platforms. The Manta is based on the previous rear-wheel-drive Ascona. The latest post-1985 range of Opel large cars, the Omega/Senator, now has a common platform.

MANUFACTURER AND MODELS	PLATFORM STATUS	NUMBER B'STYLES	SEG.	1985 PLAT. VOL.
FIAT:				
PANDA	C	1	U	141,629
LANCIA Y10		1	U	63,495
				205,124
UNO	C	2	S	**555,572**
RITMO	C	3	L	116,525
REGATA		2	L	150,312
LANCIA DELTA		1	L	23,626
LANCIA PRISMA		1	L	73,277
				363,740
CROMA	C	1	LA	4,434
LANCIA THEMA		2	LA	30,419
				34,853
ALFA ROMEO 33	C	2	L	68,668
ALFA ROMEO SPRINT		1	L	3,939
				72,607
ALFA ROMEO 75	C	2	M	**30,136**
ALFA ROMEO 90		1	LA	**31,476**

The Fiat Group has 6 unique family car platforms.

RENAULT:				
4	C	1	U	87,835
6 (Spain)		1	S	2,748
				90,583
5	U	2	S	**454,089**
9	C	1	L	221,621
11		2	L	315,546
				537,167
18	C	2	M	83,479
FUEGO		1	M	8,168
				91,647
25	U	2	LA	**137,012**
ESPACE	U	1	PC	**13,825**

Renault has 7 unique family vehicle platforms.

MANUFACTURER AND MODELS	PLATFORM STATUS	NUMBER B'STYLES	SEG.	1985 PLAT. VOL.
VAG:				
POLO	U	3	S	**260,857**
GOLF	C	2	L	648,096
JETTA		2	L	230,895
				878,991
SCIROCCO	C	1	L	33,674
GOLF CABRIO		1	L	27,654
				61,328
PASSAT	C	3	M	108,261
AUDI COUPE		1	M	23,372
				131,633
AUDI 80/90	U	2	M	**191,591**
AUDI 100/200	U	2	LA	**148,239**

VAG has 6 unique platforms.

MANUFACTURER AND MODELS	PLATFORM STATUS	NUMBER B'STYLES	SEG.	1985 PLAT. VOL.
AUSTIN-ROVER:				
MINI	U	1	U	**34,974**
METRO	U	2	S	**166,536**
MAESTRO	C	1	L	71,744
MONTEGO		2	M	95,874
				167,618
ROVER 200 (Honda Ballade)	U	1	L	**65,844**
ROVER SD1	U	1	LA	**15,920**

Austin-Rover has 5 unique platforms.

MANUFACTURER AND MODELS	PLATFORM STATUS	NUMBER B'STYLES	SEG.	85 PLAT.VOL.
PEUGEOT (PSA):				
CITROEN 2CV	C	1	U)	**54,067**
CITROEN MEHARI		1	U)	
CITROEN ACADIANE		1	U)	
PEUGEOT 205	C	2	S	589,828
PEUGEOT 309		1	L	5,511
				595,339
CITROEN VISA	C	1	S	112,588
CITROEN PEUGEOT 104		1	S	23,211
CITROEN/TALBOT SAMBA		1	S	18,328
				154,127
CITROEN BX	C	2	M	252,197
PEUGEOT 305		2	M	108,519
				360,716
CITROEN CX	U	2	LA	**38,539**
PEUGEOT 504	U	2	LA	**38,613**
PEUGEOT 505	U	2	LA	**124,677**

The PSA Group has 7 unique platforms.

VOLVO:				
300	U	3	L	**108,083**
200	U	3	LA	**131,097**
700	U	2	LA	**157,838**

Volvo has 3 unique platforms.

BMW:				
3-SERIES	U	4	M	**287,157**
5-SERIES	U	1	LA	**108,281**
7-SERIES	U	2	LA	**26,020**
6-SERIES	U	1	LA	**9,626**

BMW has 4 unique platforms.

MANUFACTURER AND MODELS	PLATFORM STATUS	NUMBER B'STYLES	SEG.	85 PLAT.VOL.
MERCEDES-BENZ:				
W201 (190)	U	1	M	**211,804**
W124 (200)	U	3	LA	**191,915**
S-CLASS	U	3	LA	**98,870**

Mercedes-Benz has 3 unique family car platforms.

MANUFACTURER AND MODELS	PLATFORM STATUS	NUMBER B'STYLES	SEG.	85 PLAT.VOL.
PORSCHE:				
924	C	1	SP	**3,999**
944		1	SP	**29,441**
911	U	3	SP	**15,662**
928	U	1	SP	**5,356**

Porsche has 3 unique platforms.

MANUFACTURER AND MODELS	PLATFORM STATUS	NUMBER B'STYLES	SEG.	85 PLAT.VOL.
SAAB:				
900	U	4	LA	**98,092**
9000	C (TYPE 4)	1	LA	**13,721**

Saab has 2 unique platforms.

KEY:

PLATFORM STATUS

U = Unique
C = Common

SEGMENT

U = Utility
S = Small
L = Lower Medium
M = Upper Medium
LA = Large
SP = Specialist

In order to establish an EC85 basis for comparison it was necessary to determine the typical platform volumes in 1985 EC auto production. The actual total and average production of the entrants in each segment is as follows:

Segment	**Total Production (000)**	**Number of Platforms**	**Average Vol. Per Platform (000)**
Utility	357	3	119
Small	2,804	8	350
Lower Medium	3,031	6	505
Upper Medium	1,942	8	243
Large	1,000	10	100
Total	**9,134**		

This analysis could suggest that the average volumes per platform could be taken as being typical for the platforms in each segment. However, review of the actual platform voulmes indicates that such an averaging of the findings would be inappropriate, because it would disguise recent trends and would be distorted by factors specific to individual models.

A more valid comparison with EC92 conditions was obtained by selecting platform volumes achieved by the typical car models that are prominent in each segment, and adjusting for non-typical volume factors. The selected method has generated the following platform numbers and volumes, those that are taken for the purposes of this study as being representative of industry practice in EC85:

Segment	Number of Platforms	Typical Volume Per Platform (000)	Total Production (000)
Utility	3	110	330
Small	6	440	2,640
Lower Medium	6	525	3,150
Upper Medium	6	315	1,890
Large A	6	140	840
Large B	3	70	210
Total	**30**		**9,060**

2. Factors Affecting Changes in Platform Production Volumes in EC92

In the preceding section, analysis has been conducted of EC85 platform production volumes by segment and typical platform production volumes in EC85. In order to generate a comparison showing the effect of EC92 conditions on variable cost, the EC92 platform evolution is posited on the basis of operative trends. In EC92 the European platforms will be produced according to a different pattern as a consequence of the following factors:

a. Sharing of Platforms

EC92 conditions will substantially facilitate the sharing of platforms between and among makers, following trends that are already evident and that are forecast to prevail in EC92 (industry interviews). The elimination of physical barriers to joint engineering work, the establishment of common production protocols, the greater ease and lower cost of travel by engineers and executives, and the more rapid and assured movement of parts and assemblies throughout Europe will contribute to this sharing of platforms.

The research and analysis findings indicate that in EC92 the following numbers of platforms will be in use by the volume car producers, as a result of the primary factors shown:

SEGMENT	EC85	EC92	FACTORS
Utility	3	2	under volume pressure
Small	6	4	economies much needed
Lower Medium	6	4	economies much needed
Upper Medium	6	5	still very competitive
Large	9	6	economies much needed

b. Specialisation in Particular Segments

In EC92 conditions car and component makers will be able to implement more fully a policy of specialising in particular product segments to gain longer annual production runs and hence higher manufacturing efficiency. Such trends are already evident among EC car producers in vehicles such as the Fiat Uno in the Small segment and the VW Golf in the Lower Medium segment.

c. Forecast EC92 Platform Production Volumes

Taking into account the factors described, and extrapolating from current trends by considering the best performances being achieved by manufacturers in EC87 in the various segments, LAL has forecast the EC92 conditions for platform numbers and volumes. To permit direct comparison with Ec85 conditions in the subsequent calculations, the total production volumes for both sets of platforms are held at the same level. The platform production volumes by segment for EC92 are as follows:

Segment	**Number of Platforms**	**Volume Per Platform (000)**	**Total Production (000)**
Utility	2	160	320
Small	4	650	2,600
Lower Medium	4	800	3,200
Upper Medium	5	380	1,900
Large A	4	220	880
Large B	2	80	160
Total	**21**		**9,060**

C. AUTO PRODUCTION ECONOMIES OF SCALE

This section describes the methodologies that have been employed for the analysis of the economies of scale and, subsequently, the automobile cost and price changes that are forecast to occur in the change from EC85 to EC92 conditions.

The work described in this section is based on the assumption that no change in overall industry volume occurs in the first iteration of the effects of EC92. Volume changes in later iterations are possible according to the indirect dynamic effects experienced, described and quantified in Section VI.

1. Variable Costs

By applying the findings concerning EC92 platform volumes to the trend data established on variable costs, the total level of car variable cost under EC92 conditions has been established. The change from EC85 thus identified can be attributed to the direct effects of EC92, because the overall level of Community production is assumed to remain static. Thus the identified cost savings arise from the structural changes in production for which the catalyst and prime mover is the introduction of EC92 conditions.

The following tables utilise the cost/volume graph of variable cost (Figure 3 Page 73) which has been used to establish the levels of variable cost per unit that are applicable at the platform volumes postulated to prevail when EC92 conditions are in existence.

The tables show that overall there is a 2.36 percent reduction in aggregate variable costs, worth 898.9 million Ecu. In terms of unit variable costs, the largest percentage decreases occur in the Utility and Large A segments, where the relatively low EC85 platform production volumes allow considerable scope for improved economies of scale.

The findings show that the scope for economies of scale decrease as the volume increases. A 45 percent increase in platform volume in the Utility segment brings about unit cost reductions of 3.4 percent, while in the higher-volume Lower Medium segment a 52 percent increase in platform volume brings about a lower 2.9 percent reduction of unit variable cost. This reflects the impact of the flattening-out of the variable cost curves illustrated in Figure 3.

Table V.16

PLATFORM VARIABLE COSTS
AT TYPICAL ANNUAL VOLUMES

Status: 1985 costs in Ecu

SEGMENT	EC85		EC92		DIFFERENCE	
	Typical Volume Per Platform	Unit Cost	Postulated Volume Per Platform	Unit Cost	VARIABLE COST ECU	%
UTILITY	110,000	2050	160,000	1980	70	3.4
SMALL	440,000	2765	650,000	2690	75	2.7
LOWER MEDIUM	525,000	3955	800,000	3840	115	2.9
UPPER MEDIUM	315,000	5115	380,000	5055	60	1.2
LARGE A	140,000	7530	220,000	7295	235	3.1
LARGE B	70,000	7960	80,000	7875	85	1.1
LARGE Volume-weighted average		7616		7384	223	2.9

2. Fixed Costs

The selected approach to quantifying the impact of EC92 on fixed costs is to apply to the fixed cost structure the findings on platform volumes, and to establish the impact that these changes in production methods will have on overheads and fixed costs. The specific effects of the projected EC92 platform changes on the fixed cost categories are outlined in the following sections on tooling costs, engineering costs, warranty and other fixed costs.

a. Tooling Costs

Based on the assumption that the automobile manufacturers continue to finance the initial tooling costs incurred by the component suppliers, the principal tooling cost savings will result from the economies of scale caused by the higher platform volumes and longer production life cycles in EC92. These savings will take effect at both the component and car producer/assembler levels.

However, the tooling cost per automobile produced will not decrease in direct proportion to the increase in volume produced. This is because not all tooling costs relate to the platforms and other commonised components. In EC92 the automobile manufacturers will still continue to produce a large number of superficially different models, with discrete external sheet metal, while they utilise more common platforms.

Thus no additional economies of scale, with regard to tooling, are assumed to be achieved for the body shell or other differentiated parts. This is due to the fact that they will be produced in broadly similar volumes in EC92 as in EC85. For this study it has been assumed that approximately 50 percent of tooling costs relate to areas which can be commonised, and thus where direct economies of scale will be realised.

Apart from the above-mentioned economies of scale at vehicle producer level, there will be an additional cost saving across all areas of automobile tooling. This cost saving is associated with changes occurring in EC92 in the parts/materials sector.

It is envisaged that the development of large basic parts suppliers capable of an order of magnitude higher production volume will be accelerated by EC92. The economies of scale associated with this development will reduce fixed as well as variable costs.

Table V.17

TOOLING COST COMPARISON

	Utility	**Small**	**Lower Medium**	**Upper Medium**	**Large**
EC85 Unit Cost (Ecu)	265	350	305	580	680
EC92 Unit Cost (Ecu)	221	291	250	525	551 (a) 631 (b)

Total Tooling Costs

	Utility	**Small**	**Lower Medium**	**Upper Medium**	**Large**	**Total**
EC85	87,450	924,000	960,750	1,096,200	714,000	3,782,400
EC92	70,720	756,600	800,000	997,500	585,840	3,210,660
COST SAVING (000 Ecu)						**571,740**

b. Engineering

As a consequence of the move to EC92 the benefits in terms of engineering fixed cost reductions are threefold, as follows:

i. Scale Economy Improvements

As a direct result of the reduction in the number of platforms being utilised, the fixed cost element of engineering will be spread over a higher production volume per platform, bringing about economies of scale.

As with tooling costs, the beneficial effects of economies of scale will not occur in direct proportion to the platform volume increases. A substantial element of the fixed engineering costs relate to areas of the automobile which will remain distinctive and unaffected by platform developments. The relevant saving will be reduced by the approximately 50 percent of the componentry of the automobile that is in those areas which will continue to be differentiated.

ii. Component Commonisation

An indirect consequence is forecast to flow from the greater use of common components. This will occur because the actual cost of designing the automobile will fall as a 'learning curve effect' is experienced through the use of already tried and tested components/designs.

It may be taken from the preceding elements of this study that up to 20 percent of automobile components could be commonised. If the use of common engineering design and testing for these components yields a 25 percent saving in terms of design time/costs, the total engineering cost saving will be in the region of 5 percent.

iii. Staff/Overhead Savings

An element of the fixed cost of engineering which must be borne by the finished vehicle is the cost of retaining an in-house engineering/product maintenance department. As a result of the simplification of type approval procedures and the greater use of common components it would be reasonable to expect some savings in this area, as discussed in Section IV. These savings would be in the order of 0.5 percent.

Table V.18

ENGINEERING COST COMPARISON

Fixed Engineering Cost Per Unit	**Utility**	**Small**	**Lower Medium**	**Upper Medium**	**Large**
EC85 (Ecu)	160	210	275	360	505
EC92 (Ecu)	127	166	215	311	390 (a)
					447 (b)

Total Fixed Engineering Cost

	Utility	**Small**	**Lower Medium**	**Upper Medium**	**Large**	**Total**
EC85	52,800	554,400	866,250	680,400	530,250	2,684,100
EC92	40,640	431,600	688,000	408,500	414,720	1,983,460
COST SAVING (000 Ecu)						**700,640**

c. Warranty

The cost of providing warranty cover on automobiles should be reduced by the effects of the change to EC92, as a result of three factors. First, the longer annual production runs per platform should enable the cost of any service failures to be spread more widely, resulting in a lower unit cost.

Second, the use of well tried and tested common components and designs should further reduce such failures, especially during the warranty or early-life failure period of a vehicle.

Third, in EC92 the direct communication between dealer and manufacturer will remove a tier of administration in dealing with warranty claims, and also remove an added administrative cost on the sale of warranty parts in cases where the manufacturer deals directly instead of through a national importer. Overall warranty cost savings in the region of 10 percent could therefore be expected.

Table V.19

WARRANTY COST COMPARISON

Warranty per Unit	**Utility**	**Small**	**Lower Medium**	**Upper Medium**	**Large**
EC85 (Ecu)	90	135	175	265	355
EC92 (Ecu)	81	122	158	239	320

Total Warranty Provision

	Utility	**Small**	**Lower Medium**	**Upper Medium**	**Large**	**Total**
EC85	29,700	356,400	551,250	500,850	372,750	1,810,950
EC92	25,920	317,200	505,600	454,100	332,800	1,635,320

COST SAVING (000 Ecu) **175,330**

d. Other Fixed Costs

i. Administration and Other Overheads

At present the manufacturers indirectly finance the costs that dealers incur by holding stocks of their automobiles. This is because the national importers, which are often owned and run (albeit with a degree of autonomy) by the manufacturers, directly finance the dealers' inventory. Since the cost of finance is an overhead to be borne by productive output, any steps which are taken to reduce these stocks and the resulting finance costs will reduce the overhead cost of producing automobiles.

If, by exploiting the potential of EC92 for improved shipping and communications, the manufacturers and the national importers succeed in reducing the stock inventory period in Europe by one month, the saving to the producers, in their cost of financing, could be as much as 213,333,000 Ecu.

ii. Selling and Marketing

An immediate cost reduction in sales and marketing will be a consequence of the increased interpenetration of the market by car makes and models in EC92. The model ranges offered by makers throughout the EC will differ country-by-country less than they do in EC85. This will allow increased pan-European advertising, promotion and launching of automobiles, which in turn will allow the fixed cost element of preparing the relevant promotional material to be reduced.

It is estimated that a saving of 5 percent in the cost of advertising could be obtained by the centralisation of advertising/marketing budgets and the greater use of common material. This is expected to generate savings in the region of 42,476,000 Ecu.

Table V.20

SUMMARY OF FACTORY FIXED COST SAVINGS (000 Ecu)

Tooling	571,740
Engineering	700,640
Warranty Provision	175,330
Administration/Finance Costs	213,333
Advertising	42,476
FIXED COST SAVING	**1,703,519**

The total saving thus achieved represents 11.5% of total factory fixed costs.

3. Non-Factory Costs/Overheads

Other costs, including those of distributing vehicles from the factory to the marketplace, have an impact on the price at which the car is sold to the dealer and eventually to the consumer. Though not a principal focus of the study requested by the Commission, such costs require a brief review.

The principal overhead in this category is the cost of maintaining national importer organisations in the respective EC Member States. The direct business relations between manufacturer and dealer which will be stimulated by EC92 conditions will significantly reduce this cost to the manufacturer by allowing relatively slimmed-down national offices to replace national sales companies. An initial costing of the magnitude of the potential savings in this area suggests a level of 1,600 million Ecu.

Potential savings also derive from an attribute of the current delivery chain, from producer to consumer, which directly impacts upon the retail price. Referred to is the practise of adding a company charge at each point of transfer. In addition to the variable and fixed cost savings on ex-factory costs/prices already discussed, a company cost is also incurred as part of the delivery charge from the storage compound to the customer.

In EC92 the direct communication between dealer and producer will lead to the dealer taking up functions that were previously within the domain of the national importer. This is likely to include order and payment for vehicles in advance at the factory gate and dockside collection where required. The removal of the intermediate role of the national importer will reduce this layer of cost, which under EC85 conditions has a magnitude of more than 400 million Ecu.

VI. DIRECT/DEFERRED EFFECTS OF EC92

The conclusions of the study have been organised in accord with a specified EC Commission format, which provides for responses showing the effects of given topic areas in key EC countries and in the Community as a whole. The study findings reported in this section are organised according to the Commission format.

A. SHARE OF VALUE ADDED IN FINAL DEMAND

This establishes the percentage of the retail value of car and component sales within the EC and Member States that is represented by the value added by the home country producers.

Table VI.1 (percentages)	West Germany	France	Italy	UK	Other	Total
	31.6	21.1	20.2	17.9	4.2	20.6

The findings were determined by applying the gross value added (GVA) percentage to the retail value of production retained within each home market and comparing the resulting value to the retail value of total sales in that market.

The results show clearly that the high GVA percentage applicable to West German production, when combined with the low value of import penetration, gives a relatively high percentage of GVA in final demand for Germany.

For France and Italy, two countries with broadly similar GVA shares of final demand, there are quite different contributory factors. Italy has a relatively high GVA percentage combined with a high value percentage of import penetration. In France the GVA percentage is lower, as is the value percentage of import penetration.

The UK has a GVA percentage second only to West Germany, but because it has by far the highest value percentage of import penetration it has the lowest GVA share of final demand.

B. SHARE OF VALUE OF PRODUCTION IN TOTAL DEMAND

This establishes the share of retail sales in the home market that is accounted for by home production.

Table VI.2 (percentages)	West Germany	France	Italy	UK	Other	Total
	79.5	71.2	60.2	51.2	15.8	59.1

C. SHARE OF VALUE ADDED EXPORTED

This establishes the percentage of value added that is exported.

Table VI.3 (percentages)	West Germany	France	Italy	UK	Other	Total
	48.6	38.9	26.0	28.4	79.5	46.5

The findings confirm that West Germany is very export-orientated and also that the other EC producing countries, which are dominated by Belgium and Spain, produce principally for the export market. It also shows the very important role that the home market plays for UK and Italian producers, and thus the threat which further import penetration would pose to the home producers in these countries.

D. CHANGE IN UNIT COST OF PRODUCTIVE LABOUR

Table VI.4 (percentage reduction)	West Germany	France	Italy	UK	Other	Total
	8.9	12.3	13.3	9.7	12.2	11.00

The LAL study of automobile costs indicates that under EC85 conditions labour accounts for approximately 22 percent of variable costs. Although considerable variation between individual countries does exist, it is anticipated, on the basis of interview findings and LAL analysis, that the introduction of EC92 conditions will further enhance trends in labour utilisation which are already being observed, such as the use of robotics and the increased automation of previously manually performed tasks. LAL concludes that under EC92 conditions the share of vehicle variable cost attributable to labour will fall from 22 to 20 percent across the car segments.

By analysing the manner in which variable costs move in the transition from EC85 to EC92 across the five car segments, and by weighting this change by reference to the significance of each segment in the total production of each country, the above reductions in unit labour costs have been established.

E. CHANGE IN DIRECT UNIT COST OF PRODUCTION

Total unit cost of production has been taken as including variable cost plus those fixed costs directly attributable to production.

Table VI.5	West Germany	France	Italy	UK	Other	Total
Reduction (%)	2.93	4.49	4.94	3.09	4.25	3.50
Attributable to:						
Labour savings	1.55	2.53	2.84	1.75	2.49	1.97
Intermediate	0.15	0.32	0.34	0.01	0.12	0.17
Tooling savings	1.23	1.64	1.76	1.33	1.64	1.36

The total cost saving in percentage terms is a consequence of those reductions in labour unit costs, lower costs of producing and/or procuring components, and also to those reductions directly attributable to the changes in platform volumes.

The largest change occurs in the Italian automobile industry, where a high level of labour content gives the greatest scope for productivity gains and also where output is heavily concentrated in those product segments where considerable scope for economies of scale occur.

F. CHANGE IN TOTAL UNIT COST OF PRODUCTION

This finding reflects the total EC92 change in unit costs/prices. It includes those fixed costs/overheads that are not directly attributable to production, but are included within the ex-factory cost of vehicles in each segment.

Table VI.6 (percentage reduction)	West Germany	France	Italy	UK	Other	Total
Total	4.34	5.54	5.68	4.30	5.32	5.00
Attributable to:						
Pure Cost	4.80	4.90	5.00	4.80	4.90	5.09
Restructuring	(0.46)	0.64	0.68	(0.50)	0.42	(0.09)

The magnitude of change is greater than for production costs alone because the fixed cost element of total unit costs experiences a higher percentage change in the transition from EC85 to EC92 conditions. However, the change differential between countries is lower because the segments exhibit similar platform volume behaviour from one country to another.

Pure cost savings are defined as those savings which would occur as a result of the development of platform sharing, technical advances and other changes brought about by the move to EC92. This excludes the changes in overall segment volumes brought about by a restructuring of production. The overall impact of the restructuring has been to reduce the potential benefits because the restructuring involves a shift in emphasis towards the high-volume Lower and Upper Medium segments. The greatest pure cost reductions occur in the lower volume segments, where the potential economies of scale are greatest. The variations between countries reflect the different segment mixes in their car production.

G. CHANGE IN LABOUR PRODUCTIVITY

Table VI.7 (percentage improvement)	West Germany	France	Italy	UK	Other	Total
	9.93	14.42	15.76	10.87	14.09	12.58

Labour productivity is defined as output of vehicles per person employed in the industry. The change in labour cost per unit produced, outlined above, is assumed to occur as a result of the reduction of manning levels. Given the underlying assumption of static production volumes, this brings about the improvements shown in labour productivity.

H. CHANGE IN CAPITAL PRODUCTIVITY

Table VI.8 (percentage improvement)	West Germany	France	Italy	UK	Other	Total
	16.64	17.63	19.33	18.50	17.41	17.48

Tooling costs have been used as a proxy for productive capital investment. This is judged to be valid because the tooling cost per unit is effectively the aggregate capital investment amortised over the number of automobiles a manufacturer produces. Given that the study assumption at this stage is that the volume produced remains static, any changes in tooling cost per unit reflect the change in aggregate capital invested and thus in productivity.

I. CHANGE IN PRODUCTIVE INVESTMENTS

Productive investments are taken as consisting of the book value of tangible fixed assets plus the level of research and development expenditure. Reductions in the level of capital investment will be possible in EC92 because the increased level of platform sharing will facilitate more efficient utilisation of plant and machinery. To produce the same volumes and model variations in EC92 as those achieved in EC85, fewer production machines will be required.

Table VI.9 (percentage reduction)	West Germany	France	Italy	UK	Other	Total
Scenario A	14.95	16.73	18.30	16.97	16.12	16.15
Scenario B	12.90	14.90	17.30	14.20	14.90	14.30

In Scenario A, R&D expenditure stays at constant levels. In this Scenario, the change in productive investments will be the change in capital productivity weighted for the importance of tangible fixed assets. In Scenario B, auto manufacturers will take advantage of the cost savings arising from the move to EC92 conditions to invest one percent of total costs in advanced research and development, in order to maintain their products at a high level of international technological competitiveness.

Amounting to 600 million Ecu, the resulting advanced R&D funding is assumed to be distributed amongst producing countries in proportion to the total costs which each accounted for in EC85.

R&D development expenditure has two effects which can be classified into direct and deferred. The direct effect of such expenditure is to reduce auto manufacturers' profits, raise ex-factory prices and depress demand. There is, however, a deferred consequence which encourages such expenditures to take place. This is the R&D expenditure which can lead to improvements in the utilisation of both raw materials and machinery, thus reducing the unit cost of production, and reducing the price of the car and hence increasing demand in the longer term.

J. EC MARKET VOLUMES

Table VI.10 (absolute increases in units sold)	West Germany	France	Italy	UK	Other	Total
Domestic market:						
Scenario 1 (000)	72.3	42.8	45.2	35.3	24.8	220.4
Scenario 2 (000)	51.7	32.9	41.1	29.6	17.8	173.1
EC-XII market: (excluding domestic)						
Scenario 1 (000)	70.3	63.9	21.9	5.7	76.7	238.5
Scenario 2 (000)	45.6	53.4	14.5	2.9	54.3	170.7
Extra-EC-XII market:						
Scenario 1 (000)	55.9	33.4	8.7	5.8	12.5	116.3
Scenario 2 (000)	38.7	21.6	5.1	2.9	8.4	76.7
EC-Producer Totals:						
Scenario 1 (000)	198.6	140.2	75.9	46.8	113.9	575.4
Scenario 2 (000)	136.0	107.9	60.7	35.4	80.5	420.5

The changes shown for Scenario 1 in units sold in the home market, the EC-XII market (excluding home country sales) and the Extra-EC-XII market are a consequence of the application of an elasticity of demand factor to the percentage change in production prices calculated above.

The changes shown in Scenario 2 in units sold assume that the non-EC producers will respond to the new EC market conditions and reduce their own prices. Their price reductions are expected to be mid-way between EC85 position and that calculated for EC92.

Studies of demand behaviour have indicated that the automotive elasticity of demand factor for the European Community countries is typically in the region of -1.2 (Ref. Prof G Rhys). This factor has been employed for the purposes of this study.

Strictly speaking this factor may not be appropriate when applied to exports of automobiles outside the EC, since each export market will have a different elasticity of demand for imports from the EC. In the absence of specific information on the elasticity of demand in foreign markets, LAL consider that the application of the -1.2 factor is preferable to not estimating the effect on this important source of sales.

In Scenario 1, to assist in the quantification of the effects of price changes on the structure of consumer demand in the EC, recourse has been made to the following assumptions:

1. That Extra-EC producers of automobiles are unable or unwilling to respond to EC producer price decreases.

2. That a process of substitution of demand takes place in favour of EC automobile producers, so that existing purchasers of non-EC produced cars will change their purchase decision to EC-produced cars in proportion to the percentage decline in their prices.

K. CHANGES IN NON-EC IMPORTS

Table VI.11 (percentage reduction of units)	West Germany	France	Italy	UK	Other	Total
Scenario 1	39	100	100	35	23	42
Scenario 2	24	84	90	19	13	28

The findings for both pricing scenarios shown in Table 21 illustrate that the price reduction in EC-produced cars developed above for EC92 has the effect of reducing the sales volumes of non-EC producers' imports. The percentage reduction in sales for Scenario 2 is lower due to the non-Ec producers responding to EC92 by reducing their own prices.

The largest degree of change is forecast in those countries where non-EC imports represent a small percentage of sales in EC85. Thus the effect is most notable in France and Italy, where non-EC imports would effectively cease to hold any meaningful market share.

Full appreciation of the basis for this forecast may be derived from a study of the market conditions that obtain in the affected countries. In Italy, non-EC imports account for only 9 percent of total imports and less than 5 percent of sales. Of the non-EC imports, 60 percent are from East European producers and a further 33 percent are from the developing countries. These producers, often utilising antiquated technology, compete chiefly on price. Thus one could postulate the virtual complete elimination of such demand. However, it is difficult to assume that there would not be any response to the EC manufacturer price decreases.

France is another country with a low percentage of non-EC imports and a significant East European content in those imports. Thus similar results to those of Italy will occur.

The 'other' EC countries have a high non-EC import penetration; 26 percent of all imports are from outside the EC-XII, of which 76 percent are from Japan and a further 4 percent from EFTA countries. These producers are not competing solely on price and therefore the reduction in imports from those sources in response to EC price reductions will be less marked.

In respect of France and Italy it is likely that the impact of price reductions is overstated. This is because the import quotas for Japanese automobiles distort the pattern of demand. In the absence of a specific study on the impact of such quotas it would be prudent to regard the findings as the best estimates of what is achievable.

VII. DYNAMIC EFFECTS OF EC92

The cost savings described and computed in Sections V and VI consist of the deferred direct consequences of introducing EC92 conditions. They are the savings/efficiencies that result from the actions taken by the auto industry to make full use of the potential of EC92. As noted they have been calculated on the basis that the total EC auto market volume remains static; thus they omit the dynamic effects that are a consequence of the price reductions that the lower manufacturing costs make possible.

In this section, the dynamic consequences are analysed and discussed. In a sense, the dynamic consequences are infinitely iterative. Each dynamic improvement has the potential to reduce costs further, and thus to trigger a further dynamic improvement. In order to simplify analysis, LAL eschewed the creation of a multi-period dynamic model of single-market Europe because beyond the initial period it would be increasingly difficult to distinguish between direct EC92 consequences and those effects that stem from secondary developments.

It is evident that as a result of the initial direct benefits of EC92 a multiplier effect will be initiated that will be felt for a number of years. In successive stages this multiplier effect will take the following form:

1. The EC92 conditions liberalise internal trade and stimulate commonisation of parts and platforms, leading to lower costs.

2. Due to intense competition and underutilised total industry capacity, the cost savings will be passed on to the consumer through lower real prices, less an allowance for intensified advanced R&D expenditure.

3. The increased price competitiveness of EC-produced automobiles vis-a-vis non-EC production leads to increased demand for vehicles from EC production, both inside and outside the Community.

4. The greater EC volumes produced as a result of (3) will allow additional economies of scale to be achieved and exploited and, as a result, a further stimulation of demand will occur.

A domestic direct/dynamic cycle very similar to this, built on an initial advantage of lower net labour costs, allowed the Japanese motor industry to make the inroads into world markets that it achieved, beginning in the 1970s. Now, however, the Japanese compete more on quality, style, technology and reliability than on the price differential that gave them their world market entree.

In part as a consequence of the appreciation of the Yen, Japanese makers have restructured their product lines for export. As a result their penetration has been steadily moving up-market, into the Lower and Upper Medium segments, and is forecast to be directed even higher. Thus it is conceivable that under EC92 conditions the European volume producers will be able to regain the grip on the 'value for money' auto market that seemed, in the early 1980s, to be lost to them forever.

For these effects to take place as outlined, the demand for EC automobiles must be sufficiently price elastic to give the manufacturers and their distributors an incentive to pass on cost savings to the retail level. Studies by Prof Garel Rhys of University College at Cardiff, Wales indicate that the European market price elasticity of demand is approximately -1.2 to -1.3 for consumer goods and for automobiles is in the range of -1.0 to -1.5.

LAL has elected to take a prudent view by selecting a figure of -1.2 for auto price elasticity across the EC market. On this basis, for every 1.0 percent decline in price, demand will increase by 1.2 percent. This price elasticity factor was employed in generating the responses to EC Commission requirements as described in Section VI. It triggered significant changes in the pattern of demand/trade.

The dynamic effects are also highly relevant with respect to the total impact of EC92 on auto industry employment. The response in Section VI dealing with labour productivity in EC92 envisaged that improved labour productivity would occur, with a concomitant reduction in the labour requirement. This finding, however, was based on the direct effect assumption that production remained static in the move to EC92.

As the dynamic effects of EC92 are realised, a proportional increase in the requirement for labour will occur. The price elasticity calculation indicates that the 5 percent reduction in price arrived at as a result of the direct effects will (multiplied by the 1.2 elasticity) increase demand for vehicles produced in the EC by at least 6 percent initially. If employment is recouped at the same rate, the employment reduction that would be assumed from the productivity improvement of EC92 would be approximately halved.

A further recoupment of employment is seen as having the potential to occur in EC92. It will be accelerated as the multiplier process outlined earlier begins to take effect. In EC92 demand may prove to be more price elastic than the -1.2 factor taken for this calculation. Also, the improved export potential of EC production resulting from the price reduction may outperform the selected price elasticity factor.

In concert, these considerations offer the potential for a European car industry in EC92 which is a substantially more rationalised and vigorous international competitor, and which at the same time maintains a level of employment that is little changed from the present.

Annexe 1

THE DIMENSIONS OF THE CAR AND COMPONENT INDUSTRIES AND MARKETS IN EUROPE

1985 - CARS SUMMARY

All in Bn Ecu

COUNTRY	PROD'N	----MARKET---		--------EXPORTS---------		
		Ret	W/Sale	Intra	Extra	Total
Germany	34.6	19.3	16.1			24.1
France	13.9	12.9	12.2			6.6
UK	7.3	14.6	12.3			2.2
Italy	6.6	12.0	9.2			2.1
Bel/Lux	7.1	2.3	2.6			7.1
Spain	5.2	4.2	2.9			3.2
Netherlands	0.8	3.5	2.4			0.6
Denmark	-	1.1	0.9			-
Ireland	-	0.8	0.6	-	-	-
Greece	-	1.1	0.9	-	-	-
Portugal	-	0.6	0.4	-	-	-
Non-Add	(3.5)*					
Totals	72.0	72.4	60.5	-	-	45.9

E = Estimate
* = Allowance for doublecounting of production, basically completed cars in both Belgian and German values

Exports at Fob values.

COMPONENT MARKETS IN EUROPE - UPDATE TO 1985

1985 SUMMARY

All in Bn Ecu

COUNTRY	TOTAL PROD'N	LOCAL USE	EXPORTS	IMPORTS
Germany	19.7	19.0	2.3	1.6
France	10.0	8.3	2.7	1.0
UK	4.7	4.5	1.2	1.0
Italy	3.8	3.6	0.6	0.4
Bel/Lux	2.4	5.2	0.4	3.2
Spain	2.6	3.1	0.5	1.0
Netherlands	0.5	0.6	0.2	0.3
Denmark	-	-	-	-
Ireland	-	-	-	-
Greece	-	-	-	-
Portugal	-	-	-	-
TOTAL	43.7	44.3	7.9	8.5

GERMANY

	1984	1985	%age
Production Volume(000units)	3.754	4.167	+11.0%
Total export value	20.2	24.05Bn Ecu	
Total export Units	2.231,000	2,800.484	
Value per unit	9.059	8.588Ecu	-5.2%

This reduction probably due to the fall in the $ - ignore. Assume as inflation.

	1984	1985	
Made and sold domestically	1.523	1.367	
Assumed unit value	7,500	7.700	
Value of German Production	31.5Bn Ecu	34.6Bn Ecu	
=	70.6Bn DM	77.1Bn DM	
TIV units	2,393.939	2,379,261	-0.5%
Import values Bn Ecu	5.4	5.6	
Wholesale value of German Market	17Bn Ecu	16.1Bn Ecu	
=	38.1Bn DM	35.9Bn DM	

Market value estimates

	MARKET REVENUES (Bn DM)		MARKET REVENUES (Bn ECU)	
	INCL TAX	EXCL TAX	INCL TAX	EXCL TAX
GERMANY - 1984	47.7	42.5	21.3	19.0

	1984	1985	%age
Volume of sales	2394	2379	-0.63%
Unit value of sales		+2.0%	

GERMANY - 1985	49.3	43.1	21.7	19.3

FRANCE

	1984	1985	%age
Production Volume(000units)	2,713	2,632	-3.0%
Export value	5.76	6.55Bn Ecu	
Export volume	1,503,000	1,288,463	
Value per unit	3,833	5,085	+32.7%

This probably reflects the dramatic reduction in kits to the US.
Market sales mix weakened - Assume no actual increase %

	1984	1985	
Assumed unit value	5,500	5,500	
Made and sold domestically	1,210,000	1,344,000	+11.1%
Value of French Production	12.4Bn Ecu	13.9Bn Ecu	
=	85.2BnFFr	94.9Bn FFr	
Import value	4,126	4,802	
TIV units	1,757,673	1,766,328	+0.5%
Wholesale value of French Market	10.8Bn Ecu	12.2Bn Ecu	
=	74.2Bn FFr	83.0Bn FFr	

Market value estimates

	MARKET REVENUES (Bn FFr)		MARKET REVENUES (Bn ECU)	
	INCL TAX	EXCL TAX	INCL TAX	EXCL TAX
France - 1984	111.3	83.7	16.2	12.1

	1984	1985	%age
Volume of sales	1758	1766	+0.45%
Unit value of sales		+4.4%	

France - 1985	116.7	87.8	17.2	12.9

UNITED KINGDOM

	1984	1985	%age
Production Volume(000units)	910	1,048	+15.2%
Export value	1.69	2.16	+28.0%
Export volume	201	226	
Value per unit	8400	9557	
Made and sold domestically	717	822	
Assumed ave. unit value	6000	6250	
Value of Production	6.0Bn Ecu	7.3	
=	3.5Bn	4.3	
Import value	6.19	7.04	
Wholesale value of Market	10.5Bn Ecu	12.3Bn Ecu	
=	6.2Bn	7.2Bn	

Market value estimates

	MARKET REVENUES (Bn)		MARKET REVENUES (Bn ECu)	
	INCL TAX	EXCL TAX	INCL TAX	EXCL TAX
UK - 1984	9.7	7.8	16.4	13.2

	1984	1985	%age
Volume of sales	1750	1832	+4.7%
Unit value of sales		+5.5%	

	INCL TAX	EXCL TAX	INCL TAX	EXCL TAX
UK - 1985	10.7	8.6	18.2	14.6

ITALY

	1984	1985	%age
Production Volume(000units)	1,439	1,389	-3.5%
Export value	2.04	2.13Bn Ecu	
Export units		449,803	
Value per unit(Ecu)		4,725	+11.3%

Assume correct value, +5% vs 4,500 assumed for 1984.

	1984	1985	
Made and sold domestically		940	
Value of Italian Production	6.5Bn Ecu	6.6Bn Ecu	
=	9.0KBnItLi	9.5Bn ItLi	
TIV	1,592.367	1,646,106	+3.4%
Import Value	4.069	4.719	
Wholesale value of Italian Market	= 8.5Bn Ecu	9.2Bn Ecu	
=	11.7KBn ItLi	13.2Bn ItLi	

Market value estimates

	MARKET REVENUES (Bn ItLi)		MARKET REVENUES (Bn ECU)	
	INCL TAX	EXCL TAX	INCL TAX	EXCL TAX
Italy - 1984	19.4	15.4	14.0	11.1

	1984	1985	%age
Volume of sales	1592	1664	+4.5%
Unit value of sales		+8.4%	

Italy - 1985	22.0	17.4	15.2	12.0

BELGIUM/LUXEMBOURG

	1984	1985	%age
Production Volume(000units)	865		
Export value Bn Ecu	5.19	6.21	+19.7%
Export volume			
Value per unit			
Value of Production	6.0Bn Ecu	7.1Bn Ecu	
=	270Bn BFr		
TIV	369.977	378.239	+2.2%
Wholesale value of Market	2.5Bn Ecu	2.6Bn Ecu	
=	114Bn BFr	117Bn Hfl	

Market value estimates

	MARKET REVENUES (Bn BFr)		MARKET REVENUES (Bn ECU)	
	INCL TAX	EXCL TAX	INCL TAX	EXCL TAX
Bel/Lux - 1984	122	99	2.7	2.2

	1984	1985	%age
Volume of sales	380	390	+2.6%
Unit value of sales		+4.8%	

Bel/Lux - 1985	131	106	2.9	2.3

SPAIN

	1984	1985	%age
Production Volume(000units)	1,177	1,230	+4.5%
Export Volume	708	762Kunits	
(EEC	645	690)	
Value	2.4Bn Ecu	3.21E	
(EEC		2.91)	
Unit export value		4221	
made and sold domestically	469	468	
Value of Production	5.0Bn Ecu	5.2Bn Ecu	
TIV	522	575	
Imports from EEC		0.832Bn Ecu	
Non-EEC imports ~5% - Total		0.88	
Units		107	
Wholesale value of Market	2.5Bn Ecu	2.9Bn Ecu	

Market value estimates

	MARKET REVENUES (Bn Psta)		MARKET REVENUES (Bn ECu)	
	INCL TAX	EXCL TAX	INCL TAX	EXCL TAX
Spain - 1984	565		4.5	3.4

	1984	1985	%age
Volume of sales	522	575	+10.2%
Unit value of sales		+7.9%	

Spain - 1985	672		5.6	4.2

NETHERLANDS

	1984	1985	%age
Production Volume(000units)	109	110	+0.9%
Export Volume	85		
Export value	0.57	0.6Bn Ecu	
Value per unit			
Value of Dutch Production	0.8Bn Ecu	0.8	
=	2.0Bn HFl	2.1	
TIV	461.391	495,685	+7.4%
Import value	1.98	2.23	
Wholesale value of Dutch Market	2.2Bn Ecu	2.4Bn Ecu	
=	5.6Bn HFl	6.1Bn HFl	

Market value estimates

	MARKET REVENUES (Bn Gu) INCL TAX	MARKET REVENUES (Bn Gu) EXCL TAX	MARKET REVENUES (Bn ECU) INCL TAX	MARKET REVENUES (Bn ECU) EXCL TAX
Netherlands - 1984	10	8.3	4.0	3.3

	1984	1985	%age
Volume of sales	461	496	+7.6%
Unit value of sales		+0.8%	

Netherlands - 1985	10.8	8.9	4.3	3.5

OTHER COUNTRIES

DENMARK

	1984	1985	%age
TIV	134	157	+17.2
Inflation		+5%	

1984 - Total Revenue 134Bn Kr = 1.5Bn Ecu tax inclusive
= 0.8Bn Ecu tax exclusive

1985 - Total Revenue 164Bn Kr = 2.0Bn Ecu tax inclusive
= 1.1Bn Ecu tax exclusive

PORTUGAL

	1984	1985	%age
TIV	85.6	104.2	+21.7
Inflation		+22%	
of 23% VAT			

1984 - Total Revenue 60Bn Esc = 0.5Bn Ecu tax inclusive
= 0.4Bn Ecu tax exclusive

1985 - Total Revenue 89Bn Esc = 0.7Bn Ecu tax inclusive
= 0.55Bn Ecu tax exclusive

GREECE

	1984	1985	%age
TIV	86.0	109.4	+27.2%
Inflation		+30	

1984 - Total Revenue 93Bn Dr = 1.1Bn Ecu tax inclusive
= 0.8Bn Ecu tax exclusive

1985 - Total Revenue 153Bn Dr= 1.45Bn Ecu Tax inclusive

= 1.06Bn Ecu Tax exclusive

IRELAND

	1984	1985	%age
TIV	67.6	70.8	+4.7
Inflation		+5%	

1984 - Total Revenue 0.55Bn Pt = 0.8Bn Ecu tax inclusive
= 0.6Bn Ecu tax exclusive

1985 - Total Revenue 0.60Bn Pt = 0.8Bn Ecu tax inclusive
= 0.6Bn Ecu tax exclusive

GERMANY

Estimated value of German car production is approximately 34.6Bn Ecu at wholesale values.

Estimated proportion of the production value bought-out at 55%.

Component market Values

Absorbed by German car production	19.0Bn Ecu
Exports of components	2.3Bn Ecu
Imports	1.6Bn Ecu
Hence:	
Value of German component production	19.7Bn Ecu

FRANCE

Value of French car production is 13.9Bn Ecu

Estimated 60% of French production value is bought-out.

Hence;

Component market Values

Absorbed by French car production	8.3Bn Ecu
Exports of components	2.7Bn Ecu
Imports	1.0Bn Ecu
Hence:	
Value of French component production	10.0Bn Ecu

ITALY

Estimated value of Italian car production is 6.6Bn Ecu

Estimated that approximately 55% of French production value is bought-out.

Hence;

Component market Values

Absorbed by Italian car production	3.6Bn Ecu
Exports of components	0.6Bn Ecu
Imports	0.4Bn Ecu

Hence:

Value of Italian component production	3.8Bn Ecu

UNITED KINGDOM

Purchases in Britain in 1985 (M) - Sourced T & I committee

ARG - 802M.	Stated
Ford - 1413M.	Stated
Talbot - 75M.	Estimated at 15% of revenue - the bulk of component purchases coming from France in KD packs
Vauxhall - 55M	41% of Vauxhall unit sales were produced in the UK. Of this production, about 5% were components sourced in the UK.
Jaguar - 300M	Estimated from comments made to the Cttee.

Total 2645M = 4.5Bn Ecu

Hence;

Component market Values

Absorbed by British car production	4.5Bn Ecu
Exports of components	1.2Bn Ecu
Imports	1.0Bn Ecu

Hence:

Value of British component production	4.7Bn Ecu

BELGIUM

Estimated the value of car production at 7.1Bn Ecu.

Overall estimate of the integration level is around 73%.

Hence;

Component market Values

Absorbed by Belgian car production	5.2Bn Ecu
Exports of components	0.4Bn Ecu
Imports	3.2Bn Ecu

Hence:

Value of Belgian component production	2.4Bn Ecu

NETHERLANDS

The value of Dutch production has been estimated at 0.8Bn Ecu, Estimate integration level around 75%.

Hence;

Component market Values

Absorbed by Dutch car production	0.6Bn Ecu
Exports of components	0.2Bn Ecu
Imports	0.3Bn Ecu

Hence:

Value of Dutch component production	0.5Bn Ecu

SPAIN

Estimated value of Spanish production 5.2Bn Ecu.

Estimated integration level 60%

Hence;

Component market Values

Absorbed by Spanish car production	3.1Bn Ecu
Exports of components	0.5Bn Ecu
Imports	1.0Bn Ecu

Hence:

Value of Spanish component production	2.6Bn Ecu

PASSENGER CAR TRADE FLOWS WITHIN THE EEC

PASSENGER CAR TRADE FLOWS WITHIN THE EEC

METHOD

- This report has been prepared using published statistics from reputable sources with 1985 as the measurement year.

- Vehicle movement, sales and production statistics have been taken primarily from the Motor Vehicle Manufacturers' Association Year Book, 1987 edition, supported by the Society of Motor Manufacturers and Traders' Year Book, 1986 edition.

- Conflict exists over statistics between Built-up units and CKD units, particularly between Belgium and Germany, where both territories claim volume achievement.

  Where such conflict occurs, the country of final assembly/ production has been credited with the build figure, to avoid, as far as possible, double counting.

- This approach is also beneficial when ECU balances are considered, as relatively low transfer values between Germany and Belgium take account of the low product value of export KD content.

- Spain and Portugal are assumed to have had EEC membership in 1985.

  All values for these two countries are included in the EEC totals.

- Due to lack of statistical definitions for ECU values for Spain and Portugal, their quoted export ECU values are assumed as import EEC values for the destination country.

- To ensure least doubt over opening and closing stocks at year end, and any delays in recording, export volumes of cars from country A are also used as import volumes for country B on intra EEC transactions.

- Luxembourg values are included with Belgium.

- No car industry exists in :-

  Denmark
  Ireland
  Greece

  ECU values for these territories are probably Tax Free/ Diplomatic vehicles.

- Rounding error may occur where values are shown in billions (1,000,000,000) or millions, but do not affect the overall figures.

SUMMARY

- The EEC car market accounted for 30.6% of total world sales and 36.1% of total world production in 1985.

- Germany dominates the EEC car industry with 24.9% of total EEC car sales and 35.8% of total EEC production in 1985.

- In ECU terms, the dominance of Germany is even more pronounced at 48% of total production value and 50.2% of total value for shipments of cars and components.

ECU value (Billions)

	CAR PRODUCTION	%	COMPONENT PRODUCTION	%	TOTAL	%	EXPORT VALUE	
GERMANY	34,6	48,1	19,7	45,1	54,3	46,9	26,4	50,2
FRANCE	13,9	19,3	10,0	22,9	23,9	20,7	9,3	17,7
OTHERS	23,5	32,6	14,0	32,0	37,5	32,4	16,9	32,1
TOTAL	72,0		43,7		115,7		52,6	

- Intra EEC trade was 4.6 million cars, worth 25.68 billion ECU's.

- The EEC exported 2.01 million cars to external markets worth 19.1 billion ECU's, and imported 1.1 million cars worth 5.41 billion ECU's, giving a positive balance of .91 million cars and 13.68 billion ECU's.

- EEC member markets :-

PRODUCED	11.62	million	cars
SOLD	9.57	"	"
EXPORTED	6.62	"	"
IMPORTED	5.71	"	"

- The major importer into the EEC was Japan with 0.8 million cars worth.

- The major external export market for EEC produced vehicles was the USA, taking 0.64 million vehicles.

MAJOR OBSERVATIONS

1) GERMANY DOMINATES THE EEC CAR MARKET

(UNITS - Millions)	*PRODUCTION*	*%*	*SALES*	*%*	*VARIANCE*
GERMANY	4.17	35.8	2.38	24.9	1.79
FRANCE	2.63	22.6	1.77	18.5	0.87
ITALY	1.39	11.9	1.75	18.3	(0.36)
SPAIN	1.23	10.6	0.56	5.8	0.67
UK	1.05	9.0	1.83	19.1	(0.78)
BELGIUM	0.99	8.5	0.39	4.1	0.60
NETHERLANDS	0.11	0.9	0.49	5.1	(0.38)
PORTUGAL	0.06	0.5	0.10	1.0	(0.04)
DENMARK	0.00	0.0	0.16	1.7	(0.16)
GREECE	0.00	0.0	0.08	0.8	(0.08)
EIRE	0.00	0.0	0.06	0.6	(0.06)
TOTAL	**11.63**	**99.8**	**9.57**	**99.9**	**2.07**

Germany accounts for 35.8% of production.

Germany and France combined account for 58.5% of production.

Germany sells 24.9% of total EEC.

Germany and the UK combined sell 44.0% of total EEC.

2) MAJOR TRADE FLOWS

(ECU's - Billions) (TOTAL EXPORTS)

	CARS	*%*	*COMPONENTS*		*TOTAL*	
GERMANY	24.1	53.9	2.3	29.1	26.4	50.2
FRANCE	6.6	14.8	2.7	34.2	9.3	17.7
BELGIUM	6.2	13.9	0.4	5.1	6.6	12.5
SPAIN	2.9	6.5	0.5	6.3	3.4	6.5
UK	2.2	4.9	1.2	15.2	3.4	6.5
ITALY	2.1	4.7	0.6	7.6	2.7	5.1
NETHERLANDS	0.6	1.3	0.2	2.5	0.8	1.5
TOTAL	**44.7**	**100.0**	**7.9**	**100.0**	**52.6**	**100.0**

Germany accounts for over 50% of ECU export billings.

Germany and France combined account for 67.9% of export ECU billings.

3) **INTRA EEC BALANCES CARS AND COMPONENTS**

(ECU's - Millions)	*EXPORTS*	*IMPORTS*	*VARIANCE*
GERMANY	12.9	5.6	7.3
FRANCE	6.9	5.4	1.5
BELGIUM	5.7	4.7	1.0
SPAIN	3.4	1.8	1.6
ITALY	2.0	4.8	(2.8)
UK	1.9	6.7	(4.8)
NETHERLANDS	0.7	2.1	(1.4)
DENMARK	0.0	0.4	(0.4)
GREECE	0.0	0.2	(0.2)
EIRE	0.0	0.2	(0.2)
TOTAL	**33.5**	**31.9**	**1.6**

Germany has by far the largest intra EEC balance at 7.3 ECU's (billions), whilst the UK has the largest import bill at 4.8 ECU's (billions).

The UK's largest import bill is from Germany with a net 3.0 ECU's (billion) adverse balance.

4) **THE EEC HAS A POSITIVE BALANCE WITH EXTRA EEC TRADING COUNTRIES OF 0.9 MILLION PASSENGER CARS.**

VOLUME (UNITS - Millions)

	INTRA	*EXTRA*	*TOTAL*
IMPORTS	4.61	1.10	5.71
EXPORTS	4.61	2.01	6.62
BALANCE	-	**0.91**	**0.91**

(Assumed Intra EEC balance in a given year)

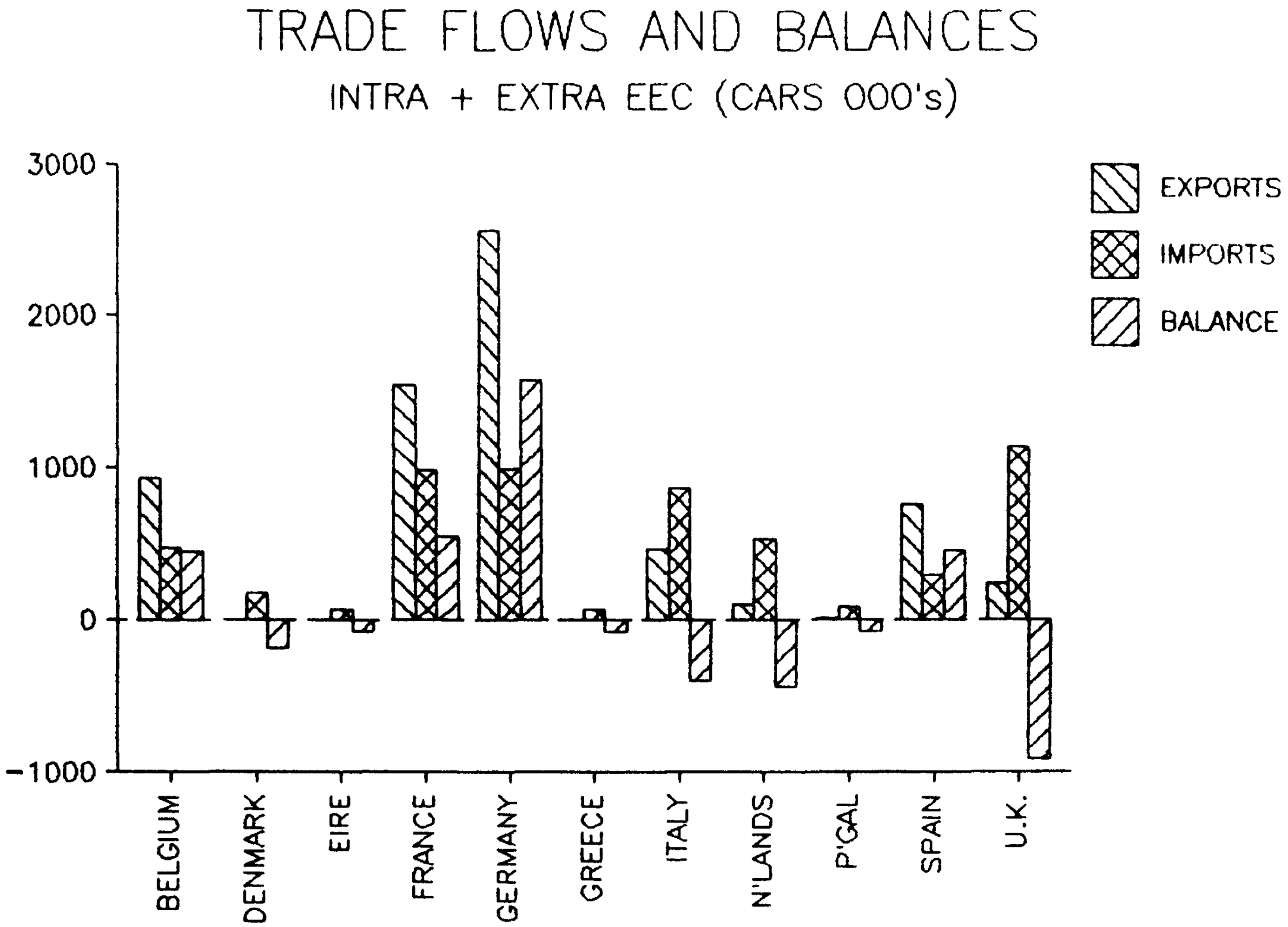
	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB	BC
EXPORTS to			BELGIUM	DENMARK	EIRE	FRANCE	GERMANY	GREECE	ITALY	N'LANDS	PORTUGAL	SPAIN	UK		TOT EEC		JAPAN	USA	CANADA	EFTA	E EUROPE	OTHERS		TOTAL		TOTAL
from (Source MVMA)																										
BELGIUM			22605	17869	2464	179968	306531	112	86836	94539	88	13838	98377		823227		3	28852	2	73861	73	7008		109799		933026
DENMARK			0	0	0	0	0	0	0	0	0	0	0		0		0	0	0	0	0	0		0		0
EIRE			0	0	0	0	0	0	0	0	0	0	0		0		0	0	0	0	0	0		0		0
FRANCE			106204	11210	6372	0	161698	5121	292804	77719	38027	191286	145865		1036306		958	135330	15166	91844	14033	245214		502545		1538851
GERMANY			147402	53596	14762	278532	0	23359	257351	188859	6578	74699	449255		1494393		36608	439148	43027	411582	24852	118438		1073655		2568048
GREECE			0	0	0	0	0	0	0	0	0	0	0		0		0	0	0	0	0	0		0		0
ITALY			39742	5511	3878	104482	88313	7182	0	9252	12034	9207	60082		339683		1884	10522	1022	66222	4908	43028		127586		467269
N'LANDS			5959	3819	972	11773	8666	279	8823	0	609	913	35944		77757		427	502	3	20453	362	3895		25642		103399
PORTUGAL			1834	0	0	7040	0	0	0	0	0	194	25		9093		0	0	0	0	0	287		287		9380
SPAIN			32551	9063	6540	274218	106070	2700	111769	41294	11418	0	106086		701709		25	27	0	27345	0	32781		60178		761887
UK			16986	873	8526	41562	16654	437	27336	2426	9963	3871	0		128634		1499	23719	1411	5265	132	79585		111611		240245
TOTAL EEC			373283	101941	43514	897575	687932	39190	784919	414089	78717	294008	895634		4610802		41404	638100	60631	696572	44360	530236		2011303		6622105
JAPAN			78299	48780	26731	55293	271492	21490	316	103339	9205	71	185625		800641		0	2215811	197012	278654	2993	930854		3625324		4425965
USA			0	0	0	1546	2414	0	770	0	0	0	0		4730		1376	0	676058	215	0	18430		696079		700809
CANADA			1	0	0	3	31	0	0	4	0	1	4		44		159	1159894	0	25	0	5787		1165865		1165909
EFTA			4177	4295	220	4437	9231	266	5058	5544	171	706	17972		52077		1915	112398	5088	22215	191	12223		154030		206107
E EUROPE			20929	13135	170	26535	13291	15002	47366	13240	84	1732	42050		193534		0	10000	4797	22995	0	1000		38792		232326
OTHERS			450	9000	0	0	5789	0	26070	1320	0	0	6505		49134		152	13894	104000	9000	0	120000		247046		296180
TOTAL			103856	75210	27121	87814	302248	36758	79580	123447	9460	2510	252156		1100160		3602	3511997	986955	333104	3184	1088294		5927136		7027296
TOTAL			477139	177151	70635	985389	990180	75948	864499	537536	88177	296518	1147790		5710962		45006	4150097	1047586	1029676	47544	1618530		7938439		13649401

BALANCE between	BELGIUM	DENMARK	EIRE	FRANCE	GERMANY	GREECE	ITALY	N'LANDS	PORTUGAL	SPAIN	UK	TOT EEC	JAPAN	USA	CANADA	EFTA	E EUROPE	OTHERS	TOTAL	TOTAL
Source MJP																				
BELGIUM	0	-17869	-2464	-73764	-159129	-112	-47094	-88580	1746	18713	-81391	-449944	78296	-28852	-1	-69684	20856	-6558	-5943	-455887
DENMARK	17869	0	0	11210	53596	0	5511	3819	0	9063	873	101941	48780	0	0	4295	13135	9000	75210	177151
EIRE	2464	0	0	6372	14762	0	3878	972	0	6540	8526	43514	26731	0	0	220	170	0	27121	70635
FRANCE	73764	-11210	-6372	0	116834	-5121	-188322	-65946	-30987	82932	-104303	-138731	54335	-133784	-15163	-87407	12502	-245214	-414731	-553462
GERMANY	159129	-53596	-14762	-116834	0	-23359	-169038	-180193	-6578	31371	-432601	-806461	234884	-436734	-42996	-402351	-11561	-112649	-771407	-1577868
GREECE	112	0	0	5121	23359	0	7182	279	0	2700	437	39190	21490	0	0	266	15002	0	36758	75948
ITALY	47094	-5511	-3878	188322	169038	-7182	0	-429	-12034	102562	-22746	445236	-1568	-9752	-1022	-61164	42458	-16958	-48006	397230
N'LANDS	88580	-3819	-972	65946	180193	-279	429	0	-609	40381	-33518	336332	102912	-502	1	-14909	12878	-2575	97805	434137
PORTUGAL	-1746	0	0	30987	6578	0	12034	609	0	11224	9938	69624	9205	0	0	171	84	-287	9173	78797
SPAIN	-18713	-9063	-6540	-82932	-31371	-2700	-102562	-40381	-11224	0	-102215	-407701	46	-27	1	-26639	1732	-32781	-57668	-465369
UK	81391	-873	-8526	104303	432601	-437	32746	33518	-9938	102215	0	767000	184126	-23719	-1407	12707	41918	-73080	140545	907545
TOTAL EEC	449944	-101941	-43514	138731	806461	-39190	-445236	-336332	-69624	407701	-767000	0	759237	-633370	-60587	-644495	149174	-481102	-911143	-911143
JAPAN	-78296	-48780	-26731	-54335	-234884	-21490	1568	-102912	-9205	-46	-184126	-759237	0	-2214435	-196853	-276739	-2993	-930702	-3621722	-4380959
USA	28852	0	0	133784	436734	0	9752	502	0	27	23719	633370	2214435	0	483836	112183	10000	-4536	2815918	3449288
CANADA	1	0	0	15163	42996	0	1022	-1	0	-1	1407	60587	196853	-483836	0	5063	4797	98213	-178910	-118323
EFTA	69684	-4295	-220	87407	402351	-266	61164	14909	-171	26639	-12707	644495	276739	-112183	-5063	0	22804	-3223	179074	823569
E EUROPE	-20856	-13135	-170	-12502	11561	-15002	-42458	-12878	-84	-1732	-41918	-149174	2993	-10000	-4797	-22804	0	-1000	-35608	-184782
OTHERS	6558	-9000	0	245214	112649	0	16958	2575	287	32781	73080	481102	930702	4536	-98213	3223	1000	0	841248	1322350
TOTAL	5943	-75210	-27121	414731	771407	-36758	48006	-97805	-9173	57668	-140545	911143	3621722	-2815918	178910	-179074	35608	-841248	0	911143
TOTAL	455887	-177151	-70635	553462	1577868	-75948	-397230	-434137	-78797	465369	-907545	911143	4380959	-3449288	118323	-823569	184782	-1322350	-911143	0

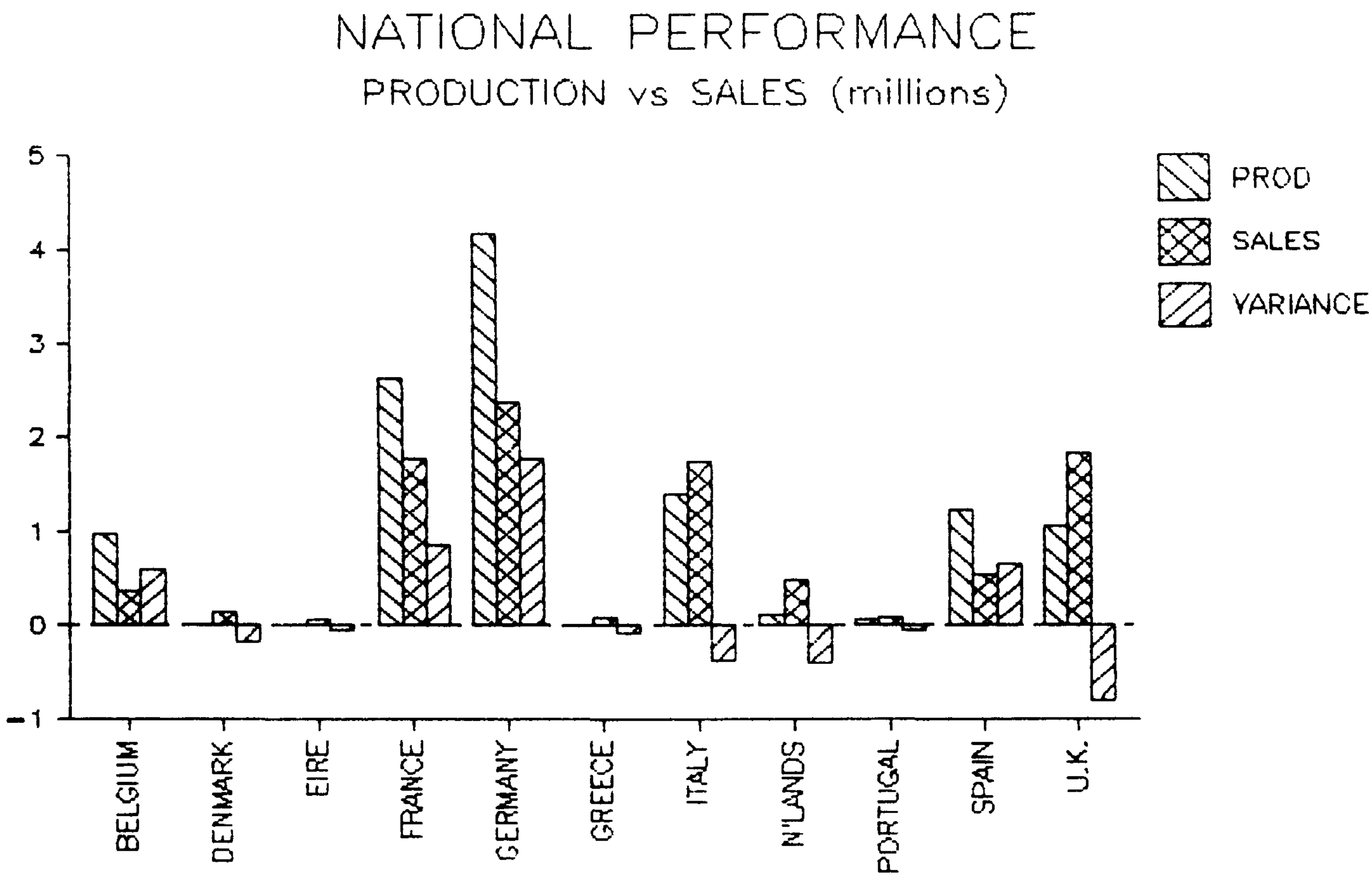
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA
EXPORTS from			BELGIUM	DENMARK	EIRE	FRANCE	GERMANY	GREECE	ITALY	N'LANDS	PORTUGAL	SPAIN	UK		TOT EEC		JAPAN	USA	CANADA	EFTA	E EUROPE	OTHERS		TOTAL		TOTAL
to (Source MVMA)																										
BELGIUM			22605	0	0	106204	147402	0	39742	5959	1834	32551	16986		373283		78299	0	1	4177	20929	450		103856		477139
DENMARK			17869	0	0	11210	53596	0	5511	3819	0	9063	873		101941		48780	0	0	4295	13135	9000		75210		177151
EIRE			2464	0	0	6372	14762	0	3878	972	0	6540	8526		43514		26731	0	0	220	170	0		27121		70635
FRANCE			179968	0	0	0	278532	0	104482	11773	7040	274218	41562		897575		55293	1546	3	4437	26535	0		87814		985389
GERMANY			306531	0	0	161698	0	0	88313	8666	0	106070	16654		687932		271492	2414	31	9231	13291	5789		302248		990180
GREECE			112	0	0	5121	23359	0	7182	279	0	2700	437		39190		21490	0	0	266	15002	0		36758		75948
ITALY			86836	0	0	292804	257351	0	0	8823	0	111769	27336		784919		316	770	0	5058	47366	26070		79580		864499
N'LANDS			94539	0	0	77719	188859	0	9252	0	0	41294	2426		414089		103339	0	4	5544	13240	1320		123447		537536
PORTUGAL			88	0	0	38027	6578	0	12034	609	0	11418	9963		78717		9205	0	0	171	84	0		9460		88177
SPAIN			13838	0	0	191286	74699	0	9207	913	194	0	3871		294008		71	0	1	706	1732	0		2510		296518
UK			98377	0	0	145865	449255	0	60082	35944	25	106086	0		895634		185625	0	4	17972	42050	6505		252156		1147790
TOTAL EEC			823227	0	0	1036306	1494393	0	339683	77757	9093	701709	128634		4610802		800641	4730	44	52077	193534	49134		1100160		5710962
JAPAN			3	0	0	958	36608	0	1884	427	0	25	1499		41404		0	1376	159	1915	0	152		3602		45006
USA			28852	0	0	135330	439148	0	10522	502	0	27	23719		638100		2215811	0	1159894	112398	10000	13894		3511997		4150097
CANADA			2	0	0	15166	43027	0	1022	3	0	0	1411		60631		197012	676058	0	5088	4797	104000		986955		1047586
EFTA			73861	0	0	91844	411582	0	66222	20453	0	27345	5265		696572		278654	215	25	22215	22995	9000		333104		1029676
E EUROPE			73	0	0	14033	24852	0	4908	362	0	0	132		44360		2993	0	0	191	0	0		3184		47544
OTHERS			7008	0	0	245214	118438	0	43028	3895	287	32781	79585		530236		930854	18430	5787	12223	1000	120000		1088294		1618530
TOTAL			109799	0	0	502545	1073655	0	127586	25642	287	60178	111611		2011303		3625324	696079	1165865	154030	38792	247046		5927136		7938439
TOTAL			933026	0	0	1538851	2568048	0	467269	103399	9380	761887	240245		6622105		4425965	700809	1165909	206107	232326	296180		7027296		13649401

TRADE FLOW SUMMARY - CARS

	SALES	PROD	VAR	PROD % SALES	IMPORTS	EXPORTS	VAR
BELGIUM	389066	986182	597116	253.47	477139	933026	455887
DENMARK	157474	0	-157474	.00	177151	0	-177151
EIRE	60428	0	-60428	.00	70635	0	-70635
FRANCE	1766328	2632366	866038	149.03	985389	1538851	553462
GERMANY	2379261	4166686	1787425	175.13	990180	2568048	1577868
GREECE	78534	0	-78534	.00	75948	0	-75948
ITALY	1747404	1389156	-358248	79.50	864499	467269	-397230
N'LANDS	495685	108083	-387602	21.80	537536	103399	-434137
PORTUGAL	104195	60975	-43220	58.52	88177	9380	-78797
SPAIN	555589	1230071	674482	221.40	296518	761887	465369
UK	1832408	1047973	-784435	57.19	1147790	240245	-907545
TOTAL	9566372	11621492	2055120	121.48	5710962	6622105	911143
JAPAN	3104074	7646816	4542742	246.35	45006	4425965	4380959
USA	11038423	8184821	-2853602	74.15	4150097	700809	-3449288
CANADA	1146251	1077935	-68316	94.04	1047586	1165909	118323
EFTA	1074176	446445	-627731	41.56	1029676	206107	-823569
E EUROPE	2082000	2331023	249023	111.96	47544	232326	184782
OTHERS	3216704	924696	-2292008	28.75	1618530	296180	-1322350
TOTAL	21661628	20611736	-1049892	95.15	7938439	7027296	-911143
GRAND TOTAL	31228000	32233228	1005228	103.22	13649401	13649401	0

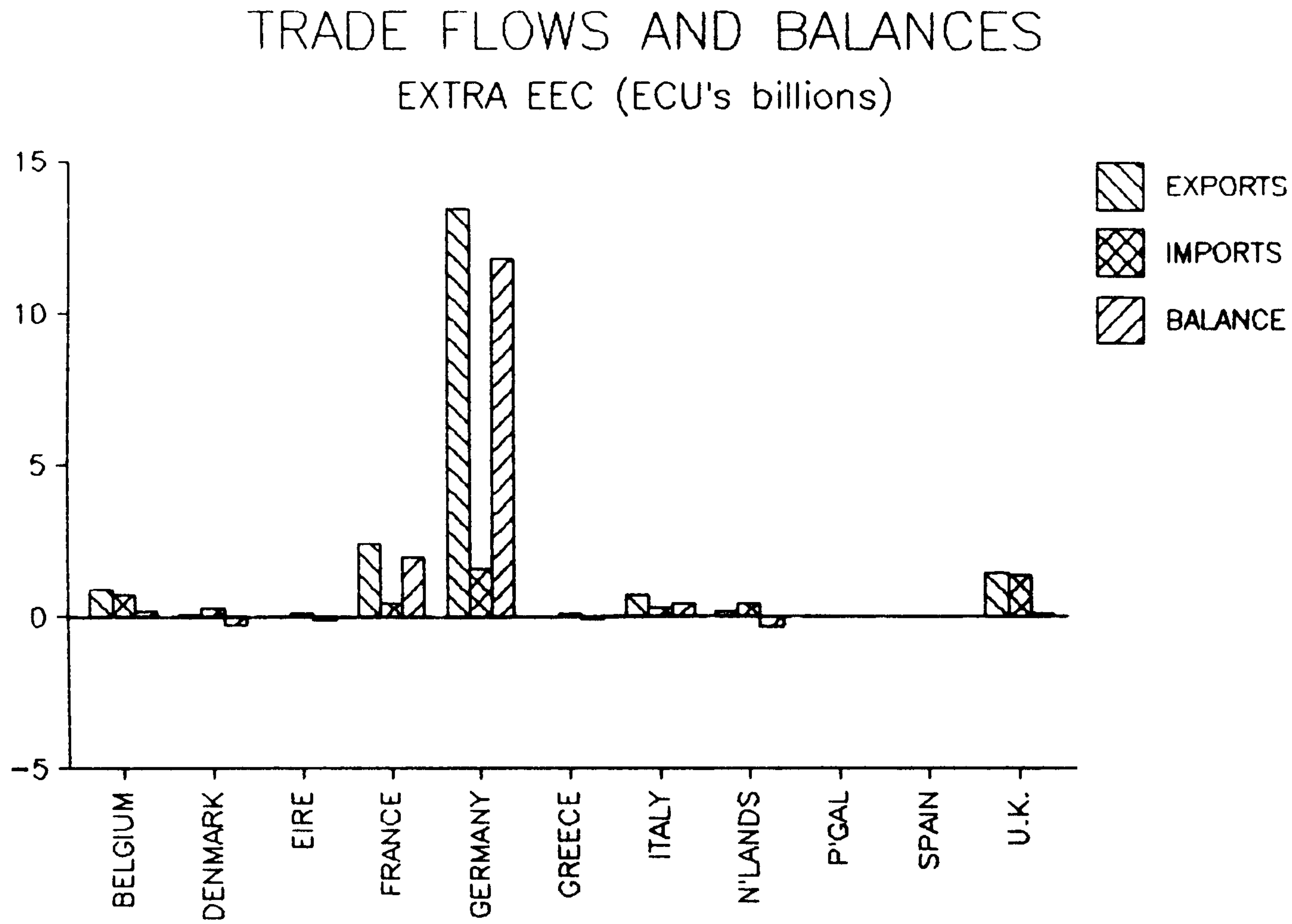


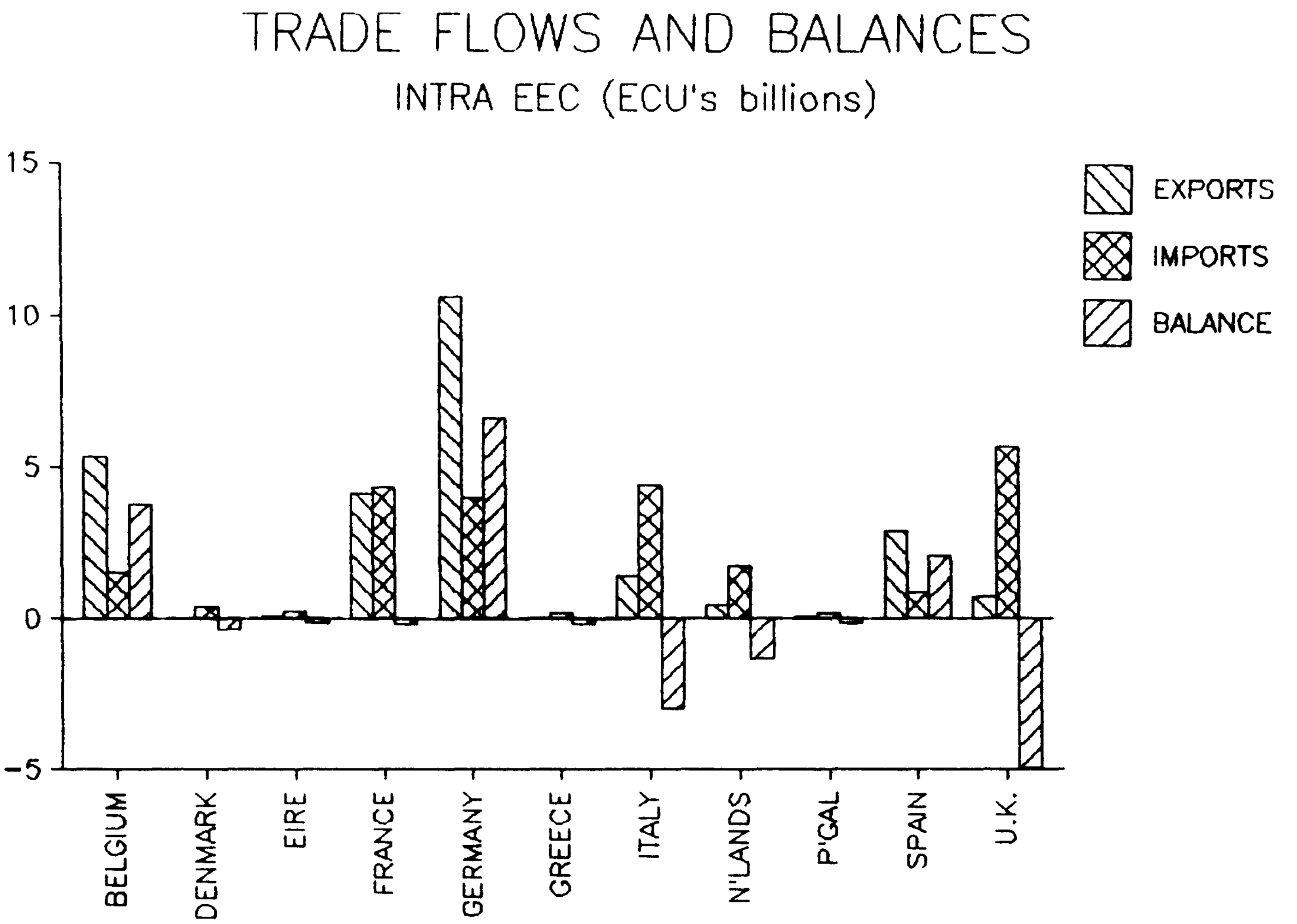
TRADE FLOWS AND BALANCES
INTRA + EXTRA EEC (CARS 000's)
3000
2000
1000
0
-1000
EXPORTS
IMPORTS
BALANCE
BELGIUM
DENMARK
EIRE
FRANCE
GERMANY
GREECE
ITALY
N'LANDS
P'GAL
SPAIN
U.K.


NATIONAL PERFORMANCE
PRODUCTION vs SALES (millions)
5
4
3
2
1
0
-1
PROD
SALES
VARIANCE
BELGIUM
DENMARK
EIRE
FRANCE
GERMANY
GREECE
ITALY
N'LANDS
PORTUGAL
SPAIN
U.K.

TRADE FLOWS AND BALANCES

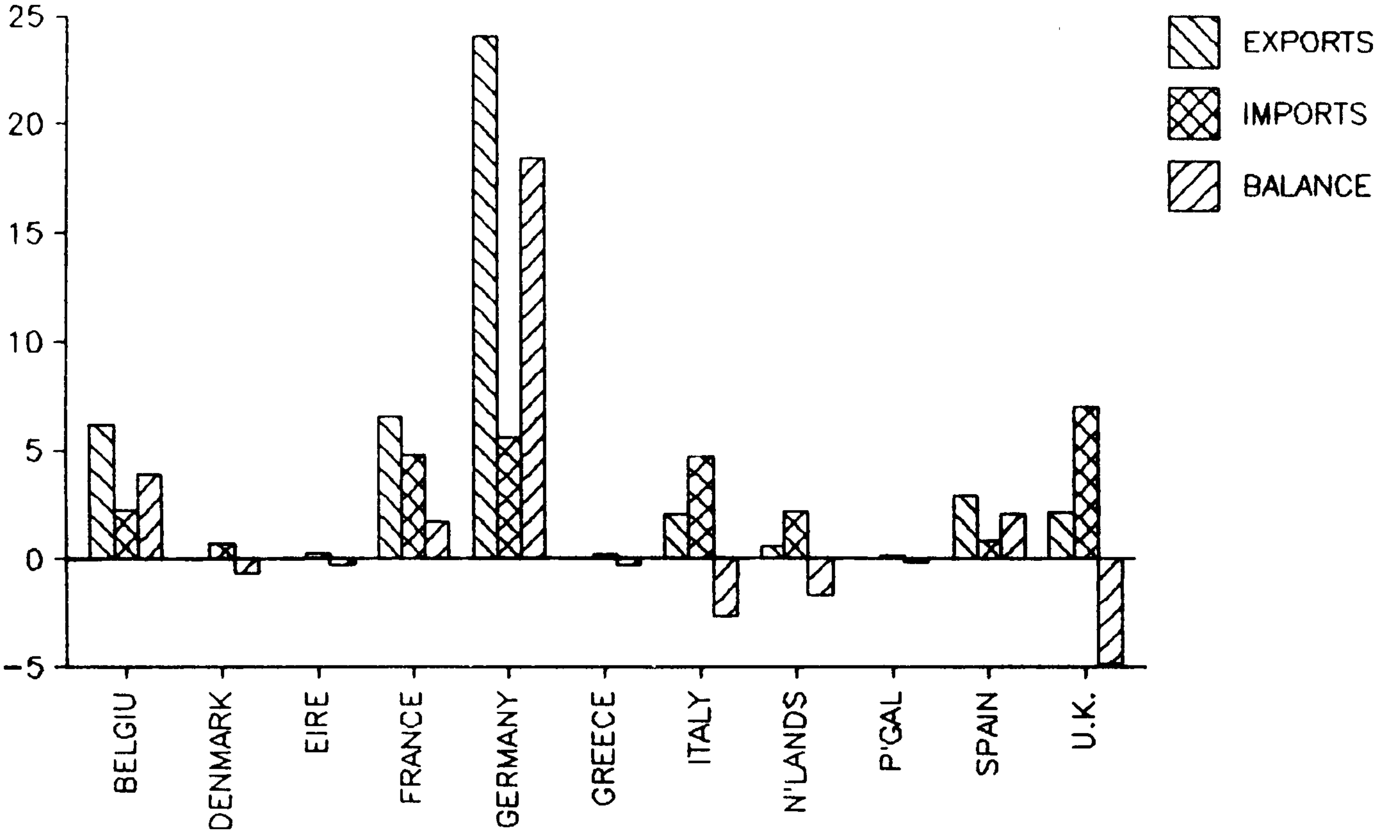
TOTAL (CARS 000's)	BELGIUM	DENMARK	EIRE	FRANCE	GERMANY	GREECE	ITALY	N'LANDS	P'GAL	SPAIN	U.K.	TOTAL
EXPORTS												
TOTAL	933.03	.00	.00	1538.85	2568.05	.00	467.27	103.40	9.38	761.89	240.25	6622.11
IMPORTS												
TOTAL	477.14	177.15	70.64	985.39	990.18	75.95	864.50	537.54	88.18	296.52	1147.79	5710.96
BALANCE												
TOTAL	455.89	-177.15	-70.64	553.46	1577.87	-75.95	-397.23	-434.14	-78.80	465.37	-907.55	911.14
INTRA EEC	BELGIUM	DENMARK	EIRE	FRANCE	GERMANY	GREECE	ITALY	N'LANDS	P'GAL	SPAIN	U.K.	TOTAL
EXPORTS												
TOTAL	823.23	.00	.00	1036.31	1494.39	.00	339.68	77.76	9.09	701.71	128.63	4610.80
IMPORTS												
TOTAL	373.28	101.94	43.51	897.58	687.93	39.19	784.92	414.09	78.72	294.01	895.63	4610.80
BALANCE												
TOTAL	449.94	-101.94	-43.51	138.73	806.46	-39.19	-445.24	-336.33	-69.62	407.70	-767.00	.00
EXTRA EEC	BELGIUM	DENMARK	EIRE	FRANCE	GERMANY	GREECE	ITALY	N'LANDS	P'GAL	SPAIN	U.K.	TOTAL
EXPORTS												
TOTAL	109.80	.00	.00	502.55	1073.66	.00	127.59	25.64	.29	60.18	111.61	2011.30
IMPORTS												
TOTAL	103.86	75.21	27.12	87.81	302.25	36.76	79.58	123.45	9.46	2.51	252.16	1100.16
BALANCE												
TOTAL	5.94	-75.21	-27.12	414.73	771.41	-36.76	48.01	-97.81	-9.17	57.67	-140.55	911.14


TRADE FLOWS AND BALANCES
EXTRA EEC (ECU's billions)
15
10
5
0
-5
EXPORTS
IMPORTS
BALANCE
BELGIUM
DENMARK
EIRE
FRANCE
GERMANY
GREECE
ITALY
N'LANDS
P'GAL
SPAIN
U.K.


TRADE FLOWS AND BALANCES
INTRA EEC (ECU's billions)
15
10
5
0
-5
EXPORTS
IMPORTS
BALANCE
BELGIUM
DENMARK
EIRE
FRANCE
GERMANY
GREECE
ITALY
N'LANDS
P'GAL
SPAIN
U.K.

TRADE FLOWS AND BALANCES

INTRA + EXTRA EEC (ECU's billions)



TRADE FLOWS AND BALANCES

TOTAL (ECUsbillions)	BELGIUM	DENMARK	EIRE	FRANCE	GERMANY	GREECE	ITALY	N'LANDS	P'GAL	SPAIN	U.K.	TOTAL
EXPORTS												
sub 1500	1.89	.01	.02	3.06	2.80	.00	1.27	.26	.04	2.36	.34	12.05
1500:3000	4.28	.04	.03	3.47	18.07	.00	.77	.32	.00	.55	.55	28.08
over 3000	.05	.01	.00	.02	3.19	.00	.09	.01	.00	.00	1.27	4.64
TOTAL	6.22	.06	.05	6.55	24.05	.00	2.13	.60	.04	2.91	2.16	44.77
IMPORTS												
sub 1500	.88	.29	.16	2.40	2.26	.22	2.15	.95	.12	.22	2.37	12.02
1500:3000	1.28	.40	.16	2.35	3.16	.03	2.48	1.25	.06	.57	4.46	16.20
over 3000	.10	.02	.00	.06	.17	.00	.09	.04	.00	.03	.20	.71
TOTAL	2.26	.71	.32	4.80	5.60	.26	4.72	2.23	.18	.83	7.04	28.94
BALANCE												
sub 1500	1.01	-.28	-.14	.66	.54	-.22	-.88	-.68	-.08	2.14	-2.03	.03
1500:3000	3.00	-.36	-.13	1.13	14.90	-.03	-1.71	-.92	-.05	-.02	-3.92	11.88
over 3000	-.05	-.01	.00	-.03	3.02	.00	-.01	-.03	.00	-.03	1.07	3.93
TOTAL	3.96	-.65	-.27	1.75	18.46	-.26	-2.59	-1.63	-.14	2.08	-4.88	15.84
INTRA EEC	BELGIUM	DENMARK	EIRE	FRANCE	GERMANY	GREECE	ITALY	N'LANDS	P'GAL	SPAIN	U.K.	TOTAL
EXPORTS												
sub 1500	1.79	.01	.02	2.17	2.41	.00	.92	.23	.04	2.36	.32	10.27
1500:3000	3.51	.02	.03	1.97	7.82	.00	.43	.21	.00	.55	.21	14.75
over 3000	.02	.00	.00	.00	.40	.00	.03	.00	.00	.00	.20	.66
TOTAL	5.32	.03	.05	4.15	10.64	.00	1.38	.45	.04	2.91	.72	25.68
IMPORTS												
sub 1500	.47	.16	.10	2.13	1.64	.16	1.94	.68	.12	.22	1.75	9.38
1500:3000	.97	.25	.11	2.16	2.25	.02	2.38	1.06	.06	.57	3.75	13.57
over 3000	.08	.01	.00	.05	.10	.00	.08	.03	.00	.03	.19	.58
TOTAL	1.53	.41	.21	4.34	3.99	.19	4.40	1.77	.18	.83	5.68	23.53
BALANCE												
sub 1500	1.32	-.15	-.08	.04	.77	-.16	-1.02	-.46	-.08	2.14	-1.43	.89
1500:3000	2.54	-.23	-.08	-.19	5.57	-.02	-1.95	-.84	-.05	-.02	-3.54	1.18
over 3000	-.06	.00	.00	-.05	.31	.00	-.05	-.03	.00	-.03	.01	.08
TOTAL	3.79	-.38	-.16	-.19	6.65	-.19	-3.02	-1.33	-.14	2.08	-4.97	2.15
EXTRA EEC	BELGIUM	DENMARK	EIRE	FRANCE	GERMANY	GREECE	ITALY	N'LANDS	P'GAL	SPAIN	U.K.	TOTAL
EXPORTS												
sub 1500	.09	.01	.00	.89	.39	.00	.35	.04	.00	.00	.03	1.78
1500:3000	.77	.02	.00	1.50	10.24	.00	.34	.11	.00	.00	.34	13.33
over 3000	.03	.00	.00	.02	2.79	.00	.05	.01	.00	.00	1.08	3.98
TOTAL	.89	.03	.00	2.40	13.41	.00	.74	.16	.00	.00	1.45	19.09
IMPORTS												
sub 1500	.40	.14	.06	.27	.62	.06	.20	.26	.00	.00	.63	2.64
1500:3000	.31	.15	.05	.19	.91	.01	.10	.19	.00	.00	.72	2.63
over 3000	.02	.01	.00	.01	.07	.00	.01	.01	.00	.00	.01	.13
TOTAL	.73	.30	.11	.46	1.61	.07	.31	.46	.00	.00	1.36	5.41
BALANCE												
sub 1500	-.31	-.13	-.06	.62	-.23	-.06	.14	-.23	.00	.00	-.60	-.86
1500:3000	.46	-.13	-.05	1.31	9.33	-.01	.24	-.08	.00	.00	-.38	10.70
over 3000	.02	-.01	.00	.01	2.71	.00	.05	.01	.00	.00	1.07	3.85
TOTAL	.17	-.27	-.11	1.94	11.81	-.07	.43	-.30	.00	.00	.09	13.68

TRADE FLOWS AND BALANCES

TOTAL (ECU's 1000'	BELGIUM	DENMARK	EIRE	FRANCE	GERMANY	GREECE	ITALY	N'LANDS	PORTUGAL	SPAIN	U.K.	TOTAL
EXPORTS												
sub 1500	1886823	13048	17449	3059498	2800358	85	1271301	263983	37257	2361860	342268	12053930
1500:3000	4278041	40740	30126	3471325	18065581	15	769457	324966	1264	550129	546472	28078116
over 3000	50454	5140	449	20701	3187415	0	85061	14996	288	622	1274084	4639210
TOTAL	6215318	58928	48024	6551524	24053354	100	2125819	603945	38809	2912611	2162824	44771256
IMPORTS												
sub 1500	876682	293328	158672	2400911	2262476	223752	2147304	945712	117925	221085	2372846	12020693
1500:3000	1281275	401543	158254	2345842	3162848	31931	2480581	1247778	55826	573066	4463771	16202715
over 3000	97280	17495	1498	55572	169818	647	90633	40139	1502	34240	203662	712486
TOTAL	2255237	712366	318424	4802325	5595142	256330	4718518	2233629	175253	828391	7040279	28935894
BALANCE												
sub 1500	1010141	-280280	-141223	658587	537882	-223667	-876003	-681729	-80668	2140775	-2030578	33237
1500:3000	2996766	-360803	-128128	1125483	14902733	-31916	-1711124	-922812	-54562	-22937	-3917299	11875401
over 3000	-46826	-12355	-1049	-34871	3017597	-647	-5572	-25143	-1214	-33618	1070422	3926724
TOTAL	3960081	-653438	-270400	1749199	18458212	-256230	-2592699	-1629684	-136444	2084220	-4877455	15835362
INTRA EEC	BELGIUM	DENMARK	EIRE	FRANCE	GERMANY	GREECE	ITALY	N'LANDS	PORTUGAL	SPAIN	U.K.	TOTAL
EXPORTS												
sub 1500	1794639	6424	17375	2173753	2414793	79	924965	227157	37257	2361860	315378	10273680
1500:3000	3507687	18524	30051	1969324	7822723	15	426534	214282	1264	550138	206718	14747260
over 3000	18670	1399	449	4999	401010	0	31295	3566	288	622	195051	657349
TOTAL	5320996	26347	47875	4148076	10638526	94	1382794	445005	38809	2912620	717147	25678289
IMPORTS												
sub 1500	472544	155063	101859	2132710	1643777	162456	1942314	683502	117925	221085	1746676	9379911
1500:3000	972460	247625	106728	2157517	2249841	23469	2378026	1056851	55826	573066	3746439	13567848
over 3000	81506	5851	1464	50401	95491	583	83249	34293	1502	34240	189968	578548
TOTAL	1526510	408539	210051	4340628	3989109	186508	4403589	1774646	175253	828391	5683083	23526307
BALANCE												
sub 1500	1322095	-148639	-84484	41043	771016	-162377	-1017349	-456345	-80668	2140775	-1431298	893769
1500:3000	2535227	-229101	-76677	-188193	5572882	-23454	-1951492	-842569	-54562	-22928	-3539721	1179412
over 3000	-62836	-4452	-1015	-45402	305519	-583	-51954	-30727	-1214	-33618	5083	78801
TOTAL	3794486	-382192	-162176	-192552	6649417	-186414	-3020795	-1329641	-136444	2084229	-4965936	2151982
EXTRA EEC	BELGIUM	DENMARK	EIRE	FRANCE	GERMANY	GREECE	ITALY	N'LANDS	PORTUGAL	SPAIN	U.K.	TOTAL
EXPORTS												
sub 1500	92184	6624	74	885745	385565	6	346336	36826	0	0	26890	1780250
1500:3000	770354	22216	75	1502001	10242858	0	342923	110684	0	-9	339754	13330856
over 3000	31784	3741	0	15702	2786405	0	53766	11430	0	0	1079033	3981861
TOTAL	894322	32581	149	2403448	13414828	6	743025	158940	0	-9	1445677	19092967
IMPORTS												
sub 1500	404138	138265	56813	268201	618699	61296	204990	262210	0	0	626170	2640782
1500:3000	308815	153918	51526	188325	913007	8462	102555	190927	0	0	717332	2634867
over 3000	15774	11644	34	5171	74327	64	7384	5846	0	0	13694	133938
TOTAL	728727	303827	108373	461697	1606033	69822	314929	458983	0	0	1357196	5409587
BALANCE												
sub 1500	-311954	-131641	-56739	617544	-233134	-61290	141346	-225384	0	0	-599280	-860532
1500:3000	461539	-131702	-51451	1313676	9329851	-8462	240368	-80243	0	-9	-377578	10695989
over 3000	16010	-7903	-34	10531	2712078	-64	46382	5584	0	0	1065339	3847923
TOTAL	165595	-271246	-108224	1941751	11808795	-69816	428096	-300043	0	-9	88481	13683380

AC :: AD :: AE ::	AF ::	AG ::	AH ::	AI ::	AJ ::	AK ::	AL ::	AM ::	AN ::	AO ::	AP ::AQ::	AR ::AS::	AT ::	AU ::	AV ::	AW ::	AX ::	AY ::AZ::	BA ::BB::	BC :
TOTAL EXPORTS from	BELGIUM	DENMARK	EIRE	FRANCE	GERMANY	GREECE	ITALY	N'LANDS	PORTUGAL	SPAIN	UK	TOT EEC	JAPAN	USA	CANADA	EFTA	E EUROPE	OTHERS	TOTAL	TOTAL
(1000's ECU's)																				
BELGIUM	0	0	0	472480	2751723	0	154975	34592	2490	98797	80440	3595497	652538	917	23	34195	39031	1247	727951	4323448
DENMARK	79008	0	0	52911	218920	0	16953	17023	3	18730	8404	411952	214413	62	10	39137	19244	30902	303768	715720
EIRE	25800	0	0	32797	72167	0	9457	5364	0	21461	39099	206145	107284	31	0	367	684	8	108374	314519
FRANCE	1008338	0	0	0	1428095	0	439757	61700	32409	1212145	205948	4388392	240066	6218	0	41125	170249	3506	461164	4849556
GERMANY	2131529	0	0	810043	0	0	400474	49529	255	414163	145726	3951719	1356335	11218	167	192319	26256	18955	1605250	5556969
GREECE	27772	0	0	25771	140365	0	28271	1779	0	11360	3661	238979	39831	328	0	1401	27459	394	69413	308392
ITALY	594218	0	0	1347882	1587047	0	0	53984	2679	451371	141520	4178701	18015	13628	179	74486	93079	114303	313690	4492391
N'LANDS	567845	0	0	339670	795559	0	38919	0	856	117237	29087	1889173	391075	2192	677	32981	25104	6933	458962	2348135
PORTUGAL	3629	0	0	58283	36819	0	34569	4046	0	0	37907	175253	0	0	0	0	0	0	0	175253
SPAIN	80071	0	0	213153	469895	0	35054	4859	0	0	25359	828391	0	0	0	0	0	0	0	828391
UK	802785	0	0	795084	3137936	0	224366	212129	117	567356	0	5739773	1032266	3799	849	212287	82172	24322	1355695	7095468
TOTAL EEC	5320995	0	0	4148074	10638526	0	1382795	445005	38809	2912620	717151	25603975	4051823	38393	1905	628298	483278	200570	5404267	31008242
JAPAN	9702	0	0	8292	195392	0	9302	3614	0	0	19005	245307	0	0	0	0	0	0	0	245307
USA	307205	0	0	294370	7853119	0	187832	15517	0	0	782492	9440535	0	0	0	0	0	0	0	9440535
CANADA	1757	0	0	102311	500231	0	6539	54	0	0	40666	651558	0	0	0	0	0	0	0	651558
EFTA	460159	0	0	509794	2865706	0	306270	108180	0	0	67339	4317448	0	0	0	0	0	0	0	4317448
E EUROPE	7735	0	0	169608	188652	0	25800	3186	0	0	16719	411700	0	0	0	0	0	0	0	411700
OTHERS	107765	0	0	1319075	1811728	0	207281	28389	0	0	519452	3993690	0	0	0	0	0	0	0	3993690
TOTAL	894323	0	0	2403450	13414828	0	743024	158940	0	0	1445673	19060238	0	0	0	0	0	0	0	19060238
TOTAL	6215318	0	0	6551524	24053354	0	2125819	603945	38809	2912620	2162824	44664213	4051823	38393	1905	628298	483278	200570	5404267	50068480

Less than 1500cc

EXPORTS from / to (000's ECU's)	BELGIUM	DENMARK	EIRE	FRANCE	GERMANY	GREECE	ITALY	N'LANDS	PORTUGAL	SPAIN	UK	TOT EEC	JAPAN	USA	CANADA	EFTA	E EUROPE	OTHERS	TOTAL	TOTAL
BELGIUM	0	0	0	222682	868573	0	99960	15332	1896	92891	37226	1338560	366143	0	23	397	36768	801	404132	1742692
DENMARK	21355	0	0	29507	64528	0	12090	6164	0	18142	579	152365	96126	10	10	2046	19244	20823	138259	290624
EIRE	2144	0	0	16226	21154	0	6532	2375	0	21114	23779	93324	56130	0	0	0	684	0	56814	150138
FRANCE	475812	0	0	0	148299	0	296866	23154	32372	996242	102651	2075396	106776	58	0	364	158974	1940	268112	2343508
GERMANY	724365	0	0	344179	0	0	249380	23538	53	335477	27507	1704499	578985	55	167	337	20320	18804	618668	2323167
GREECE	12028	0	0	23304	90608	0	26629	1332	0	11356	737	165994	33482	62	0	139	27191	44	60918	226912
ITALY	215156	0	0	922058	321026	0	0	32193	2075	363015	81565	1937088	3117	419	179	6931	84255	110009	204910	2141998
N'LANDS	256728	0	0	178291	120255	0	17452	0	856	110950	4637	689169	232948	4	0	28	23643	5582	262205	951374
PORTUGAL	583	0	0	34737	17184	0	28413	3205	0	0	33803	117925	0	0	0	0	0	0	0	117925
SPAIN	943	0	0	45529	152969	0	17788	961	0	0	2895	221085	0	0	0	0	0	0	0	221085
UK	85525	0	0	357238	610196	0	169855	118905	5	412673	0	1754397	532457	51	574	796	81529	10734	626141	2380538
TOTAL EEC	1794639	0	0	2173751	2414792	0	924965	227159	37257	2361860	315379	10249802	2006164	659	953	11038	452608	168737	2640159	12889961
JAPAN	838	0	0	1260	1273	0	6609	603	0	0	3720	14303	0	0	0	0	0	0	0	14303
USA	2508	0	0	23798	612	0	27384	100	0	0	352	54754	0	0	0	0	0	0	0	54754
CANADA	421	0	0	67068	16	0	4236	8	0	0	42	71791	0	0	0	0	0	0	0	71791
EFTA	64793	0	0	205529	335051	0	175780	29886	0	0	2823	813862	0	0	0	0	0	0	0	813862
E EUROPE	811	0	0	136725	11525	0	15581	1001	0	0	423	166066	0	0	0	0	0	0	0	166066
OTHERS	22813	0	0	451367	37089	0	116746	5226	0	0	19529	652770	0	0	0	0	0	0	0	652770
TOTAL	92184	0	0	885747	385566	0	346336	36824	0	0	26889	1773546	0	0	0	0	0	0	0	1773546
TOTAL	1886823	0	0	3059498	2800358	0	1271301	263983	37257	2361860	342268	12023348	2006164	659	953	11038	452608	168737	2640159	14663507

Between 1500 & 3000cc

EXPORTS from / to (000's ECU's)	BELGIUM	DENMARK	EIRE	FRANCE	GERMANY	GREECE	ITALY	N'LANDS	PORTUGAL	SPAIN	UK	TOT EEC	JAPAN	USA	CANADA	EFTA	E EUROPE	OTHERS	TOTAL	TOTAL
BELGIUM	0	0	0	249168	1829139	0	51203	18301	403	5525	24402	2178141	272444	112	0	33426	2263	446	308691	2486832
DENMARK	57619	0	0	23395	150491	0	4863	10843	3	588	3893	251695	106694	0	0	37091	0	10079	153864	405559
EIRE	23571	0	0	16324	50195	0	2626	2989	0	347	14398	110450	51154	31	0	333	0	8	51526	161976
FRANCE	531387	0	0	0	1235924	0	136381	38526	37	215885	57651	2215791	128454	6101	0	40603	11275	1566	187999	2403790
GERMANY	1398004	0	0	463648	0	0	137911	24381	202	78558	41671	2144375	714837	5112	0	186797	5936	151	912833	3057208
GREECE	15299	0	0	2376	47421	0	1517	447	0	4	2598	69662	6309	242	0	1262	268	350	8431	78093
ITALY	377353	0	0	425485	1207691	0	0	21734	604	88354	35698	2156919	9602	12044	0	67219	8824	4294	101983	2258902
N'LANDS	307925	0	0	161086	645528	0	20147	0	0	6287	8430	1149403	154822	343	0	32934	1461	1351	190911	1340314
PORTUGAL	2992	0	0	23514	18859	0	5643	841	0	0	3977	55826	0	0	0	0	0	0	0	55826
SPAIN	78967	0	0	167447	292094	0	16672	3884	0	0	14002	573066	0	0	0	0	0	0	0	573066
UK	714569	0	0	436881	2345381	0	49572	92335	15	154590	0	3793343	494072	1477	0	207270	643	13588	717050	4510393
TOTAL EEC	3507686	0	0	1969324	7822723	0	426535	214281	1264	550138	206720	14698671	1938388	25462	0	606935	30670	31833	2633288	17331959
JAPAN	4335	0	0	6841	36423	0	1511	2717	0	0	1456	53283	0	0	0	0	0	0	0	53283
USA	283362	0	0	266043	5777113	0	123797	6439	0	0	21678	6478432	0	0	0	0	0	0	0	6478432
CANADA	1280	0	0	35243	412287	0	1243	46	0	0	700	450799	0	0	0	0	0	0	0	450799
EFTA	394387	0	0	303403	2400826	0	123490	77918	0	0	17309	3317333	0	0	0	0	0	0	0	3317333
E EUROPE	6820	0	0	32839	173306	0	10031	2162	0	0	15952	241110	0	0	0	0	0	0	0	241110
OTHERS	80171	0	0	857632	1442903	0	82850	21403	0	0	282657	2767616	0	0	0	0	0	0	0	2767616
TOTAL	770355	0	0	1502001	10242858	0	342922	110685	0	0	339752	13308573	0	0	0	0	0	0	0	13308573
TOTAL	4278041	0	0	3471325	18065581	0	769457	324966	1264	550138	546472	28007244	1938388	25462	0	606935	30670	31833	2633288	30640532

over 3000cc

EXPORTS from	BELGIUM	DENMARK	EIRE	FRANCE	GERMANY	GREECE	ITALY	N'LANDS	PORTUGAL	SPAIN	UK	TOT EEC	JAPAN	USA	CANADA	EFTA	E EUROPE	OTHERS	TOTAL	TOTAL
to (000's ECU's)																				
BELGIUM	0	0	0	630	54011	0	3812	959	191	381	18812	78796	13951	805	0	372	0	0	15128	93924
DENMARK	34	0	0	9	3901	0	0	16	0	0	3932	7892	11593	52	0	0	0	0	11645	19537
EIRE	85	0	0	247	818	0	299	0	0	0	922	2371	0	0	0	34	0	0	34	2405
FRANCE	1139	0	0	0	43872	0	6510	20	0	18	45646	97205	4836	59	0	158	0	0	5053	102258
GERMANY	9160	0	0	2216	0	0	13183	1610	0	128	76548	102845	62513	6051	0	5185	0	0	73749	176594
GREECE	445	0	0	91	2336	0	125	0	0	0	326	3323	40	24	0	0	0	0	64	3387
ITALY	1709	0	0	339	58330	0	0	57	0	2	24257	84694	5296	1165	0	336	0	0	6797	91491
N'LANDS	3192	0	0	293	29776	0	1320	0	0	0	16020	50601	3305	1845	677	19	0	0	5846	56447
PORTUGAL	54	0	0	32	776	0	513	0	0	0	127	1502	0	0	0	0	0	0	0	1502
SPAIN	161	0	0	177	24832	0	594	14	0	0	8462	34240	0	0	0	0	0	0	0	34240
UK	2691	0	0	965	182359	0	4939	889	97	93	0	192033	5737	2271	275	4221	0	0	12504	204537
TOTAL EEC	18670	0	0	4999	401011	0	31295	3565	288	622	195052	655502	107271	12272	952	10325	0	0	130820	786322
JAPAN	4529	0	0	191	157696	0	1182	294	0	0	13829	177721	0	0	0	0	0	0	0	177721
USA	21335	0	0	4529	2075394	0	36651	8978	0	0	760462	2907349	0	0	0	0	0	0	0	2907349
CANADA	56	0	0	0	87928	0	1060	0	0	0	39924	128968	0	0	0	0	0	0	0	128968
EFTA	979	0	0	862	129829	0	7000	376	0	0	47207	186253	0	0	0	0	0	0	0	186253
E EUROPE	104	0	0	44	3821	0	188	23	0	0	344	4524	0	0	0	0	0	0	0	4524
OTHERS	4781	0	0	10076	331736	0	7685	1760	0	0	217266	573304	0	0	0	0	0	0	0	573304
TOTAL	31784	0	0	15702	2786404	0	53766	11431	0	0	1079032	3978119	0	0	0	0	0	0	0	3978119
TOTAL	50454	0	0	20701	3187415	0	85061	14996	288	622	1274084	4633621	107271	12272	952	10325	0	0	130820	4764441

Annexe 2

COMPONENT COST STUDY

THE ECONOMIC BENEFIT TO THE AUTOMOBILE SECTOR OF THE OPENING OF THE EC INTERNAL MARKET

CARPETS

50,000 p.a) 100,000 p.a.)	£18 per car set typical mid range saloon.	Tooling £100,000
200,000 p.a.	£16.20 per car set i.e. 10% reduction.	Tooling £200,000
300,000 p.a.	£15.75 per car set i.e. 2½% reduction.	Tooling £250,000

Currently European manufacturers are not set-up to produce 500,000 vehicle sets per annum, therefore price movements and tooling implications are unknown beyond 300,000 per annum. At such volumes new and differing manufacturing techniques would probably need to be developed.

It should also be noted that within the industry, manufacturers are moving towards combined carpet/NVH mouldings. Ford are currently discussing development contracts with carpet manufacturers with a view to installing a combined system in their "World Car" by 1991. Cost details for such systems are as yet unknown however.

TYRES

It is unlikely that any economy of scale would prevail on the supply of tyres as tyre manufacturers are not necessarily interested on OE business due to the extremely low, and in some cases negative profit margins. Their real interest would revolve around the replacement market where margins are considerably higher, and if presented with an opportunity to be sole source to an OE manufacturer for say 100,000 vehicle sets, would in all probability, find the prospect relatively unattractive at the margins under which they would be expected to operate. This point is particularly relevant with a basic spec tyre i.e. 155 x 13, where considerable competition from Eastern Europe and the Far East is prevalent. Within the UK there are currently 147 different brand name tyres available for this size of tyre. Additionally, with the current climate of a buoyant replacement market, European manufacturers do not have the capacity to increase greatly their current "OE" levels. It is likely therefore, that tyre supply will continue to be split between a number of manufacturers, each of whom will continue to apportion their percent'age of that overall business to a number of plants within the group.

Additionally there is little likelyhood of the vehicle manufacturer pushing toward single sourcing on commercial grounds, as traditionally mould/tooling costs are absorbed/amortised by the tyre manufacturer, and multi sourcing does not therefore readily appear to increase investment value.

RUBBER MOULDINGS (GENERAL)

As with some other processes, due to the general nature of our enquiry, precise costing details are difficult to determine. Relationship of component price to tooling investment can depend on a multitude of circumstances, not least of which is specific component complexity of design. One particular moulding, may by virtue of its complexity and or shape, need to be processed on a higher tonn'age press as volumes increase, thus affecting overhead portion of piece price adversely. The same situation would not by necessity apply to another moulding of similar size but differing complexity.

Taking a specific example, guide cost relationship to volume would be broadly as follows for a small to medium sized moulding:

50,000 p.a.	Assume as base point. Moulding cost £0.50 ea		Tooling	£ 5,000
100,000 p.a.	£0.495 ea	1% reduction	Tooling	£ 5,000
200,000 p.a.	£0.475 ea	4% reduction	Tooling	£ 5,000
300,000 p.a.	£0.475 ea	4% reduction	Tooling	£10,000
500,000 p.a.	£0.4455 ea	6% reduction	Tooling	£15,000
1,000,000 p.a.	£0.4410 ea	1% reduction	Tooling	£25,000

Above tooling costs based on capacity constraint per tool of 200,000 parts.

It should be restressed that the above cost relationships cannot be read across the vehicle range of mouldings too literally. For example one particular supplier with whom we made contact produces 50,000 mouldings per annum from a tool costing £60,000, and 11,000,000 mouldings per annum from a tool costing £10,000. Pro rated comparisons therefore become impossible.

RUBBER/PLASTIC EXTRUSIONS

Within reason rubber and plastic extrusions are only affected by economies of scale in terms of component cost as the manufacturing capacity of an extrusion die is extremely high. Against the quantities being evaluated in this exercise, a die costing say £5000 to produce a typical Glazing Rubber at levels of 50,000 per annum would equally be capable of producing one million sets per annum.

Piece price reductions would be of the following magnitude:

50,000 p.a.	Typical extruded section at £1.00 ea Die cost £5000	
100,000 p.a.	Piece price £1.00 ea.	Die cost £5000
200,000 p.a.	Piece price £1.00 ea.	Die cost £5000
300,000 p.a.	Piece price £1.00 ea.	Die cost £5000
500,000 p.a.	Piece price £1.00 ea.	Die cost £5000
1,000,000 p.a.	Piece price £0.90 ea. 10% reduction	Die cost £5000

The 10 per cent reduction indicated above would be progressive between half a million and one million vehicle sets. Generally speaking economies of scale would tend to come into effect on extrusions where several 24 hour runs can be made consecutively. Appreciating that an extruder produces material at the rate of 6000 feet per hour, it can be appreciated that, dependent on length of section required per vehicle, 500,000 vehicle sets would not represent a high level of continuous machine running time.

DOOR SEALS

Door seals have been assessed specifically, as in many cases they combine extruded rubber section and rubber shot moulded corners.

Taking a typical mid range component, with 4 varying shot moulded corners per vehicle set, cost relationship to volume would be as follows:

50,000 p.a.	£8.00 per vehicle set.	Tooling £19,000
100,000 p.a.	£7.99 per vehicle set. 1/4% reduction	Tooling £19,000
200,000 p.a.	£7.95 per vehicle set. 1/2% reduction	Tooling £19,000
300,000 p.a.	£7.95 per vehicle set.	Tooling £33,000
500,000 p.a.	£7.90 per vehicle set. 3/4% reduction	Tooling £47,000
1,000,000 p.a.	£7.10 per vehicle set. 10% reduction	Tooling £75,000

EXTERIOR MIRROR

Although the undermentioned prices have been presented against volumes of 50,000 per annum to 1,000,000 per annum, in practice we do not believe that a single style of mirror will ever be produced in significantly high volume. Whilst the internal mechanism could be common across a range of vehicles, we believe that mirror case (i.e. the high tooling cost portion of the assembly) will always be viewed as a major styling feature which at relatively low cost can significantly change the model appearance. Numerous derivatives are likely to remain the order of the day.

	Electric	Manual Remote	Manual Remote or Electric
50,000 p.a.	£10.50 ea	£8 24 ea	Tooling £ 41,000
100,000 p.a.	£10.29 ea -2%	£8 08 ea -2%	Tooling £ 60,500
200,000 p.a.	£10.14 ea -1½%	£7 96 ea -1½%	Tooling £ 82,000
300,000 p.a.	£10.04 ea -1%	£7.88 ea -1%	Tooling £123,000
500,000 p.a.	£ 9.74 ea -3%	£7 64 ea -3%	Tooling £164,000
1,000,000 p.a.	£ 9.74 ea	£7.64 ea	Tooling £328,000

INTERIOR MIRROR

Unlike the exterior mirror, interior mirrors have enormous potential for commonisation, not only across a single manufacturers vehicle range, but also across differing manufacturers vehicles. A relatively small number of head sizes could service the requirement of every major user within the EC.

50,000 p.a.	£ 2.85 ea		(assume standard head)	Tooling £ 12,000
100,000 p.a.	£ 2.79 ea	-2%	(" " ")	Tooling £ 12,000
200,000 p.a.	£ 2.75 ea	-1½%	(" " ")	Tooling £ 24,000
300,000 p.a.	£ 2.72 ea	-1%	(" " ")	Tooling £ 24,000
500,000 p.a.	£ 2.64 ea	-3%	(" " ")	Tooling £ 36,000
1,000,000 p.a.	£ 2.64 ea	-3%	(" " ")	Tooling £ 60,000

BODY HARDWARE - LOCKS & LATCHES

For purposes of the exercise a typical vehicle lockset of the type supplied to volume UK and European vehicle manufacturers has been used. The set would include door, boot, cubby box, petrol filler flap and steering column barrel devices. Unlike many other areas of the vehicle, the high end volumes under evaluation are of the approximate magnitude currently being achieved. By nature of design, lock sets are currently fitted in many cases across a range of models. Manufacturers with whom we discussed economies of scale are for example currently quoting Ford of Europe 600,000 to 700,000 sets per annum.

Expected price movements would be as follows:

50,000 p.a.	£5.00 per vehicle set		Tooling	£175,000
100,000 p.a.	£5.00 per vehicle set		Tooling	£175,000
200,000 p.a.	£4.875 ea	i.e. 2½% reduction	Tooling	£175,000
300,000 p.a.	£4.750 ea	i.e. 2½% reduction	Tooling	£175,000
500,000 p.a.	£4.650 ea	i.e. 2% reduction	Tooling	£262,500
1,000,000 p.a.	£4.500 ea	i.e. 3% reduction	Tooling	£350,000

LATCH & STRIKER SET (MANUAL SYSTEM)

50,000 p.a.	£16.20 set		Tooling	£250,000
100,000 p.a.	£15.58 set	4% reduction	Tooling	£250,000
200,000 p.a.	£14.96 set	4% reduction	Tooling	£250,000
300,000 p.a.	£14.34 set	4% reduction	Tooling	£250,000
500,000 p.a.	£12.71 set	11½% reduction	Tooling	£1,000,000
1,000,000 p.a.	£12.20 set	4% reduction	Tooling	£1,000,000

OPERATING CABLES/ASSEMBLIES

Generally speaking it is not believed that the lighter guage of operating cable assemblies will be influenced greatly volume wise by commonising of componentry with the advent of the Pan-European Motor Industry. Where, for example cables are used in engine applications, the derivative influences of manual gear box, automatic transmission, turbo charge etc., are likely to continue to prevail. Similarly, cable boot release, and fuel filler release systems will probably continue to be fitted to the higher range options only. As volumes per unit are currently relatively low, the following price movements can only be considered as factual up to 300,000 per annum. Movements beyond 300,000 are estimates only.

BOOT CABLE RELEASE ASSEMBLY

50,000 p.a.	£1.40 ea		Tooling	£ 5,000 (Injection moulded end fittings)
100,000 p.a.	£1.40 ea		Tooling	£ 5,000
200,000 p.a.	£1.33 ea	(i.e. 5% reduction)	Tooling	£ 5,000
300,000 p.a.	£1.26 ea	(i.e. 5% reduction)	Tooling	£ 5,000
500,000 p.a.	£1.26 ea		Tooling	£ 10,000
1,000,000 p.a.	£1.125 ea	(i.e.2 1/4% reduction)	Tooling	£ 10,000

BRAKE CABLE ASSEMBLY

A typical mid range hand brake cable assembly has been taken for evaluation purposes. Such a unit would included the main cable, brake reaction bracket, rubber grommets and forged eyelets.

It is not the practise of European suppliers to manufacture standard assemblies as each vehicle will require its own cable length, adjustment method etc., to suit the specific installation.

50,000 p.a.	£6.00 ea		Tooling	£ 25,000
100,000 p.a.	£5.88 ea	(2% reduction)	Tooling	£ 25,000
200,000 p.a.	£5.71 ea	(3% reduction)	Tooling	£ 27,500
300,000 p.a.	£5.54 ea	(3% reduction)	Tooling	£ 27,500
500,000 p.a.	£5.38 ea	(3% reduction)	Tooling	£ 30,250
1,000,000 p.a.	£5.16 ea	(4% reduction)	Tooling	£ 65,000

ALUMINIUM/STEEL FORGINGS

	Alum Forging Piece Price	Alum Forging Tooling	Steel Forging Piece Price	Steel Forging Tooling
50,000	£7.670 ea	£1500 part cost	£3.370 ea	£1500 part cost
100,000	£7.593 ea 1% reduction	£1500 " "	£3.336 ea 1% reduction	£1500 " "

200,000	£7.517 ea 1% reduction	£3000	"	"	£3.303 ea 1% reduction	£3000	"	"
300,000	£7.440 ea 1% reduction	£3000	"	"	£3.270 ea 1% reduction	£3000	"	"
500,000	£7.360 ea 1% reduction	£4500	"	"	£3.235 ea 1% reduction	£4500	"	"
1,000,000	£7.286 ea 1% reduction	£4500	"	"	£3.201 ea 1% reduction	£4500	"	"

By nature of the process, economy of scale has gënerally been maximised once a forging is produced in batches of approximately 10,000. The downward movement in piece price between 50,000 and 1,000,000 per annum is therefore relatively insignificant. Most forgers accept however that an arbitrary negotiated·downward movement of 1 per cent per incremental volume movement would be made in practice.

With regard to tooling, it is custom and practice in the forging industry to amortise tooling within the component price. Die replacement and repair is therefore apportioned over the anticipated annual offtake and a nominal part cost tooling cost charged to the customer. The above tooling costs should therefore be viewed accordingly.

RADIATORS

Radiator production falls in to three distinct manufacturing processes:

a) Core manufacture
b) Tank manufacture (assume plastic injection moulded on high volume production)
c) Assembly - Tanks to core

The major economy of scale (as can be seen below) takes effect once volumes reach and exceed 200,000 units per annum.

Whilst tooling constraints are mainly governed by injection moulding tool capacity, should volume requirement of a single unit exceed 500,000 per annum, certain of the European producers would need to lay down more automated core processing lines. Although the incurred cost would be classed as "plant and equipment" and would therefore be incurred by the radiator manufacturer, investment costs for such facility would be in the order of £1,500,000.

Potential for total commonisation across ranges of vehicles is considered to be somewhat limited, as cooling performance requirement will need to vary dependent on engine spec. i.e naturally aspirated, Turbo etc.,

50,000 p.a.	£20.00 ea		Tooling £100,000
100,000 p.a.	£19.60 ea	(2% reduction token gesture only)	Tooling £100,000
200,000 p.a.	£17.00 ea	(13% reduction)	Tooling £200,000
300,000 p.a.	£17.00 ea		Tooling £200,000
500,000 p.a.	£16.00 ea	(6% reduction)	Tooling £300,000
1,000,000 p.a.	£15.00 ea	(6% reduction)	Tooling £500,000

CONDENSOR

Manufacturing methods of condensors and oil coolers are similar to those adopted for radiators. Economies of scale are therefore identical. Tool costs have been excluded in both cases, as the major manufacturers have, over the years, built up a family of components from which most requirements can be adapted.

50,000 p.a.	£18.14 ea	
100,000 p.a.	£17.78 ea	(2% reduction)
200,000 p.a.	£15.47 ea	(13% reduction)
300,000 p.a.	£15.47 ea	
500,000 p.a.	£14.54 ea	(6% reduction)
1,000,000 p.a.	£13.67 ea	(6% reduction)

OIL COOLER

50,000 p.a.	£17.52 ea	
100,000 p.a.	£17.17 ea	(2% reduction)
200,000 p.a.	£14.94 ea	(13% reduction)
300,000 p.a.	£14.94 ea	
500,000 p.a.	£14.04 ea	(6% reduction)
1,000,000 p.a.	£13.20 ea	(6% reduction)

ROAD WHEELS CAST ALUMINIUM 5½" x 14"

By nature and cost, cast road wheels are reserved, and are likely to continue to be reserved to the 'up market' spec of vehicle. As an example, Ford XR3 wheels (one of the higher European offtakes) is currently running at approximately 1500 wheels per week, i.e. 14,000 vehicle sets per annum approx.

At a cost of £26.00 per wheel, it is unlikely therefore that 50,000 vehicle sets are likely to be required by a single manufactuere. Equally as a single die, costing approximately £16,000 has a maximum output of 550 wheels per week, capacity limitations fall well below the minimum annaul offtakes under consideration. The above circumstances also dictate that major economic reductions would not be possible, even if greater offtake materialised.

In the unlikely event of their doing so, the following evaluations have been limited to 50,000 per annum.

50,000 sets p.a. (250,000 wheels) £26 ea	Tooling	£160,000 dies (10 off £16,000 ea)
		£ 27,000 machine tools (3 off £9000 each)

	Total	£187,000

ROAD WHEEL STEEL

The major UK steel wheel manufacturer is currently giving consideration to the introduction of an advanced technology wheel rim line, which, if incorporated will increase their capacity from 500 rims per hour to 1000 rims per hour, and reduce change over time from ten hours to one. Based on a 100 hour week current annual capacity of 2,300,000 wheels would clearly fall well below the one million car sets being considered by the Commission as a potential maximum annual volume. It is suspected that other major European manufacturers, particularly German, already have capacity to produce in excess of four million wheels per annum.

In the absence of alternative information, the following figures are based on current UK manufacturing techniques.

250,000 wheels p.a.	£7.00 wheel		Tooling	£	87,000
500,000 wheels p.a	£7.00 wheel		Tooling	£	174,000
1,000,000 wheels p.a.	£6.79 wheel	- 3%	Tooling	£	348,000
1,500,000 wheels p.a	£6.79 wheel		Tooling	£	522,000

2,500,000 wheels p.a. £6.45 wheel - 5% Tooling £ 870,000

5,000,000 wheels p.a. £6.25 wheel - 3% Tooling £1,740,000

NOTE: Tooling estimates are based on the following information:

Rim	Tool £12,000
Assembly	Tool £ 5,000
Disc	Tool £70,000

Capacity per tool 250,000 wheels per annum.

STEERING RACK ASSY (MANUAL & POWER)

As the number of European steering rack manufacturers is relatively low, the 'majors' could readily cope with the manufacture of 1,000,000 units to a single specification. Cam Gears, for example, are currently thought to be the sole source of Ford and ARG racks, and are therefore producing well over one million racks per annum at present.

However, technically it is felt that steering racks have limited potential for commonisation. A rack tends by nature to be designed specifically for an individual model, and compromise on crucial dimensions would affect vehicle handling adversely. Equally, because of the high cost penalty, power racks are likely to remain the domain of 'up-market' models.

MANUAL RACK

50,000	p.a.	£19.00 ea		Tooling	£ 20,000
100,000	p.a.	£17.00 ea	(10% reduction)	Tooling	£ 24,000
200,000	p.a.	£16.00 ea	(6% reduction)	Tooling	£ 44,000
300,000	p.a.	£16.00 ea		Tooling	£ 64,000
500,000	p.a.	£15.00 ea	(6% reduction)	Tooling	£500,000
1,000,000	p.a.	£14.50 ea	(3 1/4% reduction)	"	£500,000

The large increase in tooling cost at levels of 500,000 per annum would be necessitated by the introduction of robotics and transfer lines etc., in order to cope with the high volume of a single specification unit. Additionally, although not directly charge'able to the customer, the estimated cost of plant and equipment for such a transfer line would be £1,750,000.

POWER RACK

50,000 p.a.	£120.00 ea		Tooling	£ 42,000
100,000 p.a.	£109.20 ea	(9% reduction)	Tooling	£ 50,000
200,000 p.a.	£103.74 ea	(5% reduction)	Tooling	£ 96,000
300,000 p.a.	£103.74 ea		Tooling	£ 170,000
500,000 p.a.	£ 98.55 ea	(5% reduction)	Tooling	£1,000,000
1,000,000 p.a.	£ 95.00 ea	(3% reduction)	Tooling	£1,000,000

The reason for high tool cost increase at levels of 500,000 per annum, is again due to the necessity of change in manufacturing technique. Estimated cost of plant and equipment for transfer lines would be £2,000,000 in the case of a power rack.

REPETITION MACHINERY (SMALL PARTS)

In order to determine a representitive picture for repetition machined componentry, the part studied is a stainless steel pin, five machining operations of which are completed on a multi spindle automatic machine, and two finishing operations are carried out on CNC equipment. Whilst current annual production of the component is 200,000 per annum, the manufacturer advises that manufacturing technique would remain unchanged on volumes of 50,000 or 1,000,000 per annum.

50,000 p.a.	£0.92 ea		Tooling	£1,400
100,000 p.a.	£0.87 ea	(5% reduction)	Tooling	£1,400
200,000 p.a.	£0.83 ea	(4% reduction)	Tooling	£1,400
300,000 p.a.	£0.79 ea	(4% reduction)	Tooling	£1,400
500,000 p.a.	£0.75 ea	(4% reduction)	Tooling	£1,400
1,000,000 p.a.	£0.73 ea	(3% reduction)	Tooling	£2,800

Economies of scale would mainly be the result of higher contribution to overhead and material cost reductions as volumes increase.

MACHINERY (CNC) VENTILATED BRAKE DISC

As with repetition machining, economies of scale would manily result from higher contribution to overhead and material cost reductions. Whilst the cost of set-up would clearly increase component cost significantly for small batch runs, once volumes have reached 50,000 per annum the effect would be so marginal as to be nonexistent

In percent'age terms movement would therefore be comparable to repetition machining.

50,000	pairs p.a.	£9.00 pr		Tooling	£ 400
100,000	pairs p.a.	£8.55 pr	- 5%	Tooling	£ 400
200,000	pairs p.a.	£8.21 pr	- 4%	Tooling	£ 400
300,000	pairs p.a.	£7.88 pr	- 4%	Tooling	£ 400
500,000	pairs p.a.	£7.56 pr	- 4%	Tooling	£ 400
1,000,000	pairs p.a.	£7.33 pr	- 3%	Tooling	£ 400

TUBULAR ASSEMBLIES LARGE (BENCH MARK ITEM TYPICAL SEAT FRAME ASSY)

In the case of seat frames, the more sophisticated manufacturers would produce units on an automated line, incorporating robotic weld equipment for all volumes being evaluated in the exercise. The economics of scale tend therefore to be raw material and overhead related.

It is interesting to note that the benefits of volume raw material purchase begin to take effect at relatively high levels. Tube mills, produce exceptionally high footage of material, much of which is sold to industries whose volume offtake is significantly higher than that of the Motor Industry.

50,000	sets p.a.	£12.33 ea		Tooling	£270,000
100,000	sets p.a.	£12.33 ea		Tooling	£270,000
200,000	sets p.a.	£11.81 ea	(- 4%)	Tooling	£270,000
300,000	sets p.a.	£11.81 ea		Tooling	£270,000
500,000	sets p.a.	£11.00 ea	(- 7%)	Tooling	£350,000
1,000,000	sets p.a.	£ 9.90 ea	(- 10%)	Tooling	£450,000

MANIPULATED TUBE - SMALL (BENCH MARK ITEM ANTI ROLL BAR)

The trend of price movement to volume is, as expected, similar to that of a seat frame assembly. Again economies tend to relate to raw material costs and overhead contribution only as all volumes under discussion would be produced on automatic formers/bending equipment. Additionally the introduction of shift working at levels in excess of 500,000 would make a major difference regarding contribution to fixed overhead.

Manufacturing capacity is not considered to be a problem in the case of tubular manipulation.

50,000 p.a.	£5.50 ea		Tooling	£ 40,000
100,000 p.a.	£5.50 ea		Tooling	£ 40,000
200,000 p.a.	£5.30 ea	(- 3½%)	Tooling	£ 40,000
300,000 p.a.	£5.15 ea	(- 3%)	Tooling	£ 40,000
500,000 p.a.	£5.00 ea	(- 3%)	Tooling	£ 40,000
1,000,000 p.a.	£4.25 ea	(- 15%)	Tooling	£ 40,000

MANIPULATED TUBE LARGE (EXHAUST SYSTEM COMPLETE)

It is unlikely that major commonisation will occur in the case of exhaust systems. The silencer/muffler internals tend to vary by model, in order to achieve the required acoustic effect. Each car manufacturer tends to hold specific views with regard to how the engine tone should sound, and each model/engine specification within the range therefore needs to be treated differently in order to achieve the 'Marquee' effect.

Equally varying legislative noise levels need to be met, and down pipes vary in shape and contour to suit model variances, i.e. manual/automatic etc.,

50,000 p.a.	£21.00 ea		Tooling	£ 25,000
100,000 p.a.	£20.00 ea	(- 5%)	Tooling	£ 25,000
200,000 p.a.	£19.50 ea	(- 2½%)	Tooling	£ 30,000
300,000 p.a.	£19.20 ea	(- 1½%)	Tooling	£ 40,000
500,000 p.a.	£19.00 ea	(- 1%)	Tooling	£ 80,000
1,000,000 p.a.	£18.50 ea	(- 2½%)	Tooling	£120,000

COIL ROAD SPRING

50,000 sets p.a.	£6.50 ea		Tooling	£ 2,000
100,000 sets p.a.	£6.50 ea		Tooling	£ 2,000
200,000 sets p.a.	£6.25 ea	(- 4%)	Tooling	£ 2,000
300,000 sets p.a.	£6.10 ea	(- 2½%)	Tooling	£ 2,000

500,000 sets p.a.	£5.95 ea	(- 2½%)	Tooling £ 4,000
1,000,000 sets p.a.	£5.00 ea	(- 16%)	Tooling £ 4,000

Again, the trend indicated on manipulated tubular componentry has been repeated. This would be expected as the principle of manufacture is broadly similar.

MOULDED HEADLINER

The following price movements relate to a moulded type polystyrene headliner with brushed nylon covering material, and incorporating wrapped around trim edges. Such a component would typically be fitted to Maestro, Montego etc.,

Savings in manufacturing costs would be achieved by greater efficiency of labour, raw material reduction and faster recovery of fixed overhead, as volumes increase.

50,000 p.a.	£12.50 ea		Tooling £ 90,000 (mould & clothing tools, piercing jigs, production aids, jigs & fixtures)
100,000 p.a.	£12.25 ea	(- 2%)	Tooling £135,000 (further mould & clothing tools required)
200,000 p.a.	£11.65 ea	(- 5%)	Tooling £195,000 (introduction of more automation)
300,000 p.a.	£11.65 ea		Tooling £195,000
500,000 p.a.	£11.05 ea	(- 5%)	Tooling £262,000
1,000,000 p.a	£10.20 ea	(- 7½%)	Tooling £350,000 (full automation)

Generally it is felt that vehicle manufacturers will continue to require numerous variances of headliner for their model ranges. Two door saloon. four door saloon, hatch back. coupe, estate all require a different design of liner. Equally each derivative may be offered with sun roof option thus doubling the number of overall derivatives required.

SOFT TRIM CUT & SEWN ASSEMBLIES - LARGE

The most representative large cut and sewn trim assembly is considered to be a front seat. The following cost indications exclude the price of seat frame and the main foam cushion and squab mouldings as these items have been assessed as individual processes. Cloth covering has been assumed.

Economies of scale are relatively small due to the labour intensive nature of the process. Higher volume, by necessity, means more manpower.

50,000 sets p.a	£80.00 pair		Tooling	£ 3,000
100,000 sets p.a.	£78.50 pair	(- 2%)	Tooling	£ 4,500
200,000 sets p.a.	£77.00 pair	(- 2%)	Tooling	£ 9,000
300,000 sets p.a.	£75.50 pair	(- 2%)	Tooling	£ 13,000
500,000 sets p.a.	£73.50 pair	(- 2%)	Tooling	£ 22,500
1,000,000 sets p.a.	£70.50 pair	(- 4%)	Tooling	£ 34,500

SOFT TRIM CUT & SEWN ASSEMBLIES - SMALL

A typical example taken to be gear lever gaiter.

50,000 p.a.	£2.00 ea		Tooling	£ 1,000
100,000 p.a.	£1.95 ea	(- 2%)	Tooling	£ 1,000
200,000 p.a.	£1.89 ea	(- 3%)	Tooling	£ 1,450
300,000 p.a.	£1.83 ea	(- 3%)	Tooling	£ 1,900
500,000 p.a.	£1.77 ea	(- 3%)	Tooling	£ 2,400
1,000,000 p.a.	£1.70 ea	(- 4%)	Tooling	£ 3,450

Pattern of ecomonies similar to seat assembly. Again as material cost is a small percent'age of the overall selling price, potential decreases for increased volume are relatively low.

LAMPS EXTERIOR

By nature of their construction, all exterior lamps are affected to the same degree by economies of scale. The major benefits materialise at 100,000 to 200,000 vehicle sets per annum, when a higher degree of automation is introduced within the assembly process.

As exterior lamps are generally styled for a specific vehicle, it is unlikely that standardisation will increase beyond the current model range levels.

a) HEAD LAMP

50,000 p.a.	£24.00 pr		Tooling	£350,000
100,000 p.a.	£22.80 pr	(- 5%)	Tooling	£350,000
200,000 p.a.	£21.66 pr	(- 5%)	Tooling	£350,000
300,000 p.a.	£21.23 pr	(- 2%)	Tooling	£450,000
500,000 p.a.	£20.81 pr	(- 2%)	Tooling	£550,000
1,000,000 p.a.	£20.60 pr	(- 1%)	Tooling	£550,000

b) TAIL LAMP

50,000 p.a.	£13.24 pr		Tooling	£250,000
100,000 p.a.	£12.60 pr	(- 5%)	Tooling	£250,000
200,000 p.a.	£12.00 pr	(- 5%)	Tooling	£250,000
300,000 p.a.	£11.76 pr	(- 2%)	Tooling	£300,000
500,000 p.a.	£11.52 pr	(- 2%)	Tooling	£350,000
1,000,000 p.a.	£11.40 pr	(- 1%)	Tooling	£350,000

DAMPERS FRONT

Generally speaking tooling expenditure would not be necessary in the case of dampers, as standard units could normally be adopted to suit by changing pressure etc., The undermentioned tooling figures reflect the approximate costs if a unit were tooled from scratch.

50,000 prs p.a.	£20.00 pr		Tooling	£ 66,700
100,000 prs p.a.	£19.00 pr	(- 5%)	Tooling	£ 66,700
200,000 prs p.a.	£18.62 pr	(- 2%)	Tooling	£ 66,700
300,000 prs p.a.	£18.25 pr	(- 2%)	Tooling	£ 66,700
500,000 prs p.a.	£17.88 pr	(- 2%)	Tooling	£133,400
1,000,000 prs p.a.	£17.52 pr	(- 2%)	Tooling	£216,660

SOUND INSULATION

For evaluation purposes a single piece front and rear floor/bulkhead moulded unit has been taken.

50,000 p.a.	£12.00 set		Tooling	£120,000
100,000 p.a.	£12.00 set		Tooling	£120,000
200,000 p.a.	£11.70 set	(- 2½%)	Tooling	£190,000
300,000 p.a.	£11.70 set		Tooling	£210,000
500,000 p.a.	£11.58 set	(- 1%)	Tooling	£250,000
1,000,000 p.a.	£11.52 set	(- ½%)	Tooling	£380,000

SCREEN GLASS (LAMINATED)

Clearly, the maximum rationalisation which can take place on vehicle glass is to standardise.across a model or body shape range. However, as premiums for tinted glass can be as high as 15 per cent, it is unlikely that low line vehicles will be fitted with anything other than clear glass unless price discrepancies are reduced significantly.

50,000 p.a.	£17.00 ea	
100,000 p.a.	£16.83 ea	1% reduction
200,000 p.a.	£16.66 ea	1% reduction
300,000 p.a.	£16.66 ea	
500,000 p.a.	£15.66 ea	6% reduction
1,000,000 p.a.	£15.66 ea	

NOTE: Toooling is traditionally absorbed by the glass manufacturer.

DOOR GLASSES/REAR SCREEN (HEATED) TOUGHENED

50,000 p.a.	£27.80 set	
100,000 p.a.	£27.52 set	1% reduction
200,000 p.a.	£27.24 set	1% reduction
300,000 p.a.	£17.24 set	
500,000 p.a.	£25.61 set	6% reduction
1,000,000 p.a.	£25.61 set	

BRAKE SYSTEM

Manufacture of braking systems has already reached a position of major commonisation. All significant brake suppliers, have, over the years accrued an extensive range of the important comprising componentry, thereby allowing car manufacturers to adapt rather than to retool systems to suit new models.

It should also be noted that ECE and EEC legislation relating to braking is common. Indeed the only non European country to incorporate its own legislative requirement is the USA. This situation has clearly accelerated the process of commonisation.

a) BRAKE DRUM

50,000 sets p.a.	£20.00 pair		Tooling	£150,000
100,000 sets p.a.	£19.80 pair	(- 1%)	Tooling	£150,000
200,000 sets p.a.	£19.60 pair	(- 1%)	Tooling	£150,000
300,000 sets p.a.	£19.30 pair	(- 1½%)	Tooling	£150,000
500,000 sets p.a.	£19.00 pair	(- 1½%)	Tooling	£150,000
1,000,000 sets p.a.	£18.50 pair	(- 2½%)	Tooling	£250,000

b)) CALIPERS

50,000 sets p.a.	£31.40 pair		Tooling	£350,000
100,000 sets p.a.	£31.08 pair	(- 1%)	Tooling	£350,000
200,000 sets p.a.	£30.76 pair	(- 1%)	Tooling	£350,000
300,000 sets p.a.	£30.28 pair	(- 1½%)	Tooling	£350,000
500,000 sets p.a.	£29.80 pair	(- 2½%)	Tooling	£350,000
1,000,000 sets p.a.	£29.00 pair	(- 2½%)	Tooling	£500,000

c) MASTER CYLINDER & RESERVOIR

50,000 p.a.	£10.50 ea		Tooling	£150,000
100,000 p.a.	£10.39 ea	(- 1%)	Tooling	£150,000
200,000 p.a.	£10.28 ea	(- 1%)	Tooling	£150,000
300,000 p.a.	£10.12 ea	(- 1½%)	Tooling	£150,000

500,000 p.a.	£ 9.96 ea	(- 1½%)	Tooling	£150,000
1,000,000 p.a.	£ 9.69 ea	(- 2½%)	Tooling	£250,000

d) BOOSTER

50,000 p.a.	£12.50 ea		Tooling	£ 80,000
100,000 p.a.	£12.37 ea	(- 1%)	Tooling	£ 80,000
200,000 p.a.	£12.24 ea	(- 1%)	Tooling	£ 80,000
300,000 p.a.	£12.05 ea	(- 1½%)	Tooling	£ 80,000
500,000 p.a.	£11.86 ea	(- 1½%)	Tooling	£ 80,000
1,000,000 p.a.	£11.54 ea	(- 2½%)	Tooling	£140,000

DRIVE SHAFT/CV JOINTS

The manufacture of drive shaft assemblies is a somewhat specialised business with a very small number of European suppliers being able to produce. The overall current requirement is therefore produced in probably two locations, both of which are producing well in excess of one million vehicle sets at present.

Whilst drive shaft manufacturers would welcome the opportunity to produce 1,000,000 common units per annum, the prospect is unlikely due to the differing technical requirement of specific models and specific model derivatives.

50,000 p.a.	£65.00 ea		Tooling	£ 60,000
100,000 p.a.	£65.00 ea		Tooling	£ 60,000
200,000 p.a.	£58.50 ea	(- 10%)	Tooling	£ 60,000
300,000 p.a.	£58.50 ea		Tooling	£ 60,000
500,000 p.a.	£58.50 ea		Tooling	£ 60,000
1,000,000 p.a.	£55.58 ea	(- 5%)	Tooling	£ 60,000

PROPRIETY COMPONENTS

In order to obtain a representative picture, a number of propriety components have been assessed.

In general terms however, by definition propriety parts are already produced in significantly high volumes, and in many cases held in stock at the suppliers risk, pending order/call off by the customer. Capacity would clearly therefore not be a constraint. The motor detailed below is currently produced in volumes of 2,000,000 per annum and is used by ARG, Citroen and Fiat.

a) COOLING MOTOR

50,000 p.a.	£4.60 ea		Tooling	NIL
100,000 p.a.	£4.60 ea		Tooling	NIL
200,000 p.a.	£4.28 ea	7% reduction	Tooling	NIL
300,000 p.a.	£4.28 ea	7% reduction	Tooling	NIL
500,000 p.a.	£3.94 ea	8% reduction	Tooling	NIL
1,000,000 p.a.	£3.55 ea	10% reduction	Tooling	NIL

b) BEARINGS (TYPICAL STANDARD BEARING)

50,000 p.a.	£1.50 ea		Tooling	NIL
100,000 p.a.	£1.47 ea	2% reduction	Tooling	NIL
200,000 p.a.	£1.47 ea		Tooling	NIL
300,000 p.a.	£1.455ea	1% reduction	Tooling	NIL
500,000 p.a.	£1.455ea		Tooling	NIL
1,000,000 p.a.	£1.44 ea	1% reduction	Tooling	NIL

Bearing manufacturers spoken to advise that maximum economies have been achieved by virtue of the high production levels currently produced. It is agreed therefore, that at our minimum requirement level of 50,000 sets per annum, price would be structured against high level production and would not therefore reduce dramatically if increased to 1,000,000 sets. Clearly however, volume would 'wet the appetite' and reductions (albeit relatively small) would be made available in order to obtain the business.

c) OIL SEAL 31 MM O/D STANDARD

50,000 p.a.	£0.13 ea	
100,000 p.a.	£0.125 ea	30% reduction
200,000 p.a.	£0.123 ea	1½% reduction
300,000 p.a.	£0.120 ea	2% reduction

500,000 p.a.	£0 117 ea	2% reduction
1,000,000 p.a.	£0 115 ea	1% reduction

HEATER/AIR CONDITIONER SYSTEMS

Whilst it is unlikely that Air Conditioner systems will be fitted to low line vehicles in the foreseeable future, a degree of rationalisation can take place by virtue of the commonality of two of the three major components within an air conditioner and a heater assembly.

i.e. Air Conditioner Pack Comprises:

a) Heater Pack (common to heater)
b) Evaporator Pack (specific to air conditioner)
c) Blower (common to heater)

Heater Pack:

a) Heater Pack (common to air conditioner)
b) Connector Tube (specific to heater)
c) Blower (common to air conditioner)

Constraints to commonisation do exist however. RHD cars would normally require a 'mirror image' condition of the LHD assembly and could not be commonised whilst RHD and LHD vehicles exist. Clearly, a move to LHD for all countries would save vehicle manufacturers a considerable amount of tooling money on new models. (See below).

It must also be emphasised that air conditioner and heater unit performance does and will continue to depend on criteria such as internal cabin dimension, area of vehicle glass etc., Differences in such criteria will prevent common use of parts across differing model ranges.

It is believed that European manufacturers, unlike their counterparts in the USA and Japan would have capacity problems if full commonisation were to occur.

AIR CONDITIONER PACK

50,000 p.a.	£50.63 set		Tooling	£ 52,327
100,000 p.a.	£50.63 set		Tooling	£ 52,327
200,000 p.a	£48.09 set	(- 5%)	Tooling	£ 82,415
300,000 p.a.	£48.09 set		Tooling	£ 82,415
500,000 p.a.	£43.26 set	(- 10%)	Tooling	£130,818

1,000,000 p.a. £42.41 set (- 2%) Tooling £130,818

Note tooling partially paid for in Heater pack below.

HEATER PACK

50,000 p.a.	£27.49 set		Tooling	£110,062
100,000 p.a.	£27.49 set		Tooling	£110,062
200,000 p.a.	£26.12 set	(- 5%)	Tooling	£172,955
300,000 p.a.	£26.12 set		Tooling	£172,955
500,000 p.a.	£23.50 set	(- 10%)	Tooling	£274,214
1,000,000 p.a.	£23.03 set	(- 2%)	Tooling	£274,214

POLYURETHANE RIM MOULDINGS

Rim mouldings are produced by an injection moulding process, and whilst cycle times are slower than those of injection moulded thermoplastics, price economies can nonetheless be achieved by introducing multi cavity tooling when higher volumes are required. In this way, double the quantity of components can be produced in less than twice the time.

Economies of scale also exist within the area of raw material purchase and contribution to fixed overheads. Percent'age wise economies are consistent with small, medium and large mouldings.

a) SMALL (EXAMPLE BUMPER END CAP)

50,000 sets p.a.	£3.00 ea		Tooling	£ 70,000
100,000 sets p.a.	£3.00 ea		Tooling	£ 70,000
200,000 sets p.a.	£2.70 ea	(- 10%)	Tooling	£120,000
300,000 sets p.a.	£2.70 ea		Tooling	£120,000
500,000 sets p.a.	£2.50 ea	(- 7%)	Tooling	£210,000
1,000,000 sets p.a.	£2.25 ea	(- 10%)	Tooling	£490,000

b) MEDIUM (EXAMPLE SPOILER)

50,000 p.a.	£12.00 ea		Tooling	£150,000
100,000 p.a.	£12.00 ea		Tooling	£150,000
200,000 p.a.	£10.80 ea	10% reduction	Tooling	£255,000

300,000 p.a.	£10.80 ea		Tooling	£255,000
500,000 p.a.	£10.04 ea	7% reduction	Tooling	£440,000
1,000,000 p.a.	£ 9.04 ea	10% reduction	Tooling	£1,000,000

c) LARGE (EXAMPLE BUMPER)

50,000 p.a.	£40.00 ea		Tooling	£ 500,000
100,000 p.a.	£40.00 ea		Tooling	£ 500,000
200,000 p.a.	£36.00 ea	10% reduction	Tooling	£ 850,000
300,000 p.a.	£36.00 ea		Tooling	£ 850,000
500,000 p.a.	£33.48 ea	7% reduction	Tooling	£1,400,000
1,000,000 p.a.	£30.13 ea	10% reduction	Tooling	£3,300,000

HARNESSES

Harness manufacture is, by nature labour intensive, and whilst certain European manufacturers have moved towards automation on certain aspects of production, the major operation of laying out harnesses on marked out boards is still largely carried out by hand. Cost benefits in relation to volume are therefore minimal.

Potential for standardisation is also considered to be small as many vehicle features affect the condition of harness required, i.e. engine variances, electric door mirror, power windows, power seats etc., etc., Commonisation will become more practical should the industry move towards multiplex wiring systems however.

A typical mid range vehicle harness set has been taken for comparison purposes.

50,000 sets p.a.	£110.00 set		Tooling	NIL
100,000 sets p.a.	£103.88 set	(- 2%)	Tooling	NIL
200,000 sets p.a.	£101.80 set	(- 2%)	Tooling	NIL
300,000 sets p.a.	£101.80 set		Tooling	NIL
500,000 sets p.a.	£100.78 set	(- 1%	Tooling	NIL
1,000,000 sets p.a.	£ 99.77 set	(- 1%)	Tooling	NIL

NOTE: It is traditional in the industry to absorb/amortise tooling costs, which by nature are relatively low.

INSTRUMENT CLUSTER (MID RANGE UNIT WITH SPEEDO, REV COUNTER & TEN WARNING LIGHTS)

50,000	p.a.	£28.00 ea		Tooling	£	230,000
100,000	p.a.	£26.00 ea	7% reduction	Tooling	£	350,000
200,000	p.a.	£23.50 ea	9½% reduction	Tooling	£	650,000
300,000	p.a.	£22.00 ea	6% reduction	Tooling	£	750,000
500,000	p.a.	£21.00 ea	5% reduction	Tooling	£	1,150,000
1,000,000	p.a.	£20.16 ea	4% reduction	Tooling	£	1,170,000

The above savings are brought about largely as a result of higher volume giving a faster recovery of overhead, bought out componentry cost reduction and improved manufacturing methods being introduced at the 200,000 per annum level.

Clearly, up market models are likely to continue to incorporate the more sophisticated level of instrumentation including such functions as voltmeter, battery condition, turbo boost etc., Standardisation is considered therefore to be limited.

PRESSED WELDED ASSEMBLIES LARGE

Although we have taken a crossmember assembly as our typical example, volumes of 50,000 per annum would be considered as high for any large pressed welded assembly. By nature of their construction, automated robotic welding would need to be introduced at such volumes in order to achieve the required level of dimensional consistency. In the main, economies would only be achieved on raw material purchase and overhead contribution.

Additionally, it is felt that volumes of 1,000,000 per annum of such componentry would be greater than most European suppliers would be capable of producing within their existing facilities.

50,000	p.a.	£30.00 ea		Tooling	£	250,000
100,000	p.a.	£29.00 ea	3½% reduction	Tooling	£	250,000
200,000	p.a.	£27.70 ea	4½% reduction	Tooling	£	625,000
300,000	p.a.	£25.90 ea	6½% reduction	Tooling	£	625,000
500,000	p.a.	£23.65 ea	9% reduction	Tooling	£	625,000
1,000,000	p.a.	£21.00 ea	11% reduction	Tooling	£	975,000

PRESSED WELDED ASSEMBLY - MEDIUM (EXAMPLE PEDALS & PEDAL BOX)

At present pedals and pedal boxes are only common to identical models produced under differing marquee names at different locations. i.e. Honda Ballard/Rover 200, Honda Legend/Rover Sterling, Vauxhall/Opel etc., It is unlikely that this situation will change unles the number of base models reduces. Tool cost savings could be made however if RHD vehicles were discontinued. This comment clearly does not apply to all pressed welded assemblies.

50,000 p.a.	£9.30 ea		Tooling £	80,000
100,000 p.a.	£8.75 ea	6% reduction	Tooling £	80,000
200,000 p.a.	£8.50 ea	3% reduction	Tooling £	80,000
300,000 p.a.	£8.35 ea	2% reduction	Tooling £	80,000
500,000 p.a.	£ 7.80 ea	6½% reduction	Tooling £	120,000
1,000,000 p.a.	£ 7.00 ea	10% reduction	Tooling £	120,000

SMS MOULDINGS

The following cost comparisons are based on a sheet moulded compound wing panel of 'Metro' size and approximate weight of 6 kilos.

50,000 p.a.	£12.50 ea		Tooling £	170,000
100,000 p.a.	£12.50 ea		Tooling £	170,000
200,000 p.a.	£11.50 ea	8% reduction	Tooling £	230,000
300,000 p.a.	£11.00 ea	4½% reduction	Tooling £	390,000
500,000 p.a.	£ 9.50 ea	13½% reduction	Tooling £	715,000
1,000,000 p.a.	£ 8.00 ea	16% reduction	Tooling £	1,300,000

Major benefits of scale upto annual volumes of 300,000 are in the main, raw material purchase and overhead related. At volumes in excess of 300,000 tooling/manufacturing methods would become far more automated, thus reducing labour costs dramatically.

STEERING WHEEL

For purpose of price comparison evaluations are of a polyurethane moulded wheel with a steel and aluminium armature. As the process is relatively labour intensive, price reduction again relates to overhead contribution plus a small benefit on raw material purchases.

Shella Clifford, one of Europes major wheel manufacturers currently produce well over 1,000,000 units per annum, albeit to differing design levels. They felt however, that should a requirement for 1,000,000 specific wheels materialise, high additional investment would be required in plant and equipment. This being the case, prices would not fall below £8 per unit, even if the requirement exceeded one million per annum.

50,000 p.a.	£ 9.00 ea		Tooling £	65,000
100,000 p.a.	£ 8.75 ea	3% reduction	Tooling £	91,880
200,000 p.a.	£ 8.50 ea	3% reduction	Tooling £	156,110
300,000 p.a.	£ 8.30 ea	2% reduction	Tooling £	331,665
500,000 p.a.	£ 8.00 ea	4% reduction	Tooling £	392,775
1,000,000 p.a.	£ 8.00 ea		Tooling £	770,550

IN CAR ENTERTAINMENT (2 SPEAKER SYSTEM + ELECTRONIC CASSETTE/RADIO)

It is unlikely that vehicle manufacturers will ever standardise a single unit across their complete model range due to the marketing mix of low line, high line etc.,

50,000 p.a.	£82.00 ea		
100,000 p.a.	£80.00 ea	2 1/4%	reduction
200,000 p.a.	£78.50 ea	2%	reduction
300,000 p.a.	£75.00 ea	4½%	reduction
500,000 p.a.	£75.00 ea		
1,000,000 p.a.	£75.00 ea		

Tooling would not be paid for by the customer other than perhaps to personalise the system. Twenty thousand pounds would more than cover such personalisation at all volume levels.

Generally speaking, the radio manufacturers contacted felt that economies of scale would have been maximised at 300,000 units per annum.

LARGE PRESSINGS

For evaluation purposes price assessment had been made of a door inner panel of 10.5 kg weight and incorporating seven separate press operations. Whilst tooling necessary for 50,000 units per annum would also be capable of producing one milion sets, at levels of 500,000 per annum, a dedicated press line would be necessary.

50,000 p.a.	£ 7.14 ea		Tooling	£ 550,000
100,000 p.a.	£ 7.08 ea	(- 1 1/4%)	Tooling	£ 550,000
200,000 p.a.	£ 6.96 ea	(- 1 1/2%)	Tooling	£ 550,000
300,000 p.a.	£ 6.86 ea	(- 1 1/2%)	Tooling	£ 550,000
500,000 p.a.	£ 6.69 ea	(- 2 1/4%)	Tooling	£ 550,000
1,000,000 p.a.	£ 6.41 ea	(- 4%)	Tooling	£ 550,000

SMALL PRESSINGS (HEADLAMP BRACKET)

50,000 p.a.	£13.868 per 100		Tooling	£ 8,000
100,000 p.a.	£13.836 per 100	(- ½%)	Tooling	£ 8,000
200,000 p.a.	£13.823 per 100	(- ½%)	Tooling	£ 8,000
300,000 p.a.	£13.823 per 100		Tooling	£ 8,000
500,000 p.a.	£13.814 per 100	(- 1/4%)	Tooling	£ 8,000
1,000,000 p.a.	£13.812 per 100	(- 1/4%)	Tooling	£ 8,000

TRUNKING & DUCTING (CONVOLUTED TUBING NYLON 2" DIA x 1 METRE LONG

50,000 p.a.	£ 1.11 ea		Tooling	£ 7,000
100,000 p.a.	£ 0.98 ea	11% reduction	Tooling	£ 7,000
200,000 p.a.	£ 0.94 ea	4% reduction	Tooling	£ 7,000
300,000 p.a.	£ 0.91 ea	3% reduction	Tooling	£ 7,000
500,000 p.a.	£ 0.88 ea	3% reduction	Tooling	£ 7,000
1,000,000 p.a.	£ 0.78 ea	11% reduction	Tooling	£ 7,000

FUEL TANKS

Wrapped metal tanks have not been evaluated as cost would make their use prohibitive at volumes of 50,000 per annum.

STEEL PRESSED TANKS

For volumes of 50,000 per annum or less, tanks would be manufactured by a 'jobbing' method as opposed to an assembly line method where robotic seam welding is incorporated. For this reason, the major economies would prevail at the 100,000 per annum point. The ultimate economies of scale on assembly would be achieved at an annual output of 336,000 units, beyond which point savings would be limited to economies on the pressings only.

A single assembly line would have a maximum output capacity of 8,000 tanks per week, i.e. 368,000 tanks per year. A second and third line would therefore need to be introduced at levels of 368,000 and 7363,000 respectively. Estimated investment costs per dedicated line are £300,000.

50,000 p.a.	£25.00 ea		Tooling	£	300,000
100,000 p.a.	£22.00 ea	12% reduction	Tooling	£	300,000
200,000 p.a.	£20.00 ea	9% reduction	Tooling	£	360,000
300,000 p.a.	£18.00 ea	10% reduction	Tooling	£	360,000
500,000 p.a.	£17.50 ea	3% reduction	Tooling	£	520,000
1,000,000 p.a.	£17.00 ea	2 3/4% reduction	Tooling	£	520,000

BLOW MOULDED PLASTIC TANK

A major consideration in the manufacture of blow moulded fuel tanks is machine capacity. Typically each tank would take two minutes to produce, therefore on a machine running time of 120 hours per week the maximum number of tanks capable of being produced per machine would be 165,000 per annum. Seven machines would therefore be required in order to produce one million tanks per annum.

50,000 p.a.	£18.00 ea		Tooling	£	80,000
100,000 p.a.	£15.00 ea	16½% reduction	Tooling	£	150,000
200,000 p.a.	£12.00 ea	20% reduction	Tooling	£	230,000
300,000 p.a.	£10.00 ea	16½% reduction	Tooling	£	230,000
500,000 p.a.	£ 9.00 ea	10% reduction	Tooling	£	330,000
1,000,000 p.a.	£ 9.00 ea		Tooling	£	600,000

One would expect from the above pressed tank/plastic tank price comparisons, that all volume vehicle manufacturers would currently be fitting plastic tanks. The real reluctance for them to do so revolves around the technical and legal implications of potential fuel vapour loss, federal product liability laws etc.,

The resolution of such issued would clearly be a major threat to metal pressed units.

RUBBER TO METAL BONDINGS

Generally speaking, volume requirement would dictate whether a component be manufactured on a transfer type press or on a screw injection machine. As cure times run at twenty minutes and three minutes respectively the injection process is normally reserved for higher production runs. Clearly output from either process will be affected by the amount of cavities incorporated on each tool. In the following comparisons a change to the injection system has been assumed at levels of 200,000 per annum, hence the large price reduction at that point.

50,000 p.a.	£ 0.67 ea		Tooling £	11,000
100,000 p.a.	£ 0.65 ea	3% reduction	Tooling £	11,000
200,000 p.a.	£ 0.48 ea	26% reduction	Tooling £	27,500
300,000 p.a.	£ 0.46 ea	3% reduction	Tooling £	27,500
500,000 p.a.	£ 0.46 ea		Tooling £	27,500
1,000,000 p.a.	£ 0.44 ea	3% reduction	Tooling £	27,500

INJECTION MOULDINGS THERMOPLASTIC

In percent'age terms, the economies of scale between small, medium and large injection mouldings will be consistent at the varying volumes.

By comparison to other processes, potential savings are somewhat limited as manufacturing methods at 50,000 per annum are identical to those incorporated at one million per annum. Number of cavities per tool will increase as volumes increase, and cycle times per component will therefore increase accordingly The resultant effect on cost is not startling however.

As achievable saving is unaffected by size a typical mid range example has been taken.

RADIATOR GRILLE

50,000 p.a.	£8.00 ea		Tooling £	70,000
100,000 p.a.	£7.77 ea	3% reduction	Tooling £	70,000
200,000 p.a	£7 46 ea	4% reduction	Tooling £	140,000
300,000 p.a.	£7 46 ea		Tooling £	140,000
500,000 p.a	£7.24 ea	3% reduction	Tooling £	2[illegible]0,000
1,000,000 p.a.	£7.24 ea		Tooling £	350,000

FASTENERS

Taking a typical automotive self tapping panhead screw as an example, manufacturers advise that for quantities of 50,000 vehicle sets per annum, vehicle producers would purchase their fastening requirement direct rather than through stockists. This being the case, they are adamant that the same price level would prevail at 1,000,000 sets and 50,000 sets.

On the basis that they produce in the order of 80 million self tapping screws to a single specification per annum, one million vehicle sets is considered to be relatively low volume

STEERING COLUMN ASSEMBLY

50,000 p.a.	£17.45 ea		Tooling £	230,000
100,000 p.a.	£16.01 ea	8% reduction	Tooling £	230,000
200,000 p.a.	£16.01 ea		Tooling £	230,000
300,000 p.a.	£15.85 ea	1% reduction	Tooling £	230,000
500,000 p.a.	£15.69 ea	1% reduction	Tooling £	700,000
1,000,000 p.a.	£15.30 ea	2½% reduction	Tooling £	1,600,000

PAINT

It is unlikely that manufacturers will greatly reduce the number of paint options currently available to the customer. The Henry Ford option would clearly be unacceptable in the modern day market place.

As most major companies offer upto sixteen colour options even the major paint suppliers are producing paint at well below the sorts of volume under our consideration.

Taking an average vehicle usage of five litres, the number of colour options available reduces Ford's total Dagenham and Halewood paint offtake to well below 200,000 litres per annum, per colour.

Equally, where a single company's product is produced in a number of European assembly plants, each plant tends to source its paint locally, in order that day to day paint problems can be resolved immediately by that local source. This practise is unlikely to change.

It should also be noted that paint price varies, colour to colour, dependent on the type and amount of pigment required in each.

e.g.	White	£2	per litre
	Red	£5	per litre
	Green	£3	per litre
	Blue	£3.50	per litre
	Black	£2.50	per litre
	Yellow	£5	per litre

For purposes of evaluation white had been taken as a typical example.

250,000 litres p.a.	£2.00 per litre		
500,000 litres p.a.	£1.95 per litre	2% reduction	
1,000,000 litres p.a.	£1.90 per litre	2% reduction	
1,500,000 litres p.a.	£1.84 per litre	2% reduction	
2,500,000 litres p.a.	£1.75 per litre	4% reduction	
5,000,000 litres p.a.	£1.60 per litre	9% reduction	

WIPER MOTOR, LINKAGE & BRACKETRY (LESS ARMS & BLADES)

Within a screen or backlight wipe system, the motor has to a large degree already been heavily rationalised across differing models and manufacturers product ranges. The linkage and bracketry tends to be more individual to the model specification as its design is determined largely by the space package available in the bulkhead area of the vehicle.

50,000 p.a.	£14.80 ea		Tooling £ 100,000
100,000 p.a.	£14.80 ea		Tooling £ 100,000
200,000 p.a.	£14.40 ea	3% reduction	Tooling £ 125,000
300,000 p.a.	£14.40 ea		Tooling £ 125,000
500,000 p.a.	£14.40 ea		Tooling £ 125,000

1,000,000 p.a	£14.[illegible] ea	3% reduction	Tooling £	175,000

WIPER ARMS & BLADES

Whilst a few of the smaller items within an arm and blade system can be common across a range of assemblies, i.e. springs, clips etc., the assembly itself needs to be designed specifically to suit each vehicle screen glass in terms of arm and blade length, cranked angles etc., It is therefore unlikely th[illegible] rationalisation will extend beyond its current position.

50,000 p.a.	£ 3.60 set		Tooling £	50,000
100,000 p.a.	£ 3.60 set		Tooling £	50,000
200,000 p.a.	£ 3.53 set	2% reduction	Tooling £	50,000
300,000 p.a.	£ 3.53 set		Tooling £	50,000
500,000 p.a.	£ 3.46 set	2% reduction	Tooling £	100,000
1,000,000 p.a.	£ 3.42 set	1% reduction	Tooling £	100,000

SEAT BELTS (4 BELT SYSTEM)

To a major extent, manufacture of seat belt assemblies has already standardised across model and vehicle range, in the sense that motor manufacturers can usually find standard componentry which will suit their specific requirement.

Although anchorage positions and belt lengths vary from model to model, essentially the comprising components within an assembly are very similar, and belt manufacturers have therefore accrued sufficient range of parts over the years to offer their use as standard parts.

50,000 sets p.a.	£36.70 set		Tooling £	400,000
100,000 sets p.a.	£33.29 set	(- 9½%)	Tooling £	470,000
200,000 sets p.a.	£30.32 set	(- 9%)	Tooling £	500,000
300,000 sets p.a.	£27.72 set	(- 8½%)	Tooling £	540,000
500,000 sets p.a.	£25.52 set	(- 8%)	Tooling £	600,000
1,000,000 sets p.a.	£23.57 set	(- 8%)	Tooling £	725,000

It should be noted that the above tooling costs represent the amount of tooling expenditure which would be required if a belt system were tooled from scratch at the volumes indicated. As mentioned previously, standard parts would normally be available however

SEAT FOAMS (MOULDED)

The major capacity constraint to foam moulding is curing time. Once the constituent chemicals have been introduced into the tool cavity there is a predetermined time in which it will take the chemical to react. As volumes increase, more moulds can be introduced into the system, automated carousal arrangements can be adopted, and chemicals can be introduced into the tool automatically. However, as the maximum capacity per mould is be 750 units per week, it can be appreciated that a huge floor area would be required in which to build one milion vehicle sets per annum.

The larger foam companies have separate plants situated strategically around Europe, for easy delivery into the major car plants. Whilst the 'majors' would be capable of producing one million foam sets per annum from within the group, the maximum capacity per plant is believed to be no higher than 350,000 sets

a) FRONT SQUAB FOAM

50,000 prs p.a.	£4.84 set		Tooling	£ 8,575
100,000 prs p.a.	£4.62 set	(- 4½%)	Tooling	£ 13,650
200,000 prs p.a.	£4.40 set	(- 4%)	Tooling	£ 23,800
300,000 prs p.a.	£4.34 set	(- 1%)	Tooling	£ 33,950
500,000 prs p.a.	£4.26 set	(- 2%)	Tooling	£ 54,215
1,000,000 prs p.a.	£4.18 set	(- 2%)	Tooling	£ 104,965

b) FRONT CUSHION FOAM

50,000 prs p.a.	£4.40 set		Tooling	£ 7,650
100,000 prs p.a.	£4.20 set	(- 4½)	Tooling	£ 11,700
200,000 prs p.a.	£4.00 set	(- 4%)	Tooling	£ 20,400
300,000 prs p.a.	£3.94 set	(- 1%)	Tooling	£ 29,100
500,000 prs p.a.	£3.88 set	(- 2%)	Tooling	£ 46,470
1,000,000 prs p.a.	£3.80 set	(- 2%)	Tooling	£ 89,970

c) FOAM SQUAB BENCH REAR

50,000 p.a.	£6.60 ea		Tooling	£ 10,575
100,000 p.a.	£6.30 ea	(- 4½%)	Tooling	£ 15,650

200,000 p.a.	£6.00 ea	(- 4%)	Tooling	£ 25,800
300,000 p.a.	£5.91 ea	(- 1%)	Tooling	£ 35,950
500,000 p.a.	£5.82 ea	(- 2%)	Tooling	£ 56,215
1,000,000 p.a.	£5.70 ea	(- 2%)	Tooling	£ 106,965

d) FOAM CUSHION BENCH REAR

50,000 p.a.	£7.70 ea		Tooling	£ 9,713
100,000 p.a.	£7.35 ea	(- 4½%)	Tooling	£ 14,425
200,000 p.a.	£7.00 ea	(- 4%)	Tooling	£ 23,850
300,000 p.a.	£6.89 ea	(- 1%)	Tooling	£ 33,275
500,000 p.a.	£6.79 ea	(- 2%)	Tooling	£ 52,092
1,000,000 p.a.	£6.65 ea	(- 2%)	Tooling	£ 99,217

BATTERY (DIN 40)

Having spoken to a number of battery manufacturers, it is claimed that prices are not sensitive to volume between 50,000 and 1,000,000 per annum. Although information was not particularly forthcoming, it is suspected that because a single type of battery is already produced in very high volume, as with standard bearings, the maximum discount level would be allowed on a volume of 50,000.

However, as it is believed that negotiation would enable some reduction to be achieved, the following figures assume an overall difference of 5% between minimum and maximum quantity levels.

50,000 p.a.	£14.50 ea	
100,000 p.a.	£14.36 ea	1% reduction
200,000 p.a.	£14.22 ea	1% reduction
300,000 p.a.	£14.08 ea	1% reduction
500,000 p.a.	£13.94 ea	1% reduction
1,000,000 p.a.	£13.80 ea	1% reduction

It is not the custom of battery manufacturers to charge for tooling.

CASTINGS (ALUMINIUM)

a) SMALL (WATER PUMP)

50,000 p.a.	£ 2.00 ea		Tooling £ 30,000
100,000 p.a.	£ 1.97 ea	1½% reduction	Tooling £ 38,000
200,000 p.a.	£1.80 ea	8½ reduction.	Tooling £ 100,000
500,000 p.a.	£ 1.76 ea		Tooling £ 160,000
1,000,000 p.a.	£ 1.72 ea	2% reduction	Tooling £ 250,000

NOTE: double shifting would be introduced at levels of 300.000 per annum, and a two carousal multi impression die method would need to be adopted at levels of one million per annum.

b) MEDIUM (MANIFOLD)

50,000 p.a.	£ 9.00 ea		Tooling £ 60,000
100,000 p.a.	£ 8.70 ea	3% reduction	Tooling £ 76,000
200,000 p.a.	£ 8.20 ea	6% reduction	Tooling £ 150,000
300,000 p.a.	£ 8.20 ea		Tooling £ 150,000
500,000 p.a.	£ 8.10 ea	1% reduction	Tooling £ 240,000
1,000,000 p.a.	£ 8.00 ea	1% reduction.	Tooling £ 400,000

c)LARGE (SUMP)

50,000 p.a.	£35.00 ea		Tooling £ 160,000
100,000 p.a.	£35.00 ea		Tooling £ 160,000 (Double shift)
200,000 p.a.	£33.00 ea	(- 5 3/4%)	Tooling £ 200,000 (Automate & double shift)
300,000 p.a.	£32.00 ea	(- 3%)	Tooling £ 250,000
500,000 p.a.	£31.25 ea	(- 2 1/4%)	Tooling £ 400,000
1,000,000 p.a.	£29.00 ea	(- 7 1/2%)	Tooling £ 700,000

d) LARGE (CYLINDER HEAD)

50,000 p.a.	£38.00 ea		Tooling £ 400,000

100,000 p.a.	£38.00 ea		Tooling £ 400,000 (Double shift)
200,000 p.a.	£36.[illegible] ea	(- 4%)	Tooling £ 750,000
300,000 p.a.	£35.00 ea	(- 4%)	Tooling £1,050,000
500,000 p.a.	£34.60 ea	(- 1 1/4%)	Tooling £1,700,000 (Second carousal)
1,000,000 p.a.	£34.60 ea		Tooling £2,600,000

All quantities to be produced on a fully automated system.

As can be seen from the above reductions, downward movements will to a degree depend on the complexity of casting and therefore upon the method of manufacture adopted at the varying levels, i.e. double shifting, automation etc.,

Capacity would not be seen as a problem at the higher volume levels.

STRUCTURAL FOAM (CONSOLE ASSY COMPLETE WITH POLYPROPYLENE ARMATURE & COVERING MATERIAL)

50,000 p.a.	£28.00 ea		Tooling £ 195,000
100,000 p.a.	£28.00 ea		Tooling £ 250,000
200,000 p.a.	£25.00 ea	(- 10%)	Tooling £ 386,000
300,000 p.a.	£25.00 ea		Tooling £ 500,000
500,000 p.a.	£22.00 ea	(- 12%)	Tooling £ 860,000
1,000,000 p.a.	£20.00 ea	(- 9%)	Tooling £1,600,000

Structural foam is generally used in the manufacture of interior trim assemblies. It is not considered that major rationalisation will take effect in this area as vehicle manufacturers are likely to continue to offer a variety of trim options against low line mid range and high line options etc.,

INTERIOR TRIM MOULDINGS/DOOR CASINGS

Unfortunately, due to the complex nature of assessing accurately the economies of scale against such parts, it has proved impossible to obtain factual information from supply sources. In broad terms however, one could reasonably expect percent'age savings at differing volumes to be similar to those indicated for structural foam.

ROLLED SECTION - SMALL (WINDOW LIFT SECTION)

The rolling of metal is broadly similar to the extrusion of plastic in that a single set of rolls will produce vast quantities of a specific section.

It differs from extrusion however in that a number of rolls may be required in order to form a specific sectional shape, and machine setting time is considerably longer. Whilst small run quantities would be considerably more expensive to manufacture, economies beyond 50,000 are limited to material cost and overhead contribution.

50,000 p.a.	£0.30 ea		Tooling	£ 5,000
100,000 p.a.	£0.294 ea	2% reduction	Tooling	£ 5,000
200,000 p.a.	£0.291 ea	1% reduction	Tooling	£ 5,000
300,000 p.a.	£0.291 ea		Tooling	£ 5,000
500,000 p.a.	£0.288 ea	1% reduction	Tooling	£ 5,000
1,000,000 p.a.	£0.286 ea	½% reduction	Tooling	£ 5,000

ROLLED SECTION MEDIUM/LARGE (ROOF MOULDING)

50,000 p.a.	£4.50 ea		Tooling	£ 15,000
100;000 p.a.	£3.50 ea	22% reduction	Tooling	£ 80,000
200,000 p.a.	£3.29 ea	6% reduction	Tooling	£110,000
300,000 p.a.	£3.26 ea	1% reduction	Tooling	£110,000
500,000 p.a.	£3.23 ea	1% reduction	Tooling	£220,000
1,000,000 p.a.	£3.21 ea		Tooling	£220,000

A body in white roof moulding can by nature be a relatively complex component, requiring clippings, notching and pressing operations. With regard to the form bending of such a component, the above prices reflect a choice of conventional bending techniques for volumes of 50,000 per annum. As can be seen tool costs are comparatively low.

However, for higher volumes, 'stretch bending' operations would probably be introduced. Such a method warrants considerably more tooling investment, but as the bend is formed at a time when the material has been stretched, and is therefore inert, no 'spring back' occurs, and finishing operations are reduced dramatically. At volumes above 100,000, potential savings are somewhat limited. Tooling would have to be duplicated however at the 500,000 level

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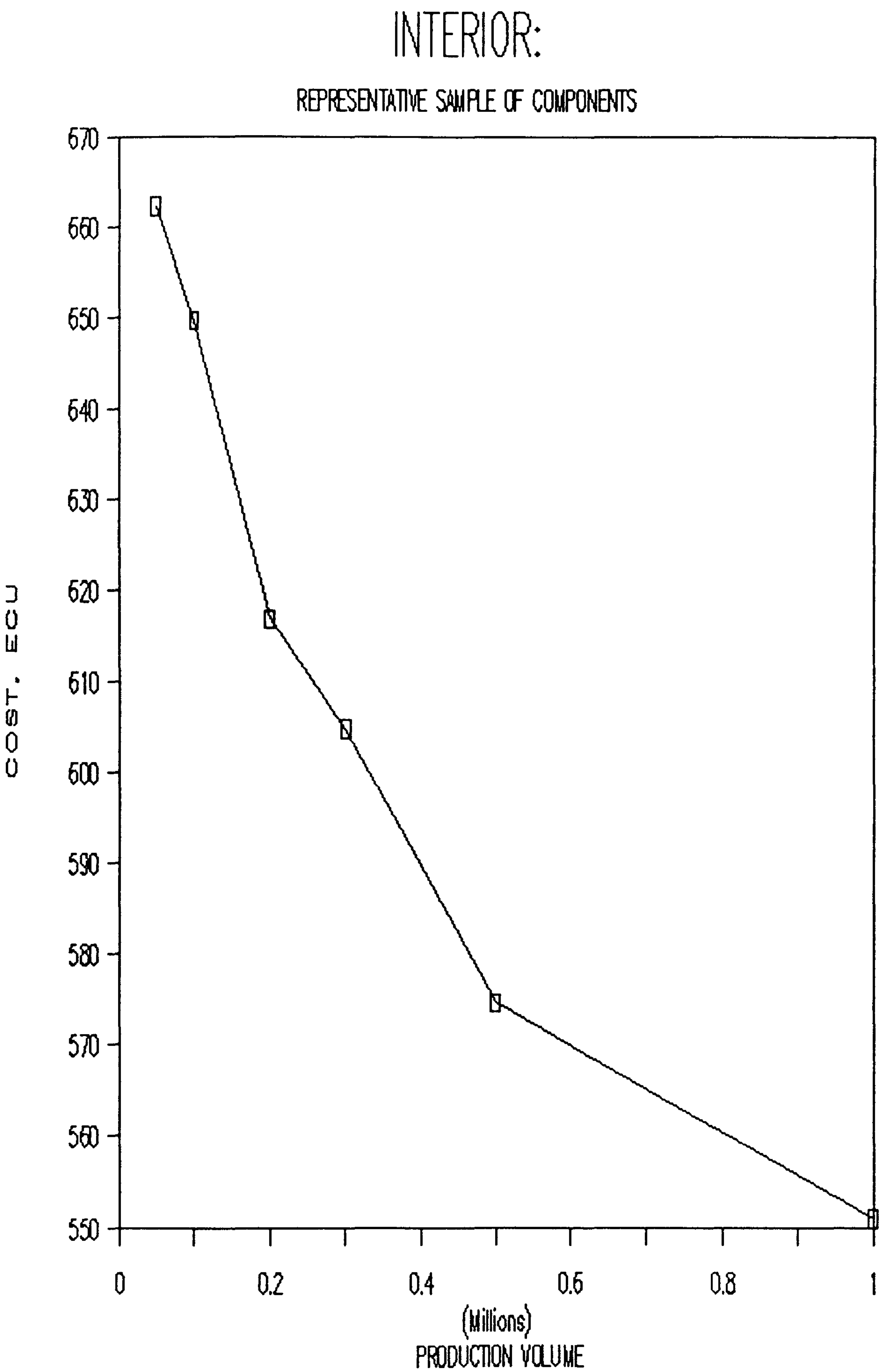
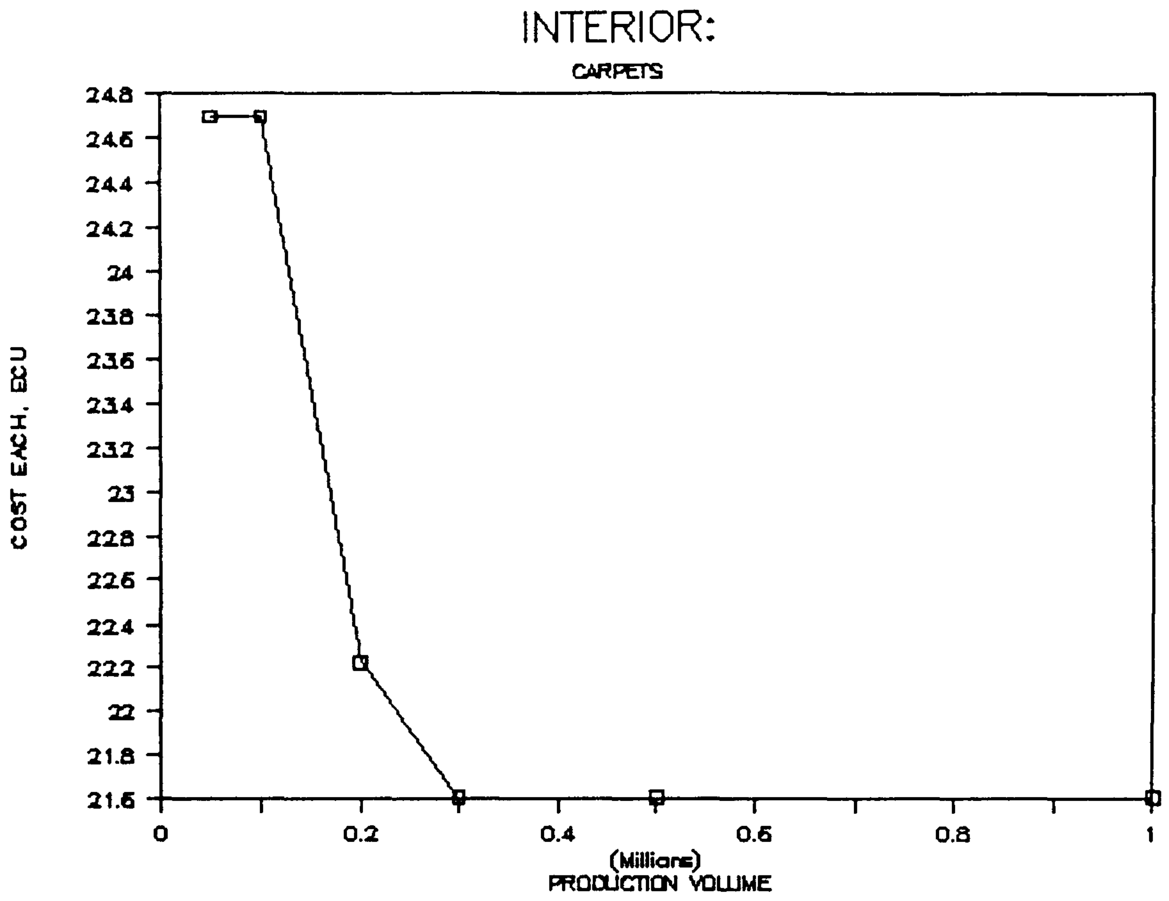
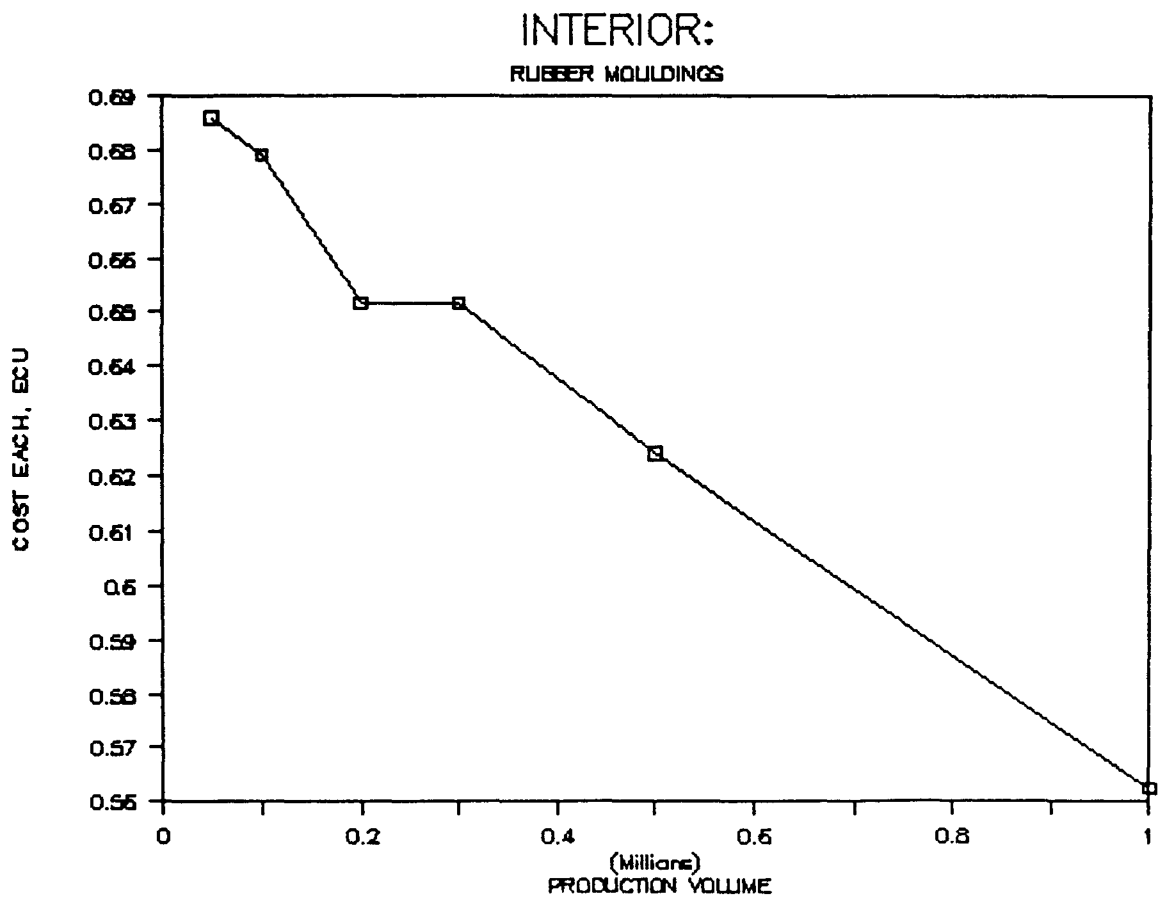
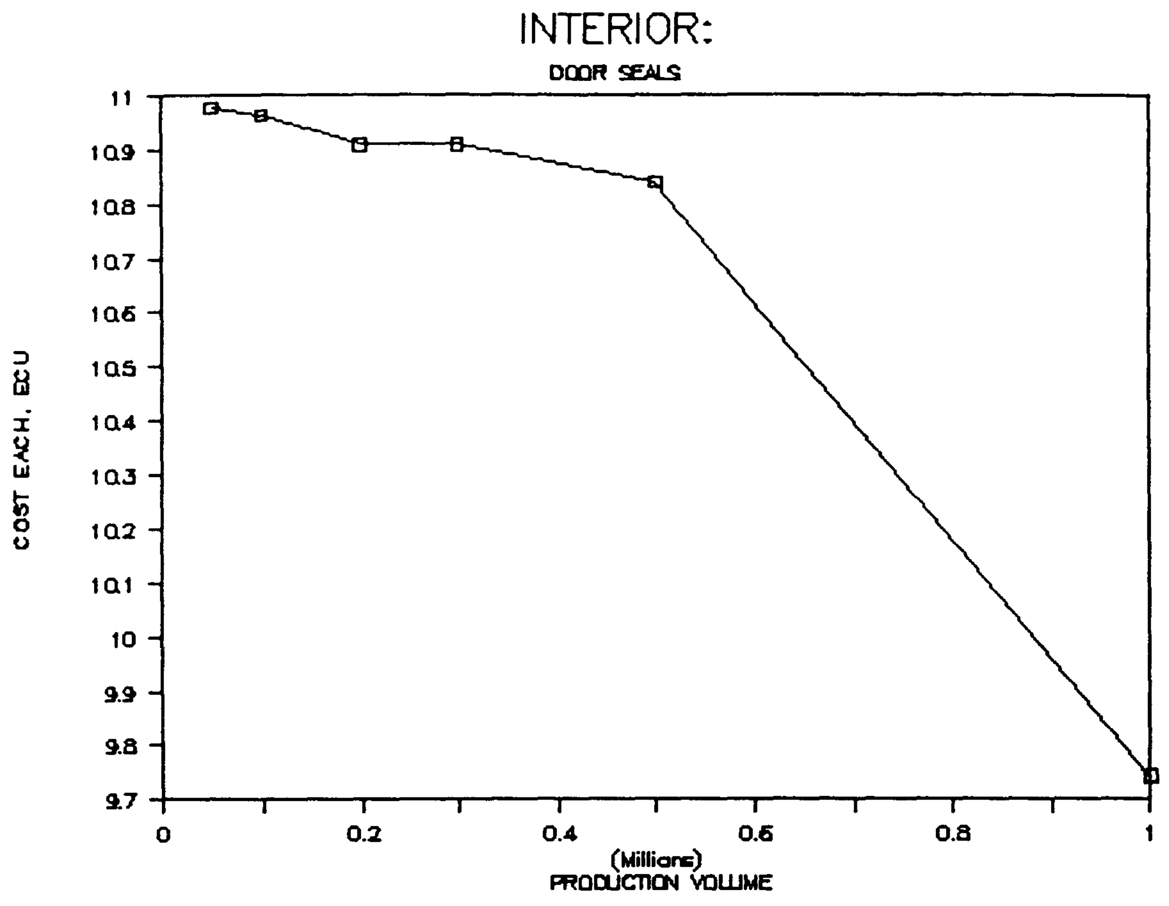
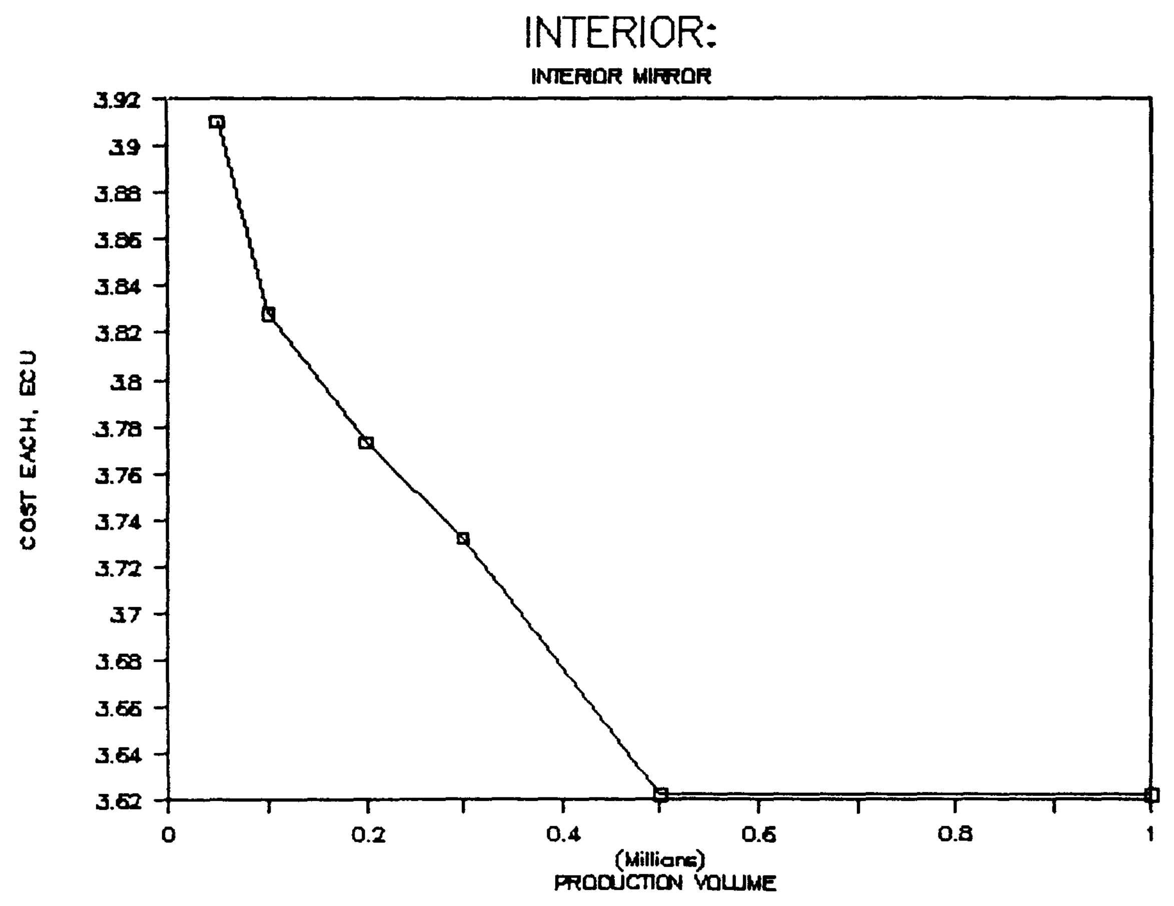
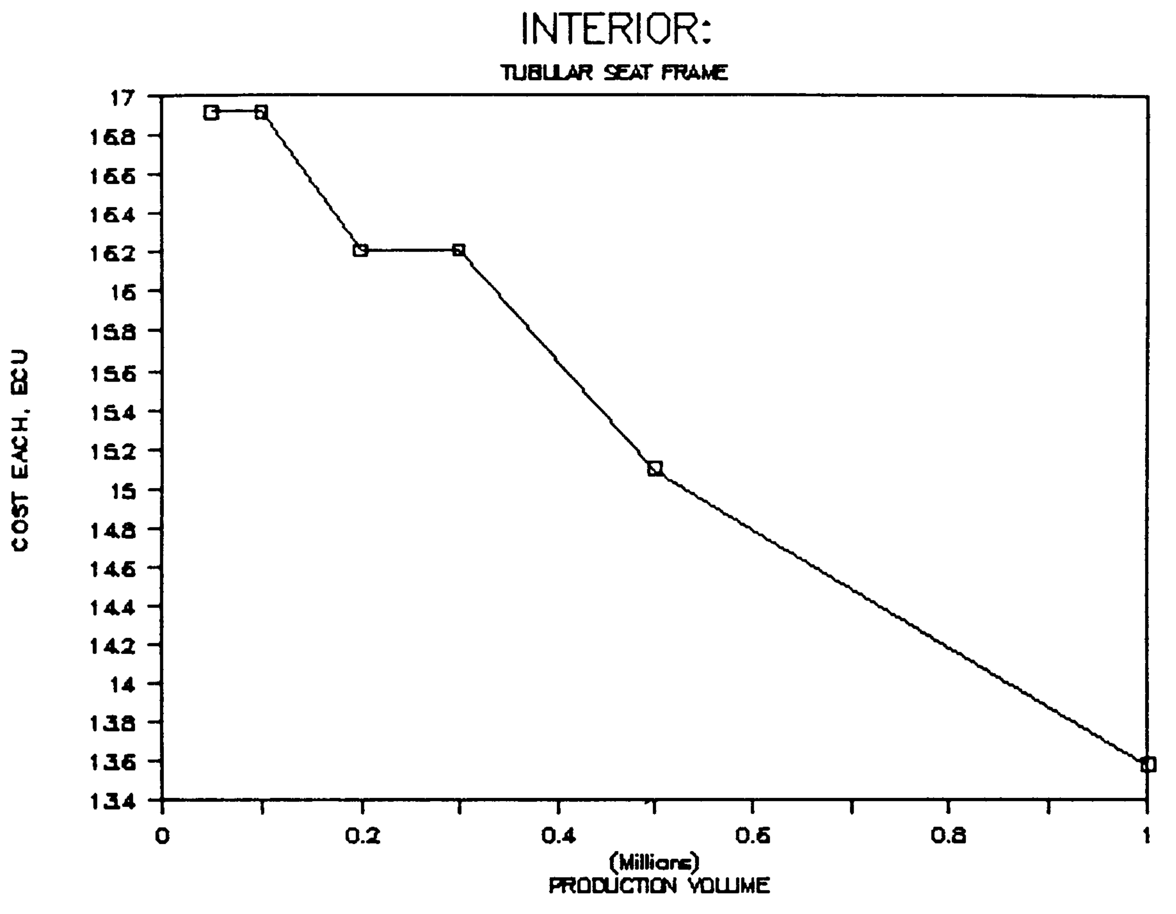

INTERIOR:
REPRESENTATIVE SAMPLE OF COMPONENTS
COST, ECU
670
660
650
640
630
620
610
600
590
580
570
560
550
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

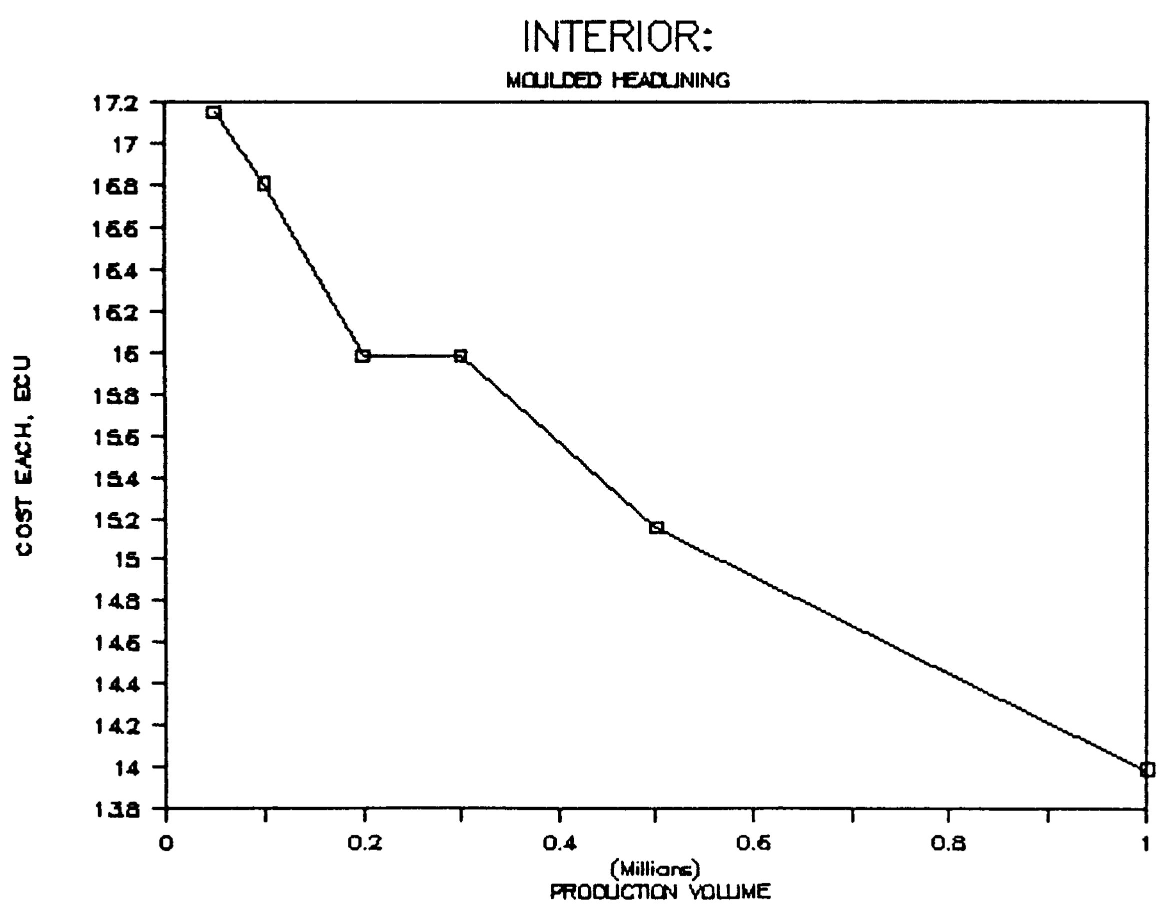

INTERIOR:
CARPETS
COST EACH, ECU
24.8
24.6
24.4
24.2
24
23.8
23.6
23.4
23.2
23
22.8
22.6
22.4
22.2
22
21.8
21.6
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

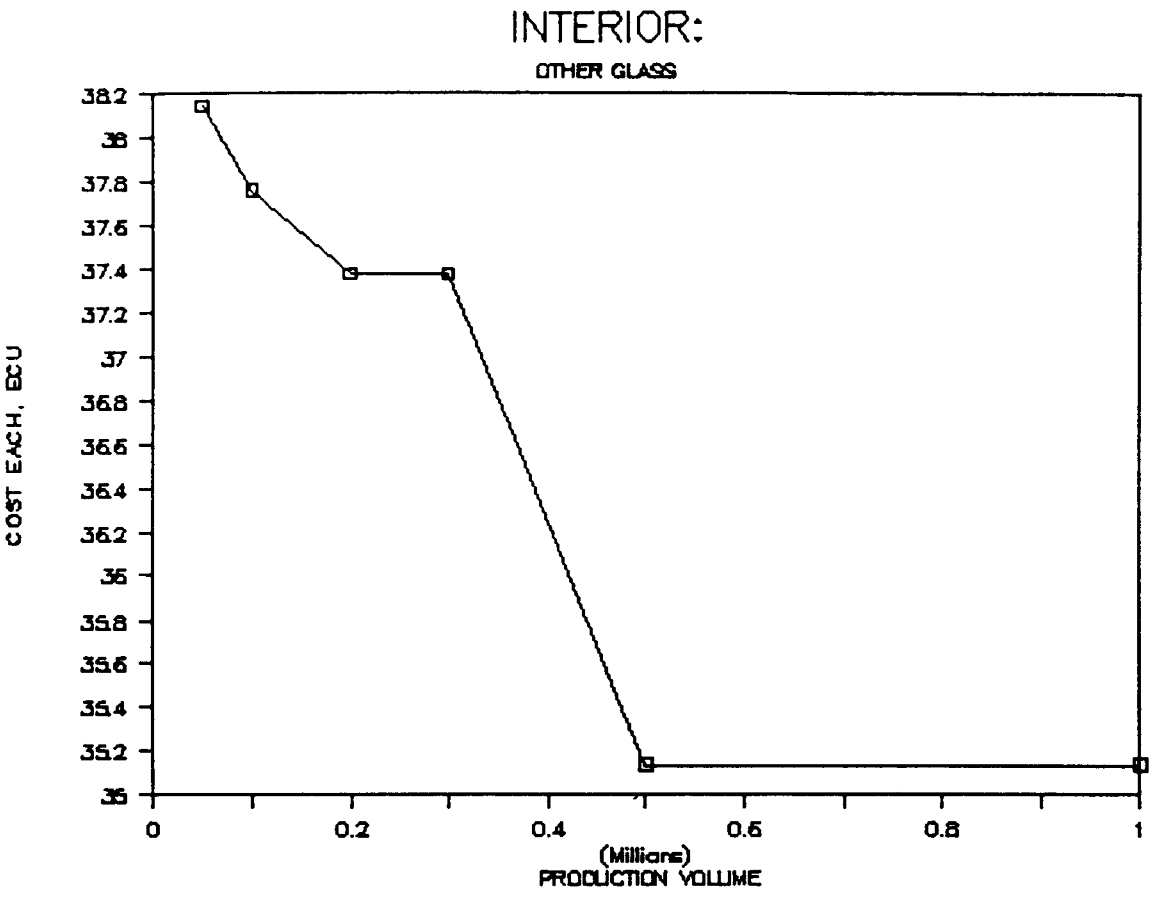

INTERIOR:
RUBBER MOULDINGS
COST EACH, ECU
0.69
0.68
0.67
0.66
0.65
0.64
0.63
0.62
0.61
0.6
0.59
0.58
0.57
0.56
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

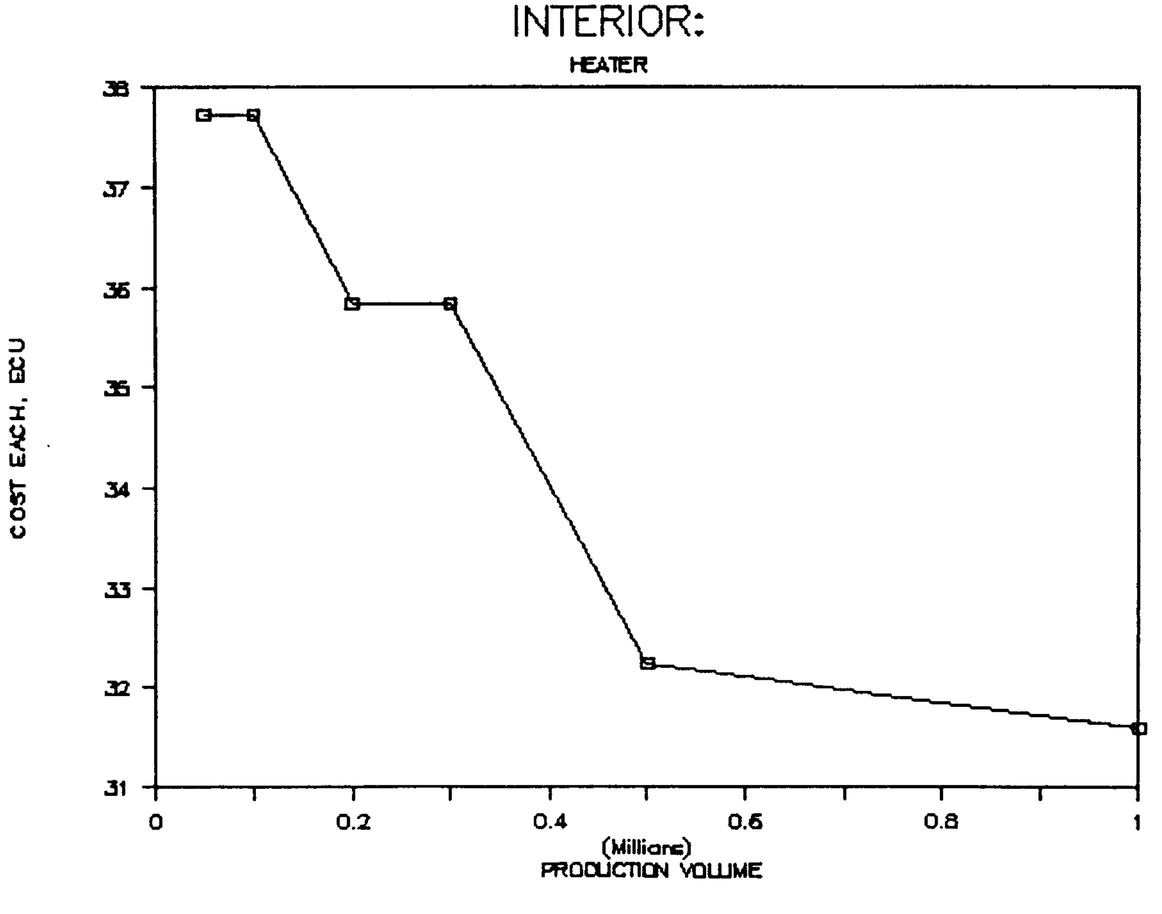

INTERIOR:
DOOR SEALS
COST EACH, ECU
11
10.9
10.8
10.7
10.6
10.5
10.4
10.3
10.2
10.1
10
9.9
9.8
9.7
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

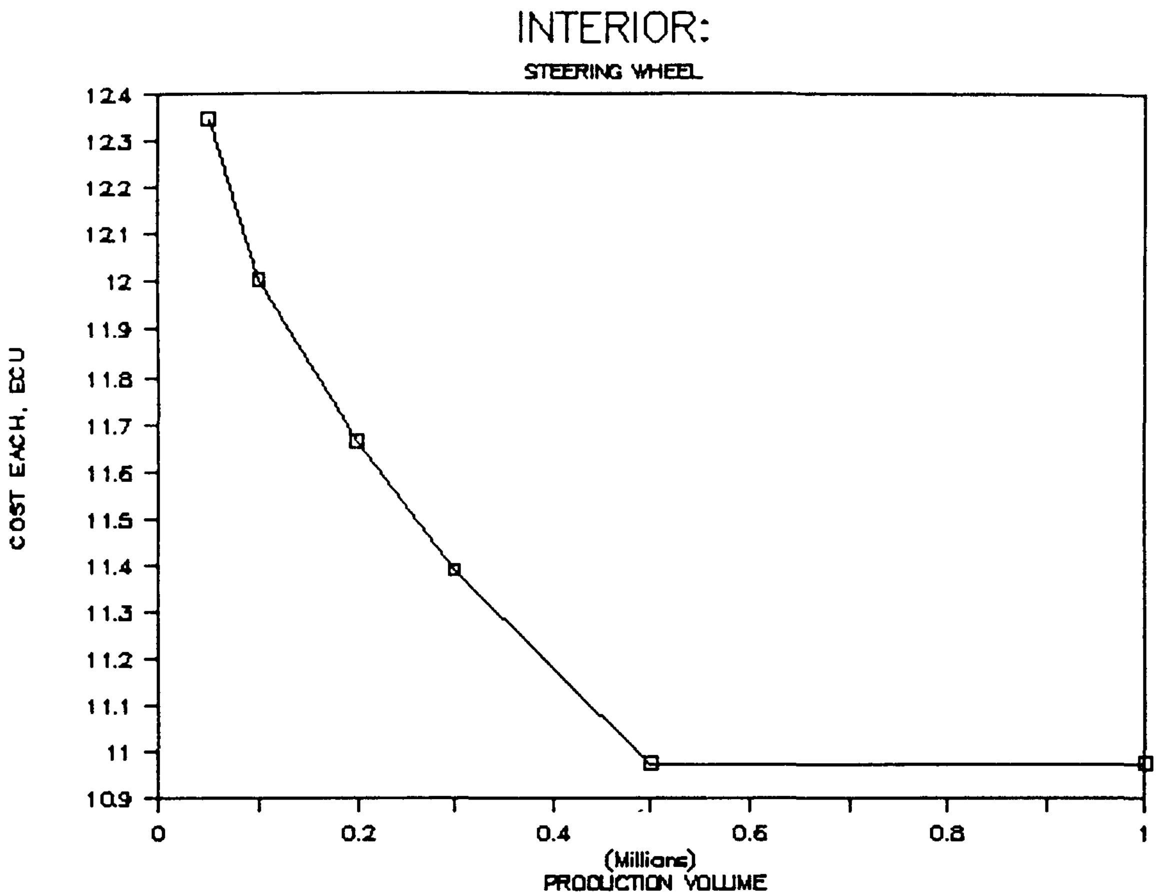

INTERIOR:
INTERIOR MIRROR
COST EACH, ECU
3.92
3.9
3.88
3.86
3.84
3.82
3.8
3.78
3.76
3.74
3.72
3.7
3.68
3.66
3.64
3.62
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

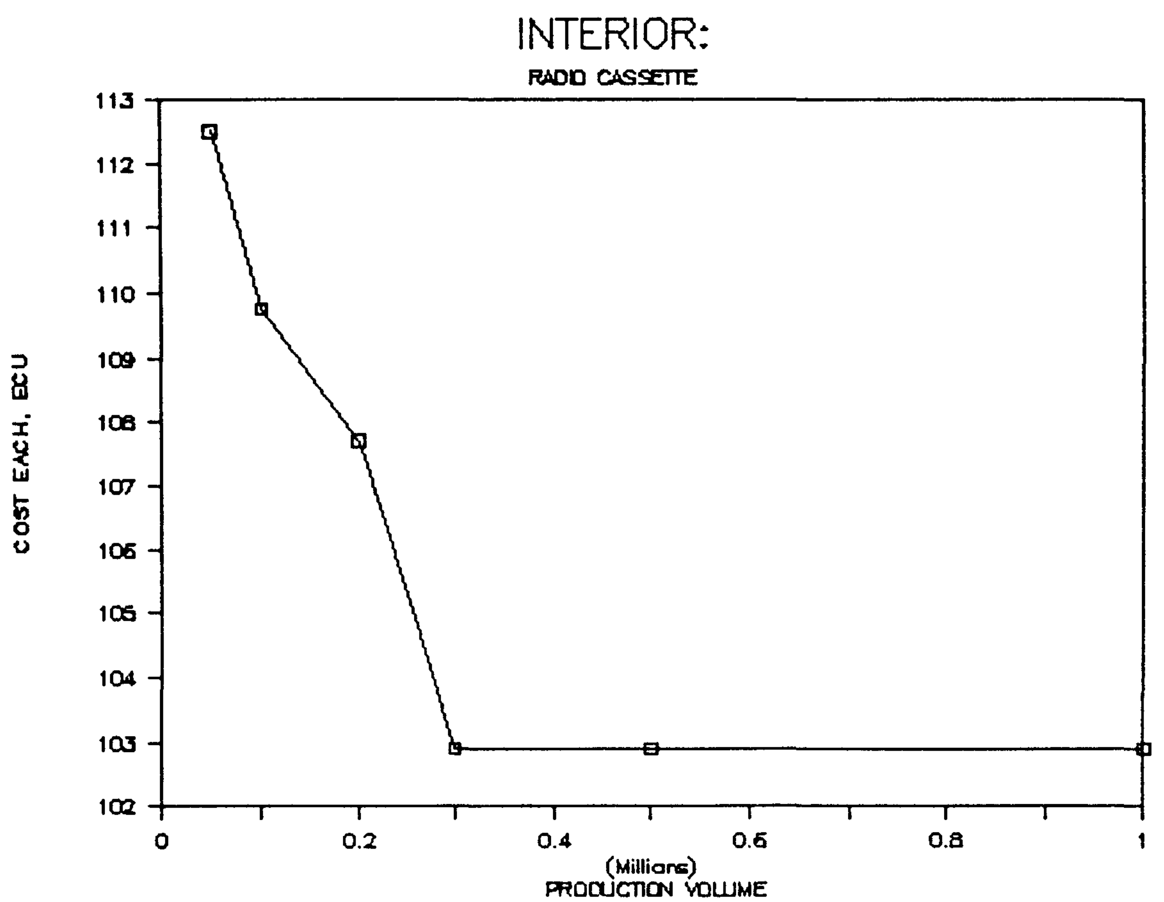

INTERIOR:
TUBULAR SEAT FRAME
COST EACH, ECU
17
16.8
16.6
16.4
16.2
16
15.8
15.6
15.4
15.2
15
14.8
14.6
14.4
14.2
14
13.8
13.6
13.4
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

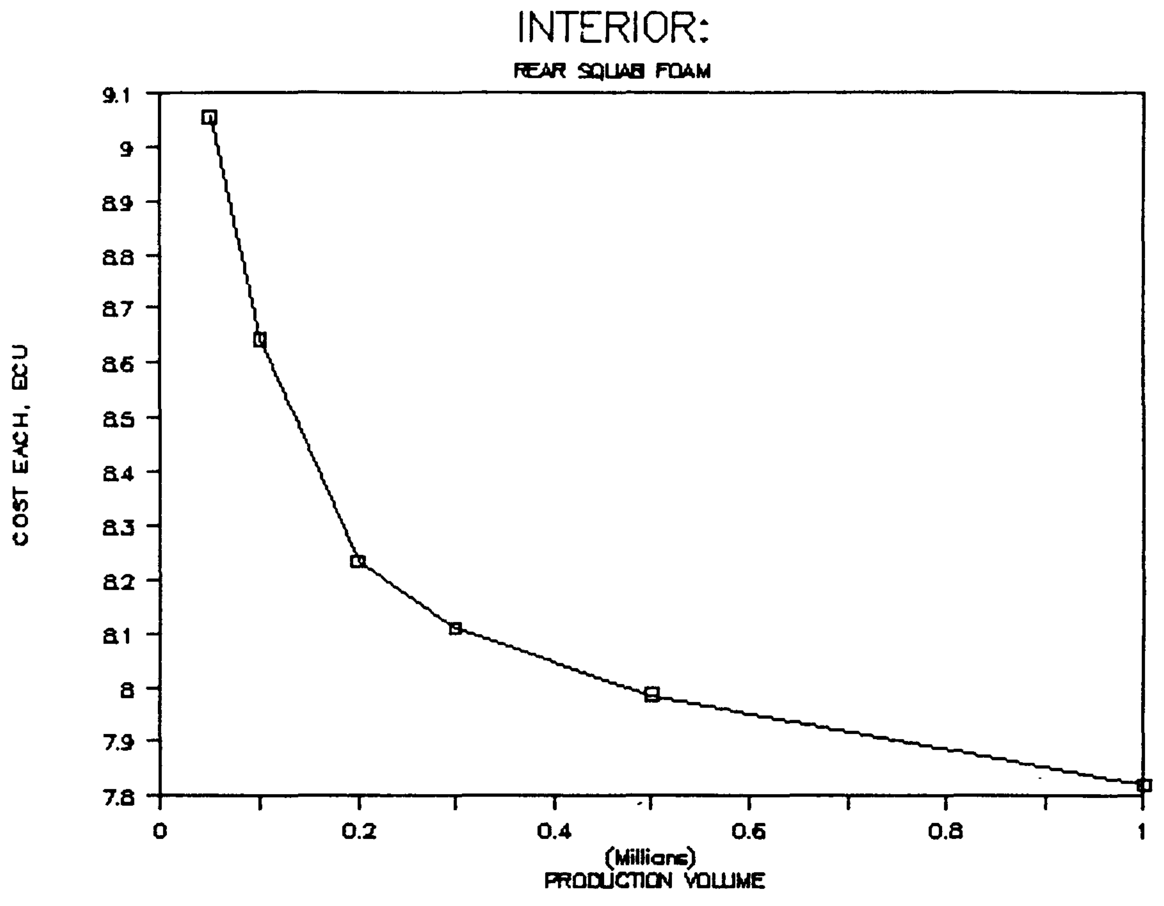

INTERIOR:
MOULDED HEADLINING
COST EACH, ECU
17.2
17
16.8
16.6
16.4
16.2
16
15.8
15.6
15.4
15.2
15
14.8
14.6
14.4
14.2
14
13.8
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

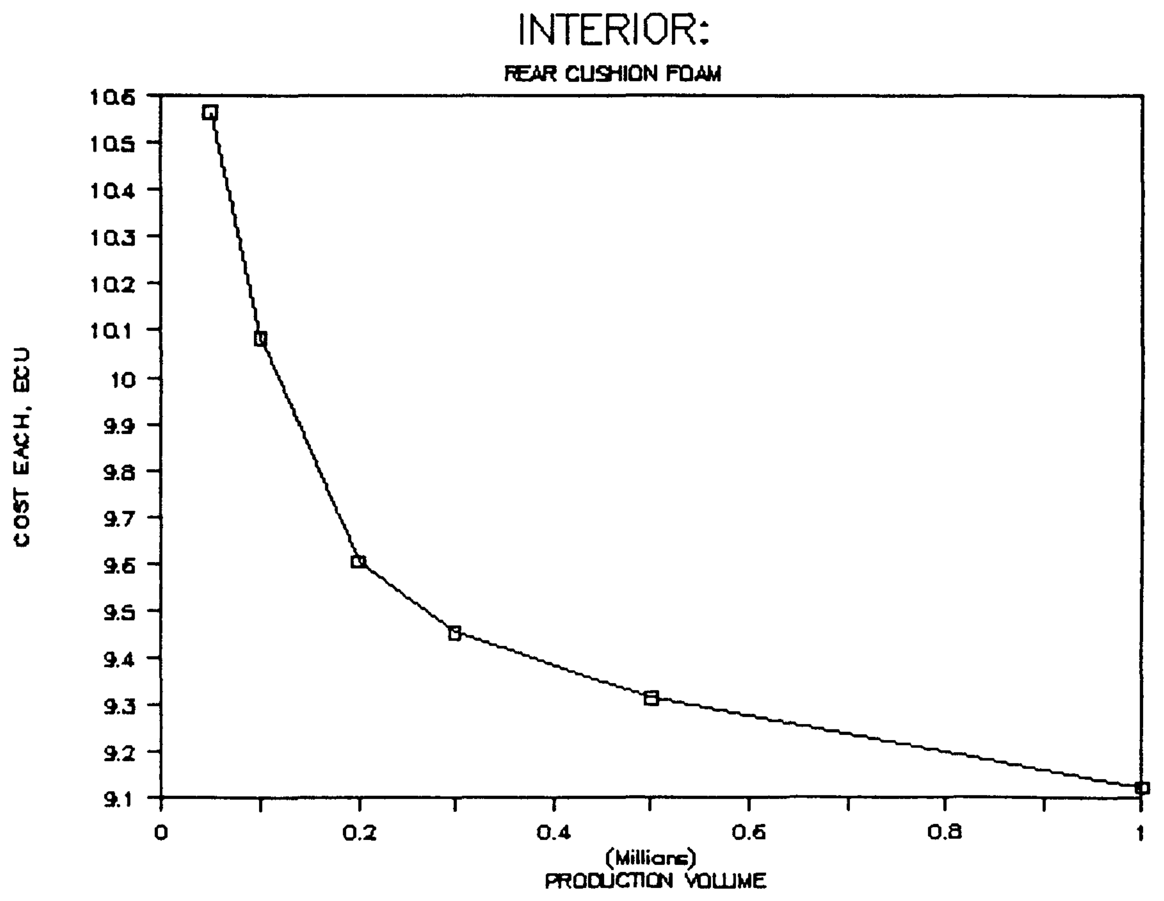

INTERIOR:
OTHER GLASS
COST EACH, ECU
38.2
38
37.8
37.6
37.4
37.2
37
36.8
36.6
36.4
36.2
36
35.8
35.6
35.4
35.2
35
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

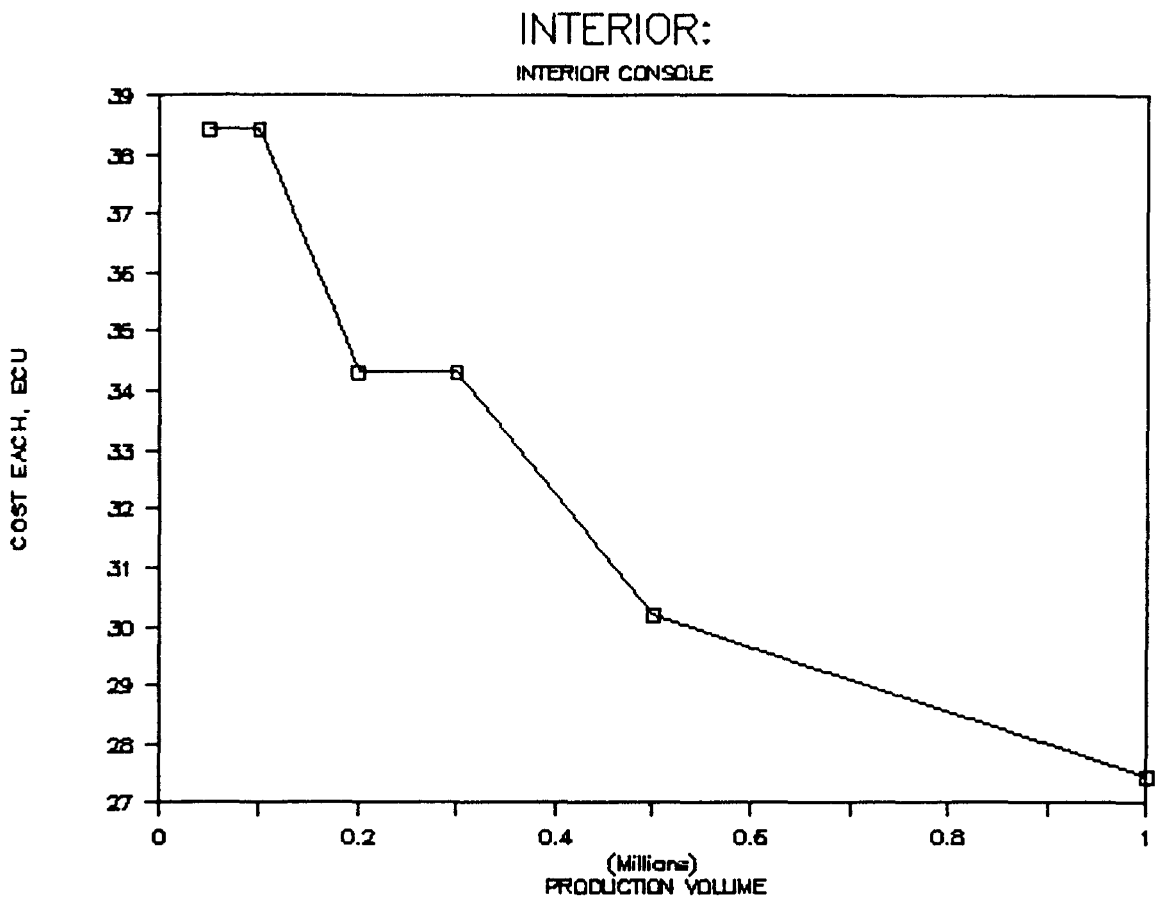

INTERIOR:
HEATER
COST EACH, ECU
38
37
36
35
34
33
32
31
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

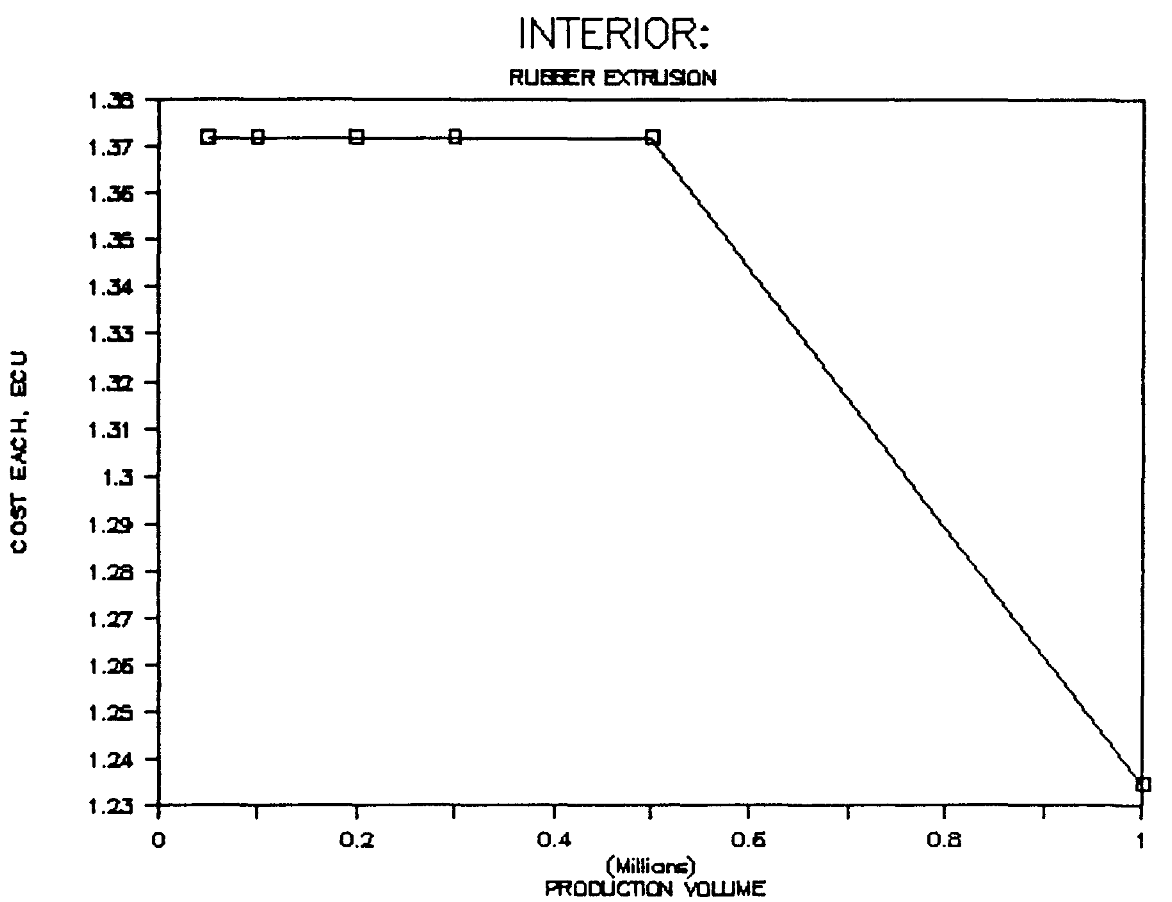

INTERIOR:
STEERING WHEEL
COST EACH, ECU
12.4
12.3
12.2
12.1
12
11.9
11.8
11.7
11.6
11.5
11.4
11.3
11.2
11.1
11
10.9
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

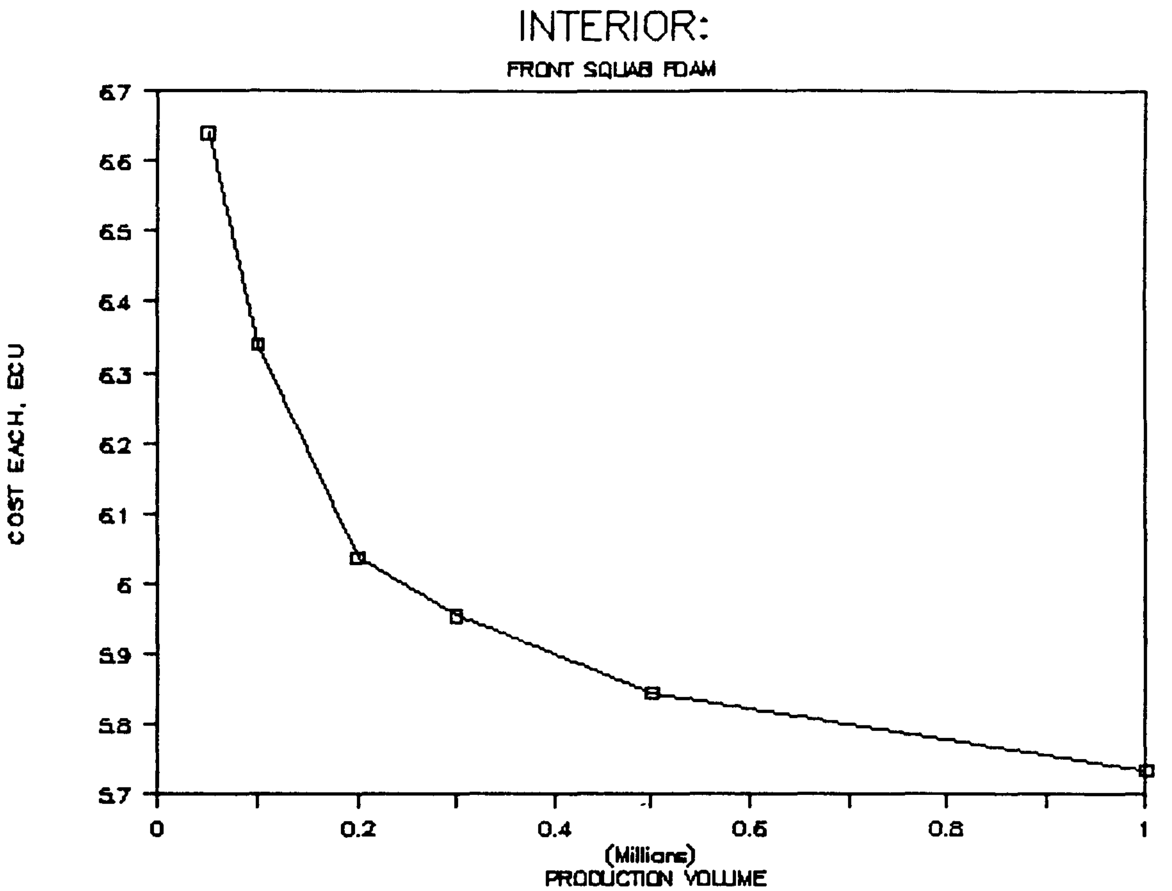

INTERIOR:
RADIO CASSETTE
COST EACH, ECU
113
112
111
110
109
108
107
106
105
104
103
102
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

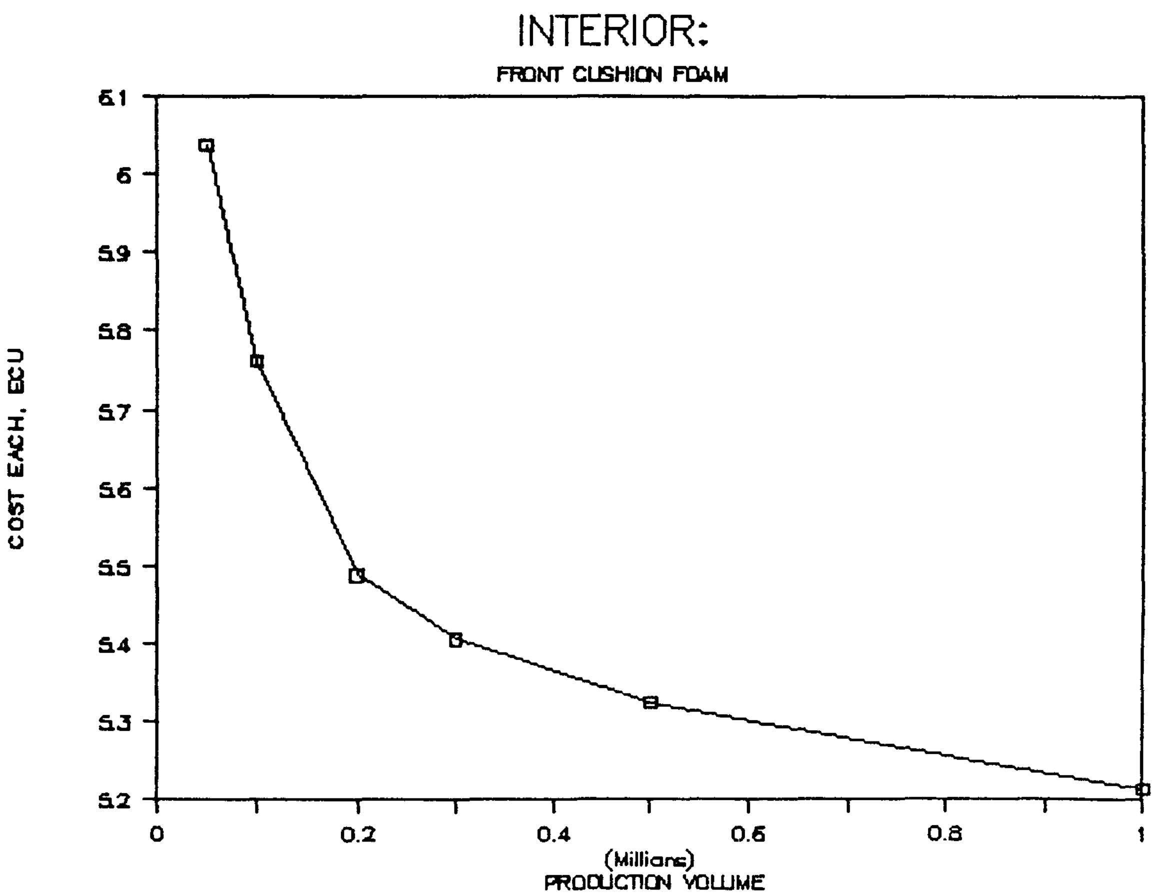

INTERIOR:
REAR SQUAB FOAM
COST EACH, ECU
9.1
9
8.9
8.8
8.7
8.6
8.5
8.4
8.3
8.2
8.1
8
7.9
7.8
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

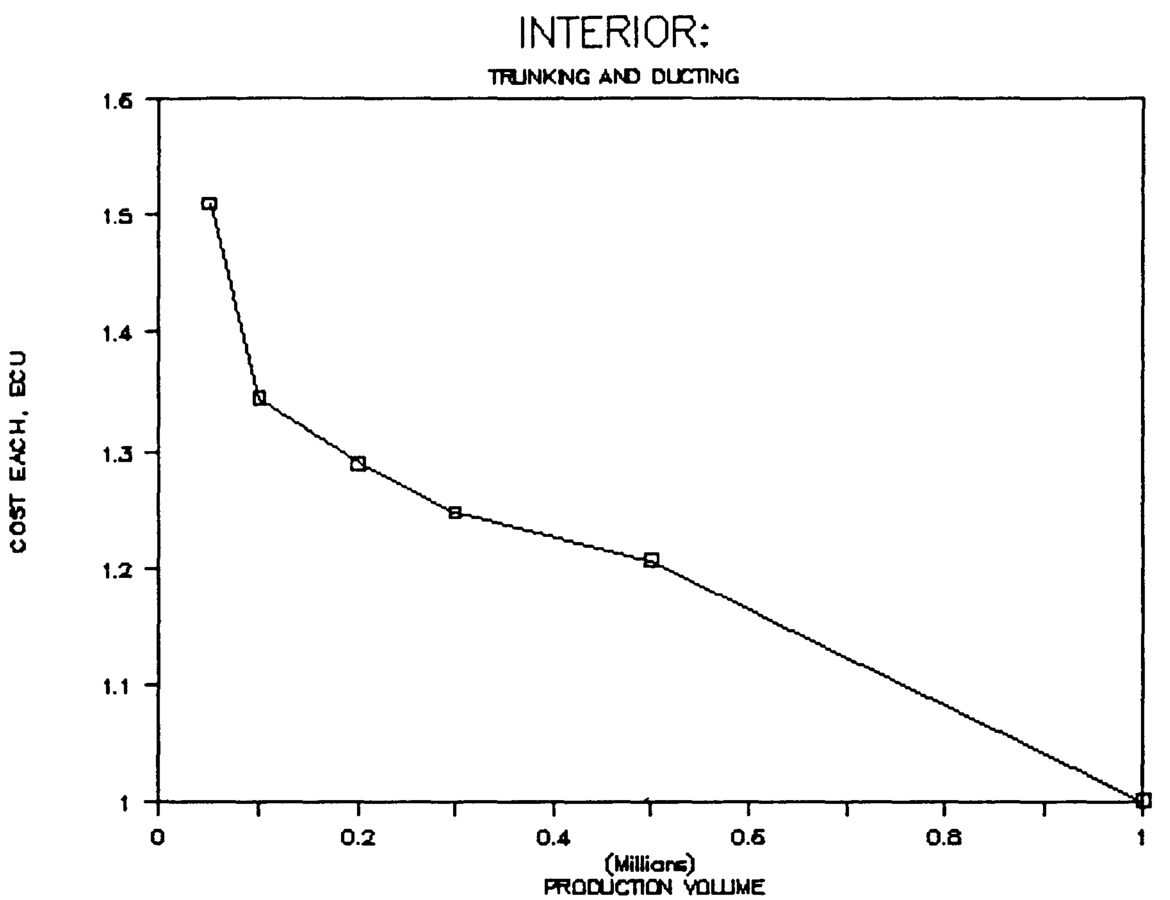

INTERIOR:
REAR CUSHION FOAM
COST EACH, ECU
10.6
10.5
10.4
10.3
10.2
10.1
10
9.9
9.8
9.7
9.6
9.5
9.4
9.3
9.2
9.1
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

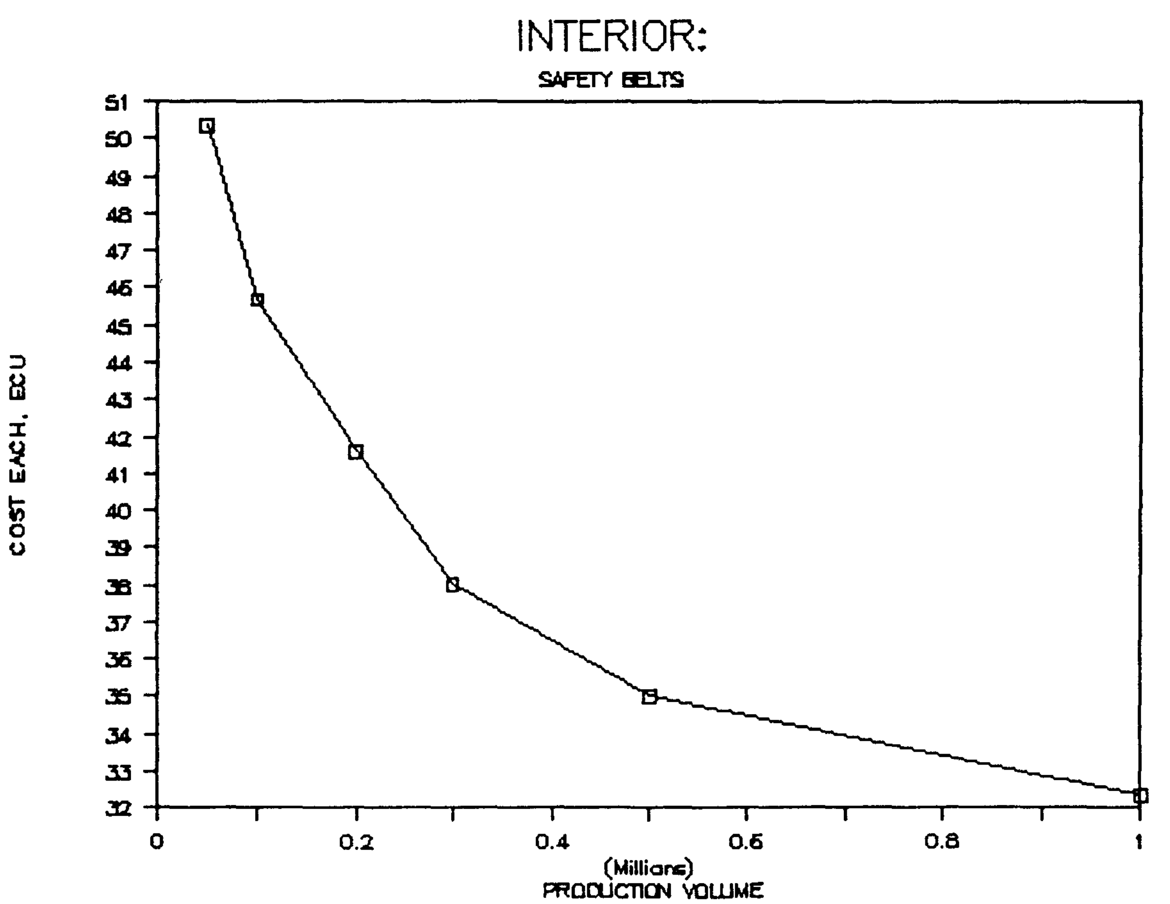

INTERIOR:
INTERIOR CONSOLE
COST EACH, ECU
39
38
37
36
35
34
33
32
31
30
29
28
27
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

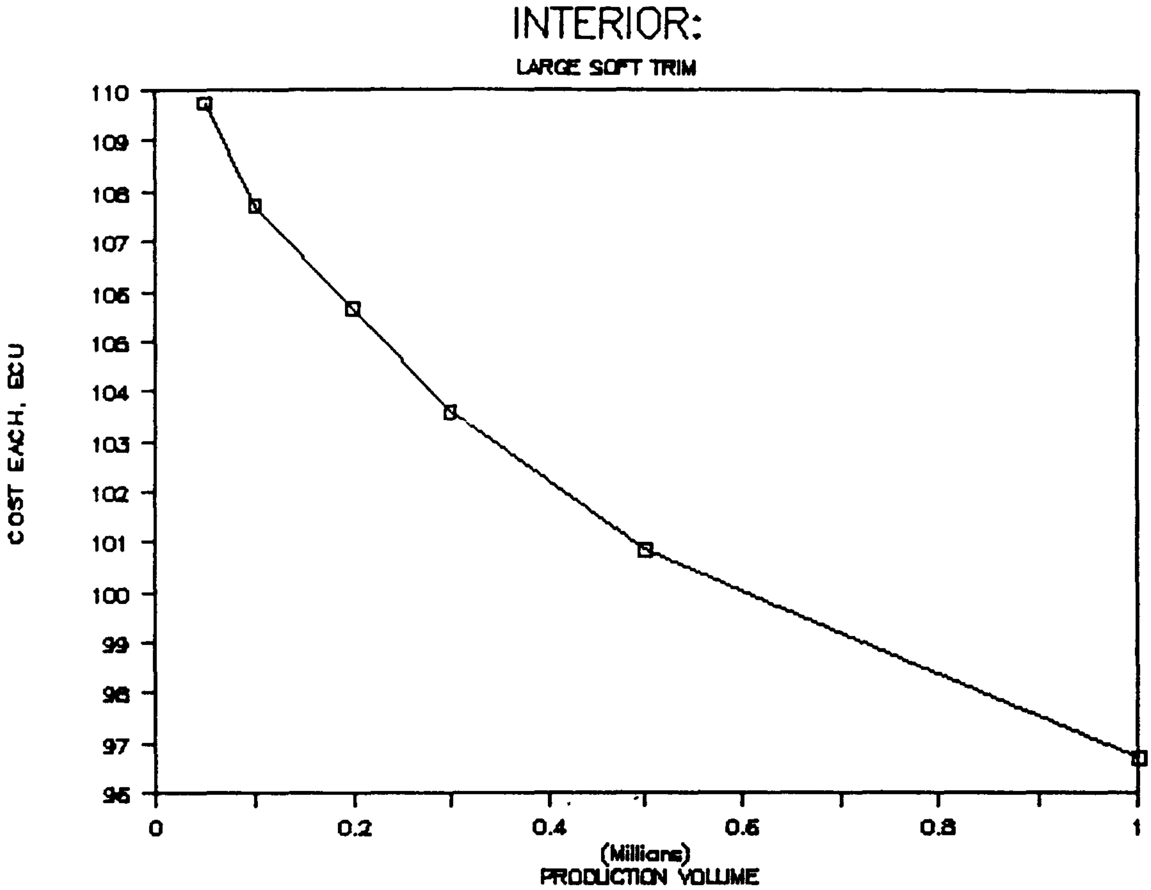

INTERIOR:
RUBBER EXTRUSION
COST EACH, ECU
1.38
1.37
1.36
1.35
1.34
1.33
1.32
1.31
1.3
1.29
1.28
1.27
1.26
1.25
1.24
1.23
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

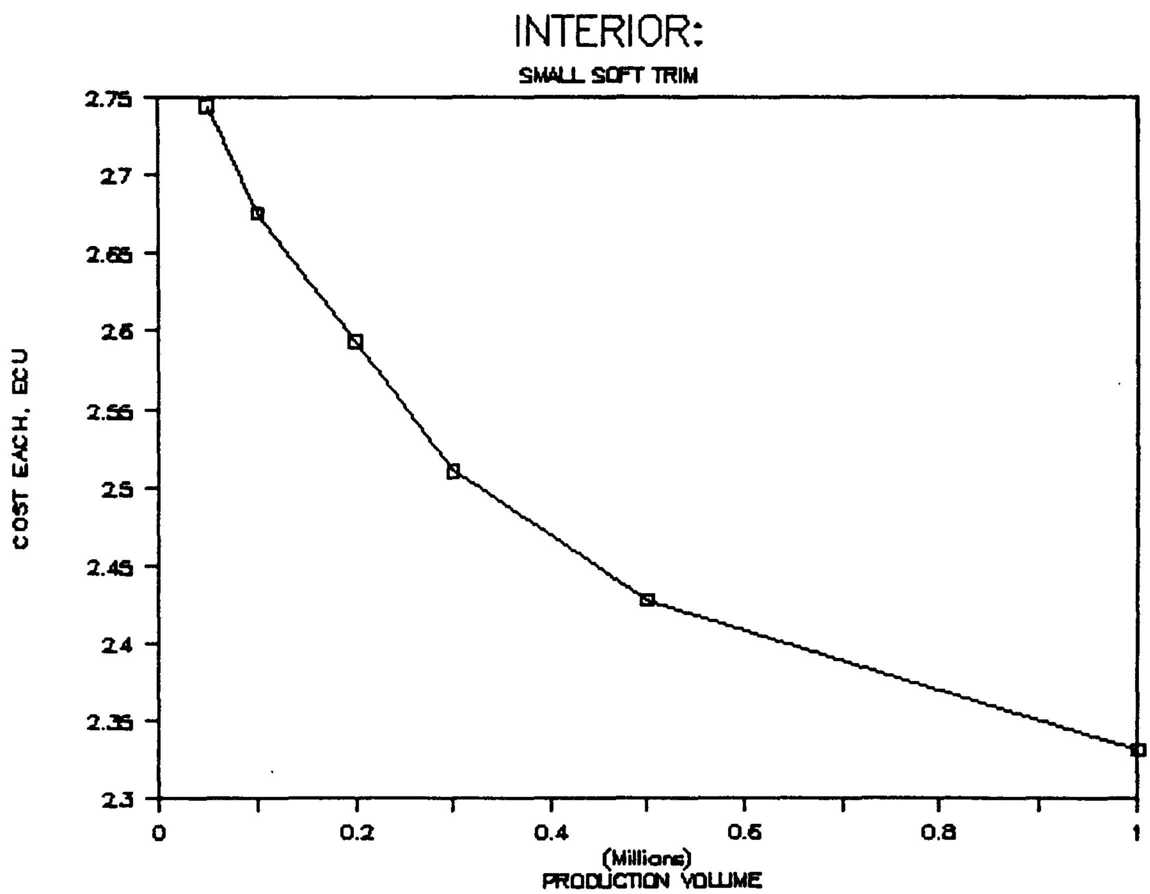

INTERIOR:
FRONT SQUAB FOAM
COST EACH, ECU
6.7
6.6
6.5
6.4
6.3
6.2
6.1
6
5.9
5.8
5.7
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

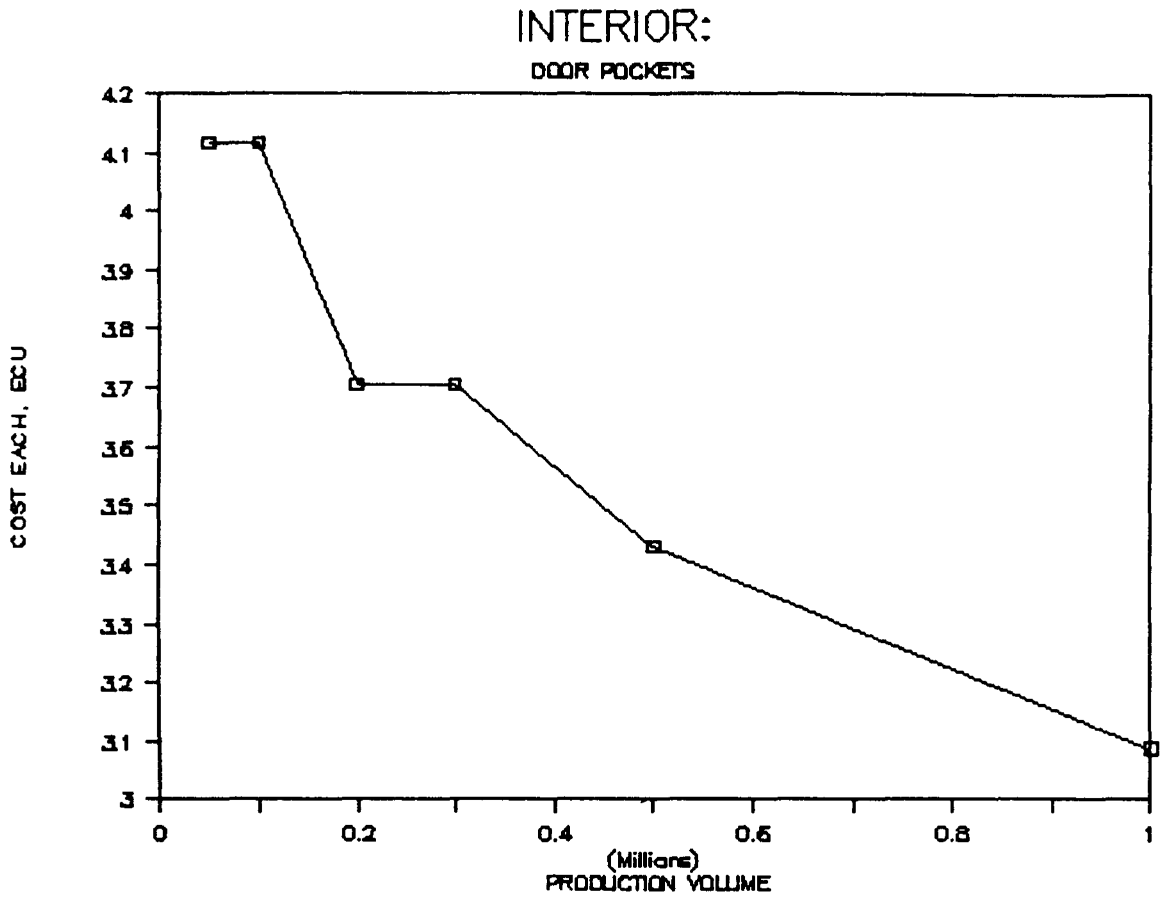

INTERIOR:
FRONT CUSHION FOAM
COST EACH, ECU
6.1
6
5.9
5.8
5.7
5.6
5.5
5.4
5.3
5.2
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

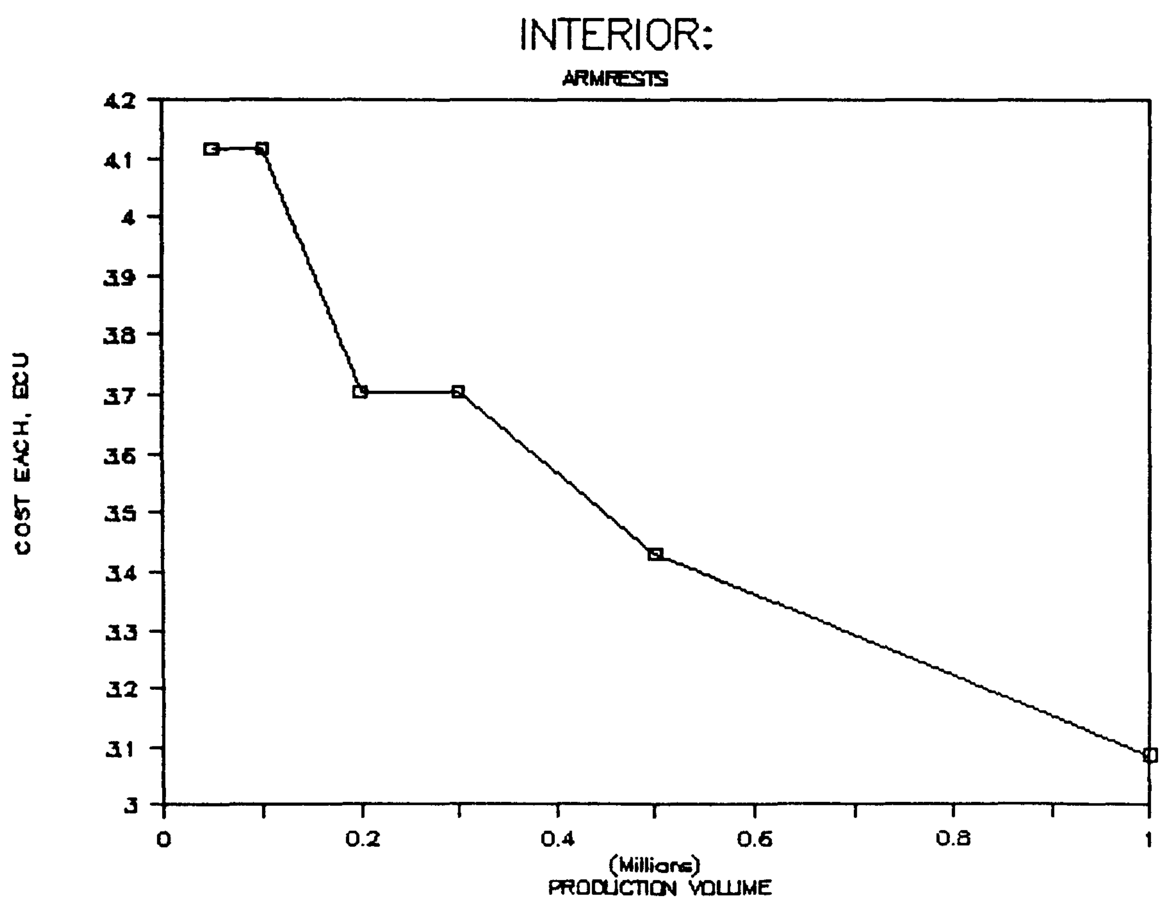

INTERIOR:
TRUNKING AND DUCTING
COST EACH, ECU
1.6
1.5
1.4
1.3
1.2
1.1
1
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

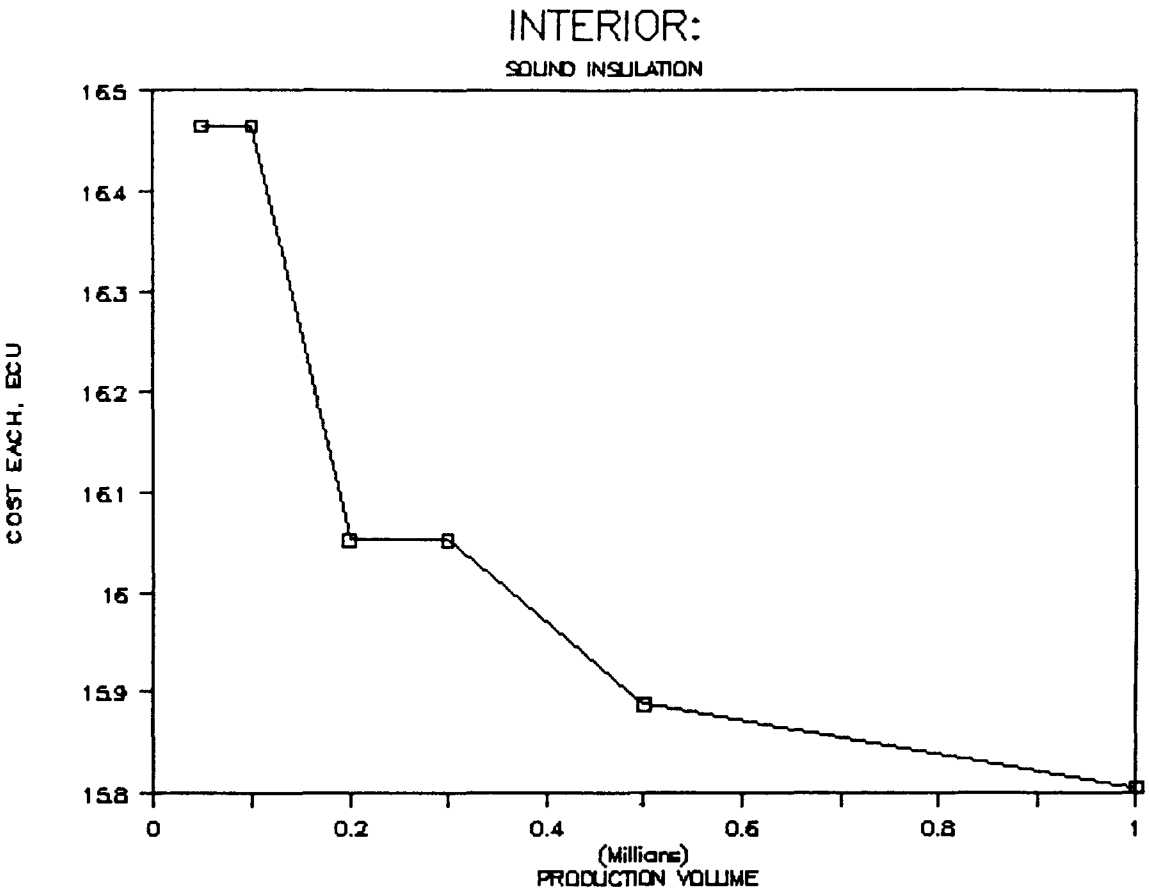

INTERIOR:
SAFETY BELTS
COST EACH, ECU
51
50
49
48
47
46
45
44
43
42
41
40
39
38
37
36
35
34
33
32
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

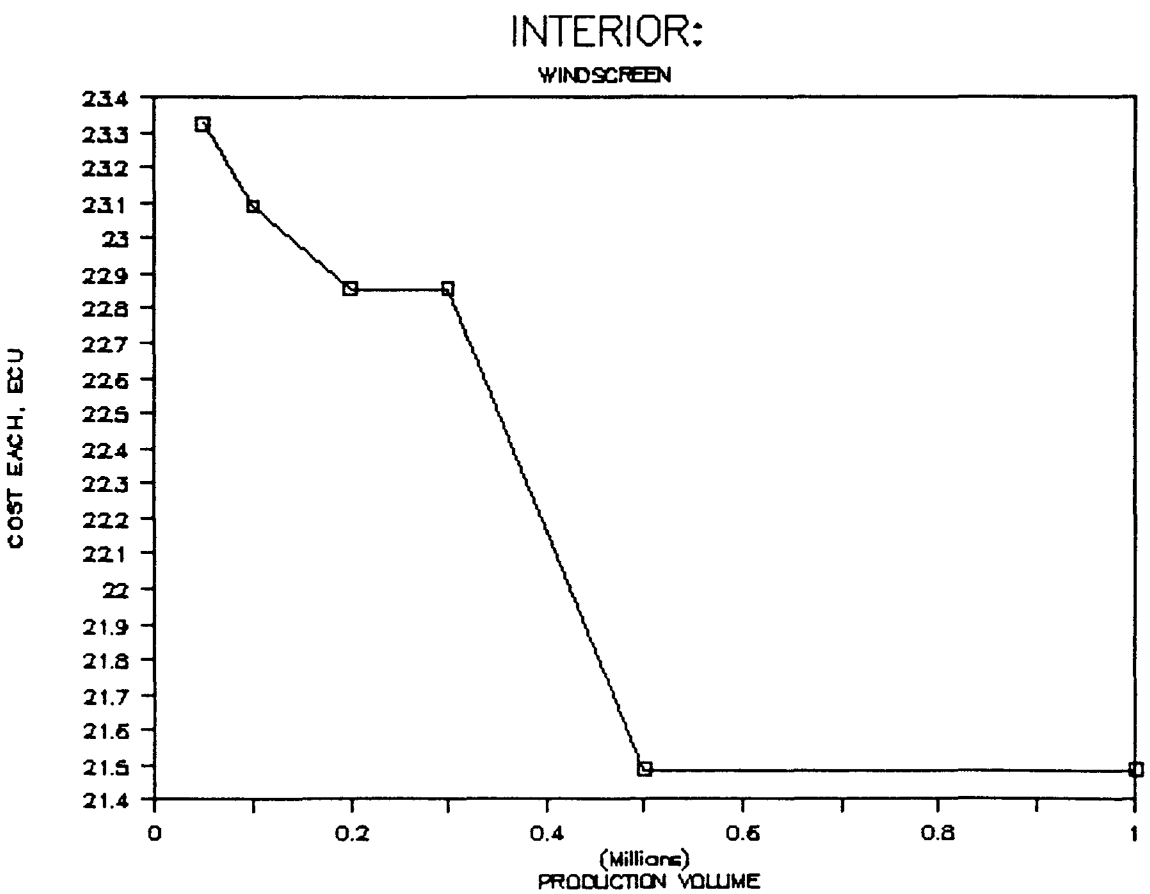

INTERIOR:
LARGE SOFT TRIM
COST EACH, ECU
110
109
108
107
106
106
104
103
102
101
100
99
98
97
96
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

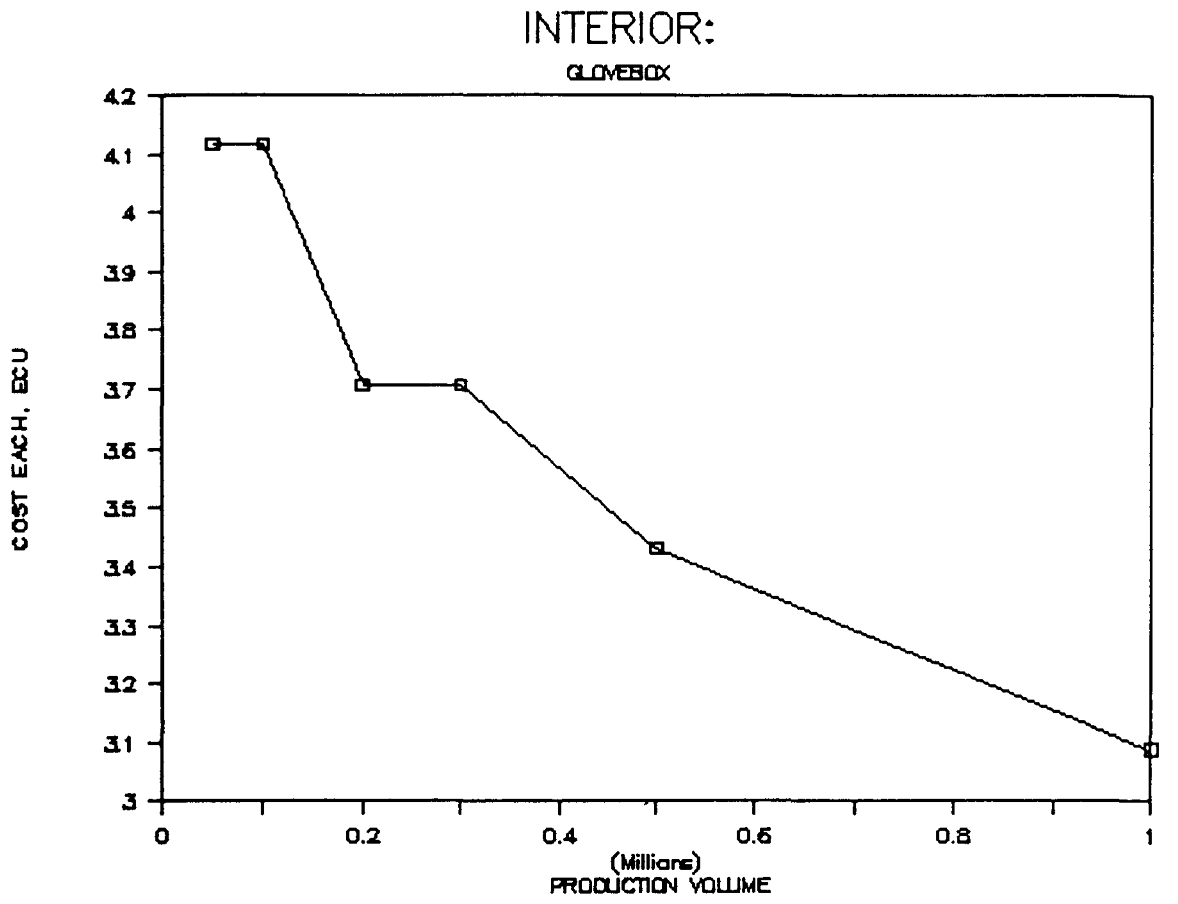

INTERIOR:
SMALL SOFT TRIM
COST EACH, ECU
2.75
2.7
2.65
2.6
2.55
2.5
2.45
2.4
2.35
2.3
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

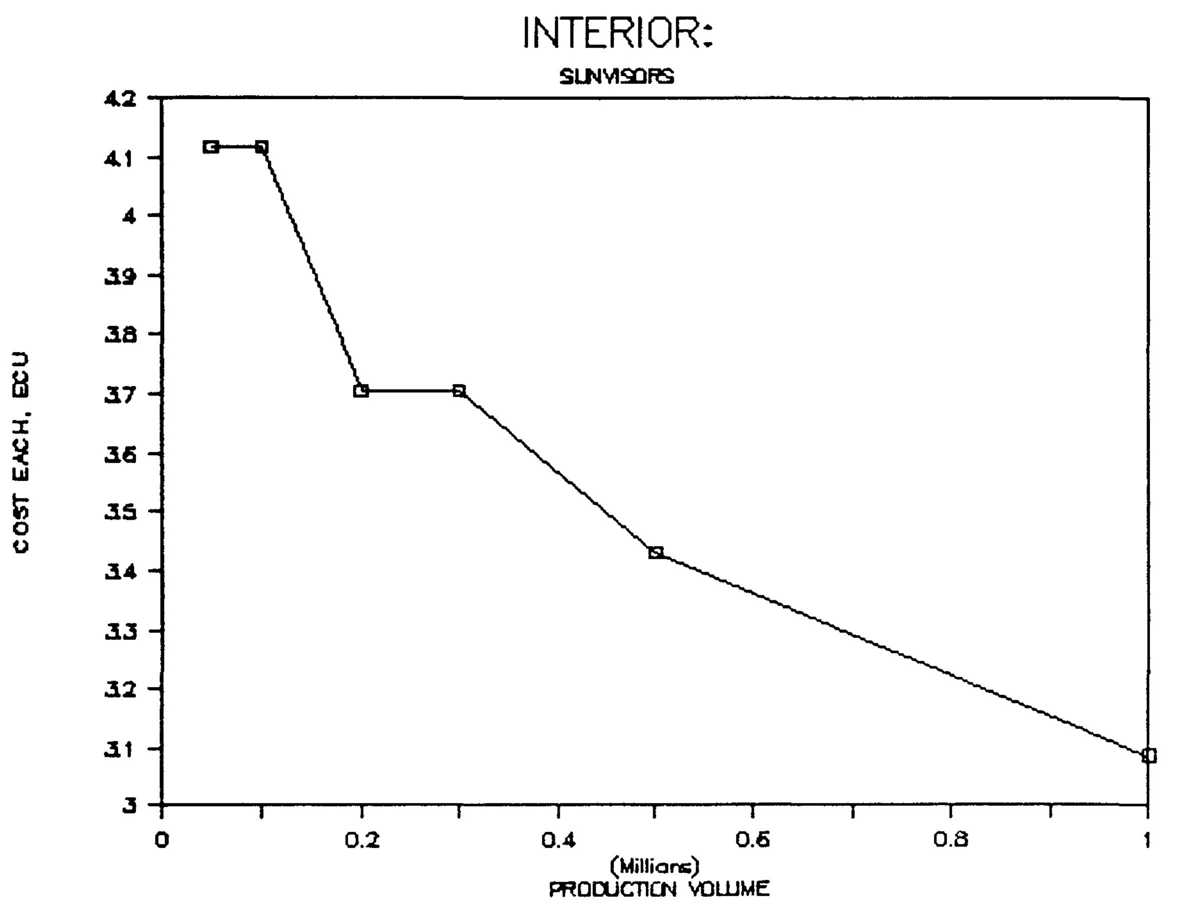

INTERIOR:
DOOR POCKETS
COST EACH, ECU
4.2
4.1
4
3.9
3.8
3.7
3.6
3.5
3.4
3.3
3.2
3.1
3
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

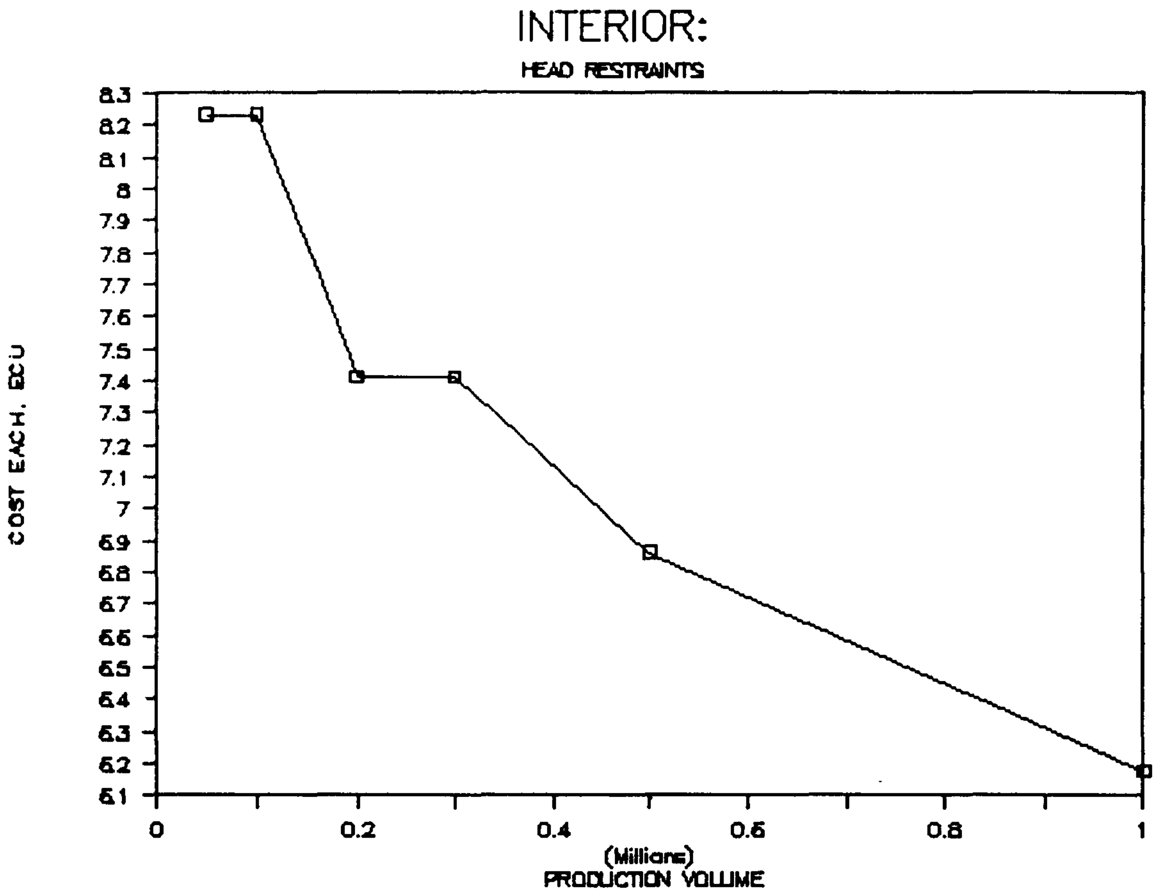

INTERIOR:
ARMRESTS
COST EACH, ECU
4.2
4.1
4
3.9
3.8
3.7
3.6
3.5
3.4
3.3
3.2
3.1
3
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

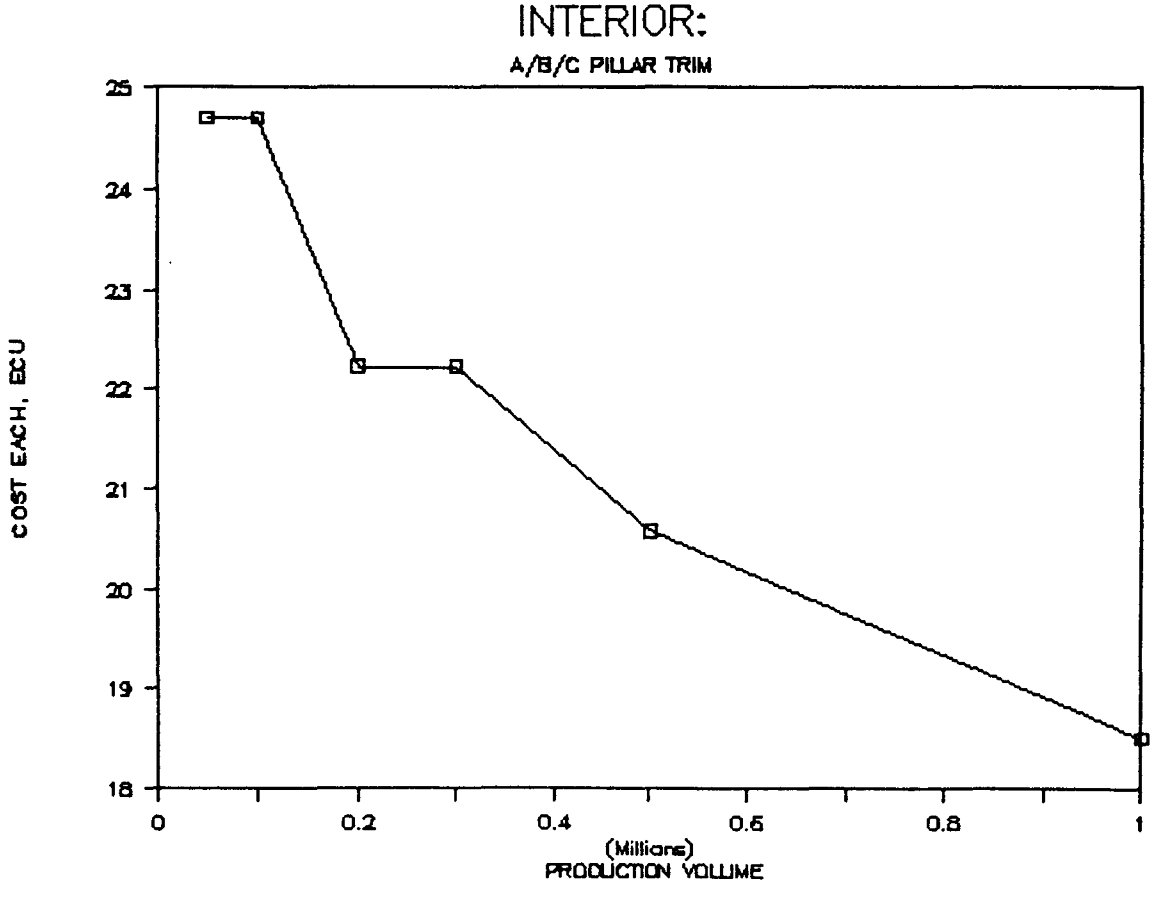

INTERIOR:
SOUND INSULATION
COST EACH, ECU
16.5
16.4
16.3
16.2
16.1
16
15.9
15.8
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

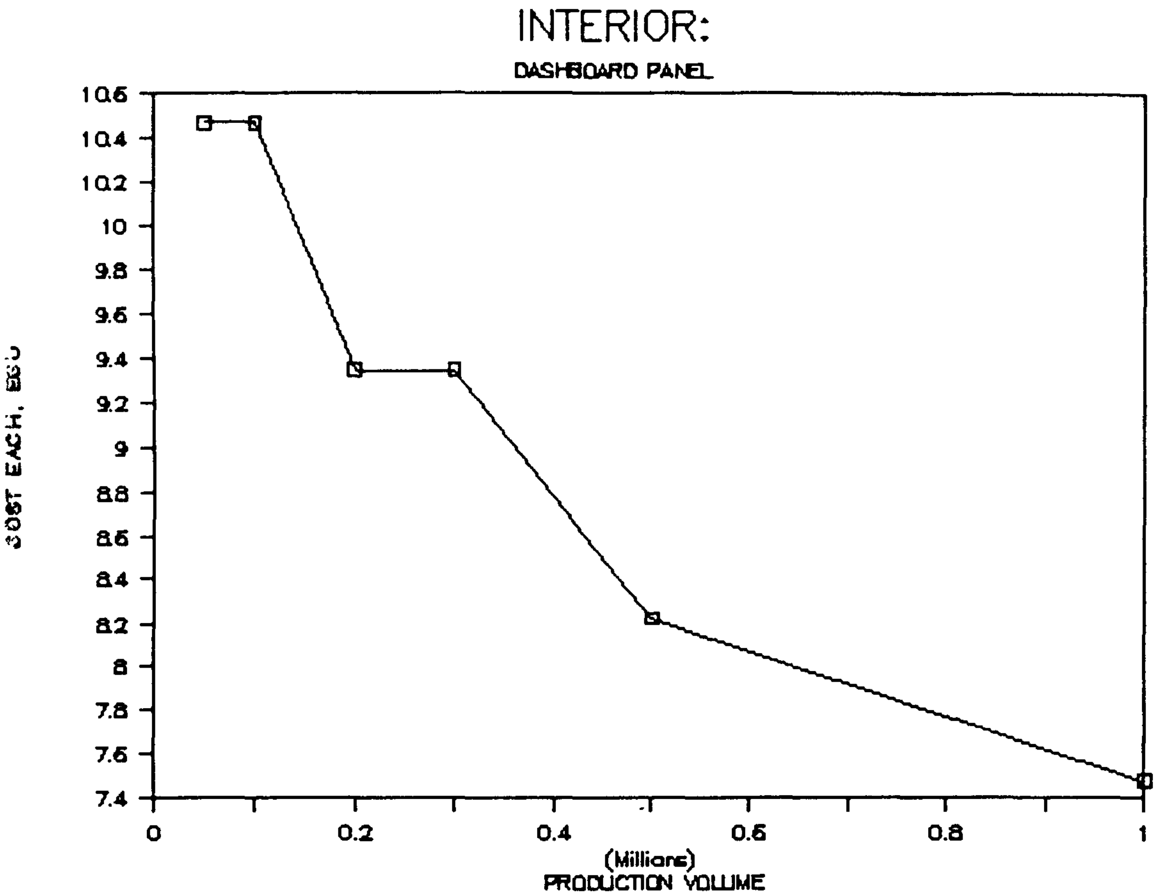

INTERIOR:
WINDSCREEN
COST EACH, ECU
23.4
23.3
23.2
23.1
23
22.9
22.8
22.7
22.6
22.5
22.4
22.3
22.2
22.1
22
21.9
21.8
21.7
21.6
21.5
21.4
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

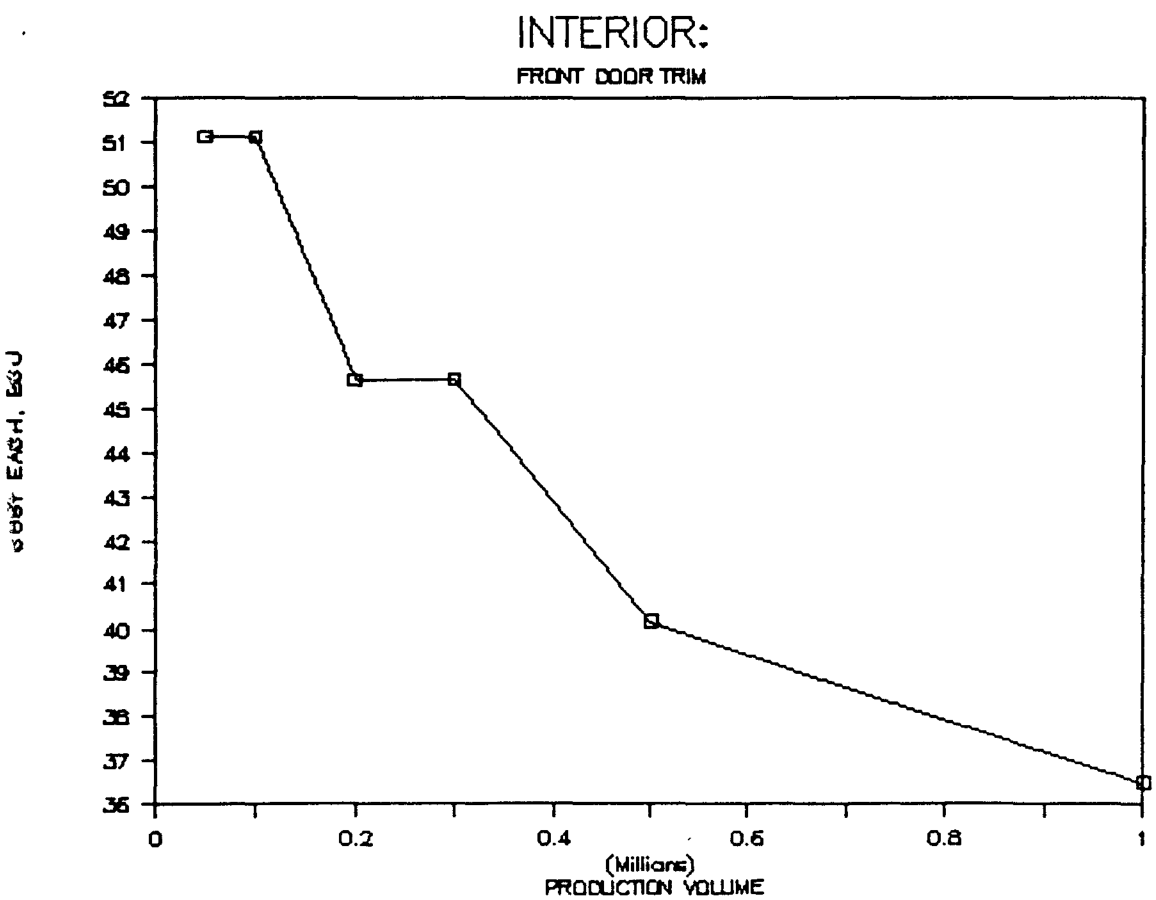

INTERIOR:
GLOVEBOX
COST EACH, ECU
4.2
4.1
4
3.9
3.8
3.7
3.6
3.5
3.4
3.3
3.2
3.1
3
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

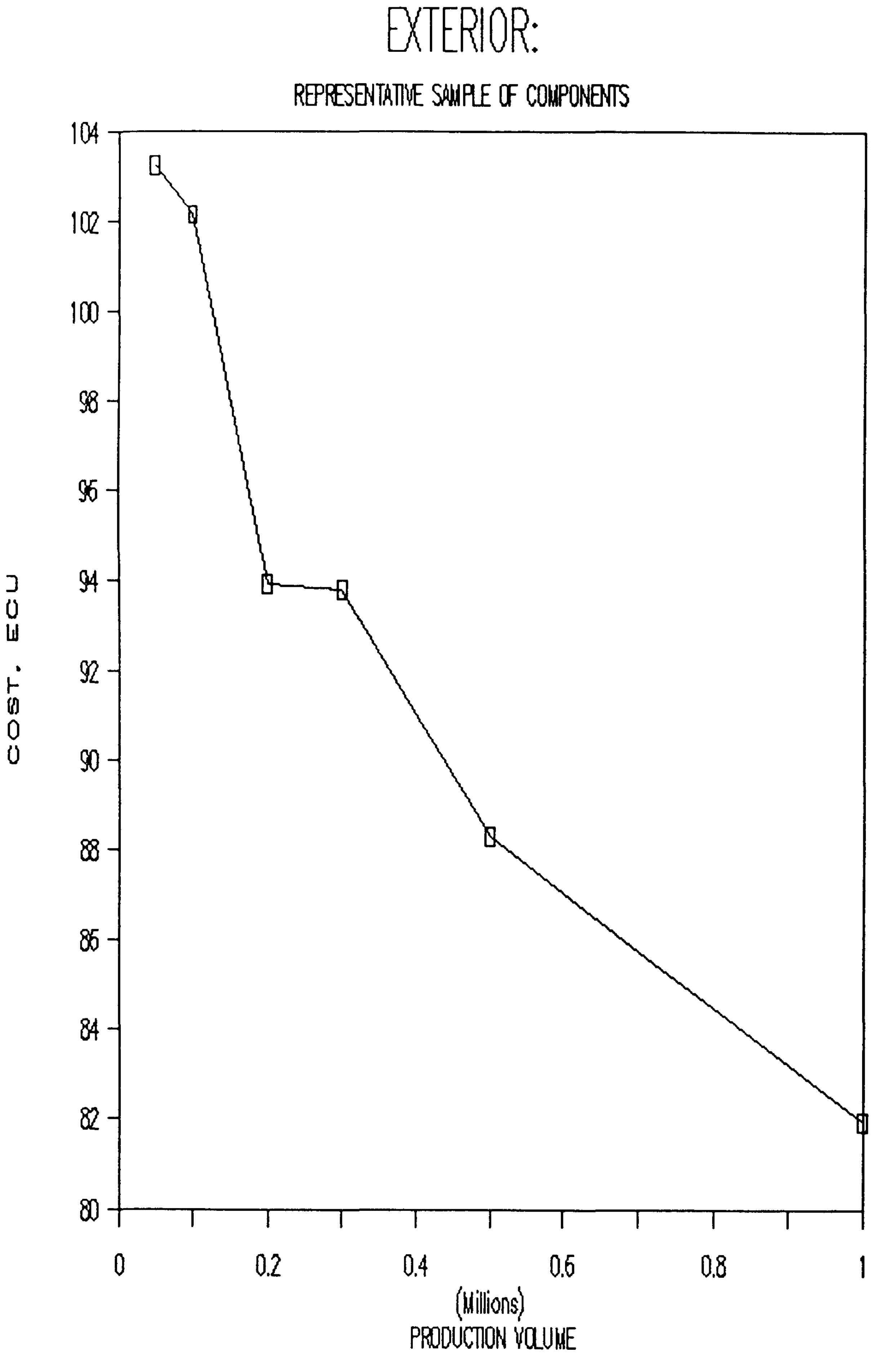

INTERIOR:
SUNVISORS
COST EACH, ECU
4.2
4.1
4
3.9
3.8
3.7
3.6
3.5
3.4
3.3
3.2
3.1
3
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

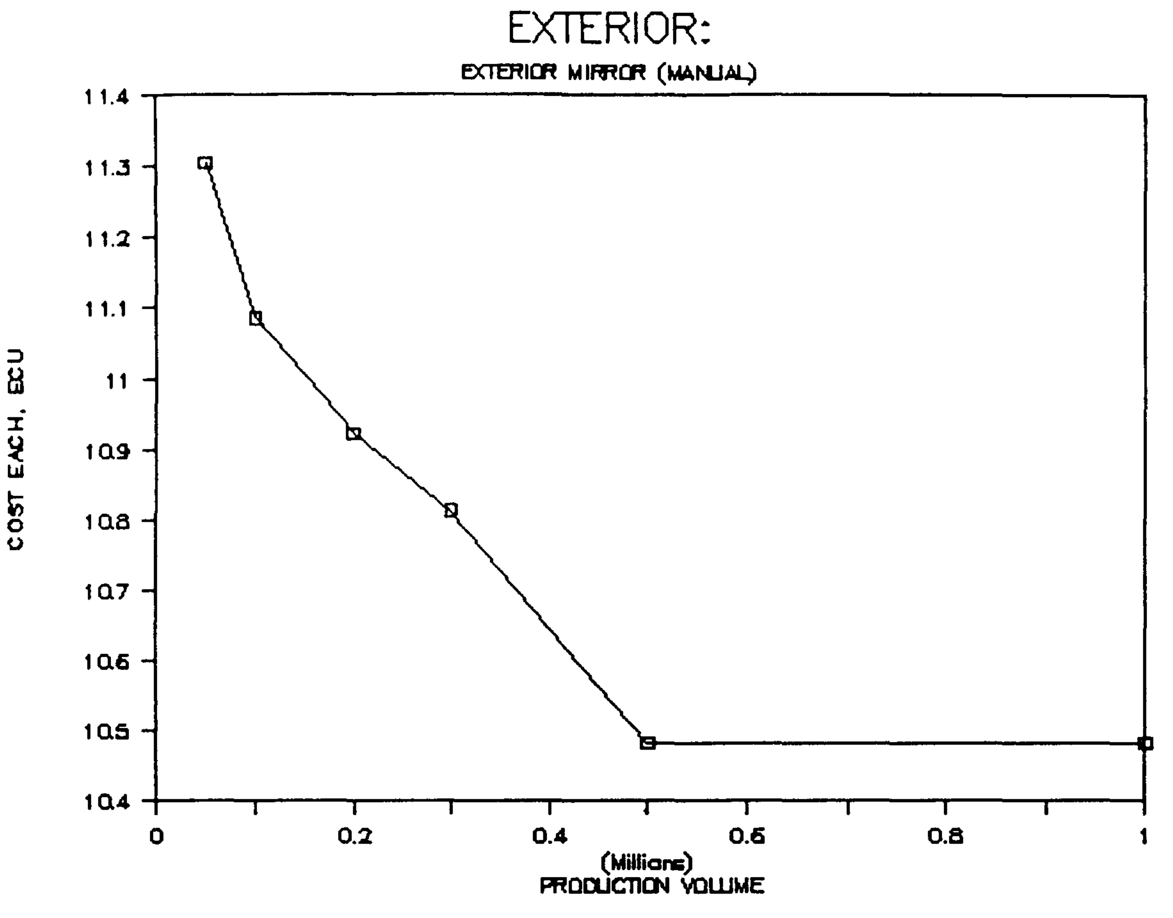

INTERIOR:
HEAD RESTRAINTS
COST EACH, ECU
8.3
8.2
8.1
8
7.9
7.8
7.7
7.6
7.5
7.4
7.3
7.2
7.1
7
6.9
6.8
6.7
6.6
6.5
6.4
6.3
6.2
6.1
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

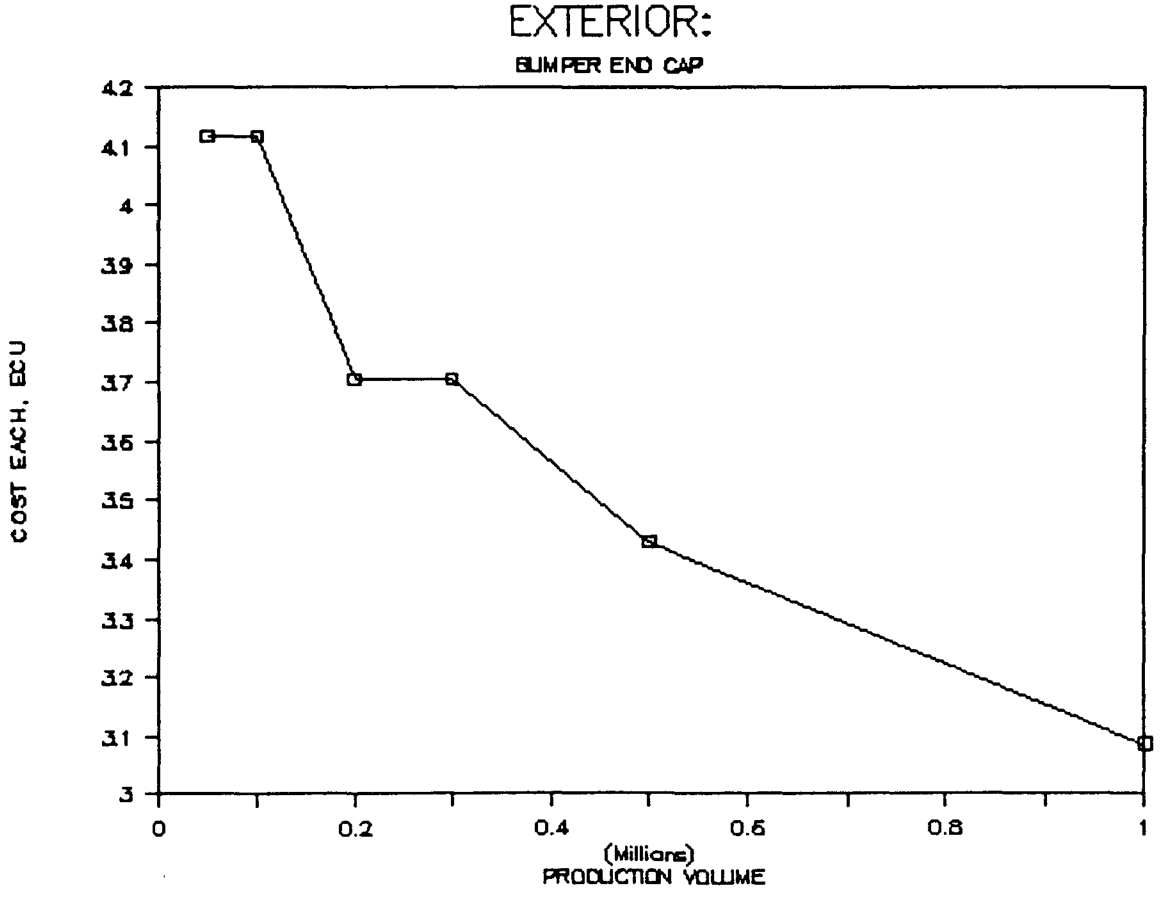

INTERIOR:
A/B/C PILLAR TRIM
COST EACH, ECU
25
24
23
22
21
20
19
18
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

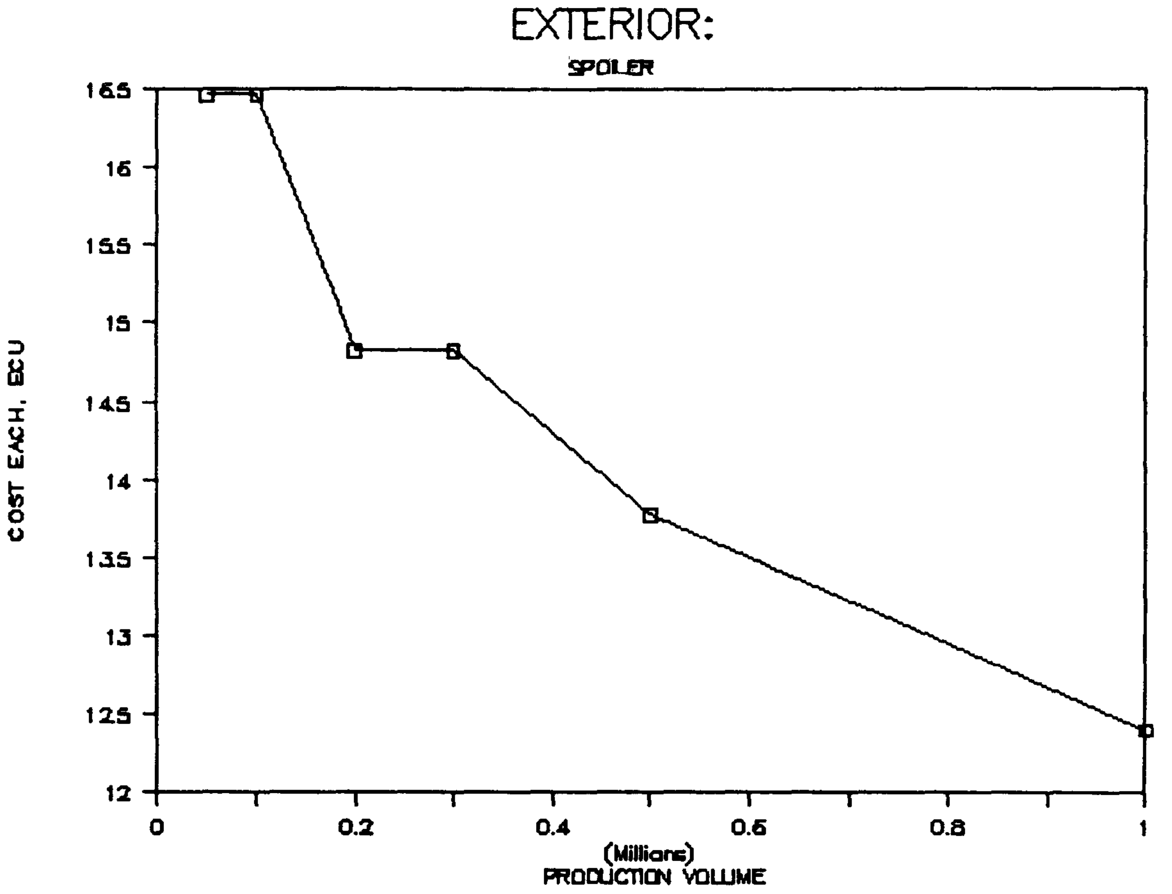

INTERIOR:
DASHBOARD PANEL
COST EACH, ECU
10.6
10.4
10.2
10
9.8
9.6
9.4
9.2
9
8.8
8.6
8.4
8.2
8
7.8
7.6
7.4
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

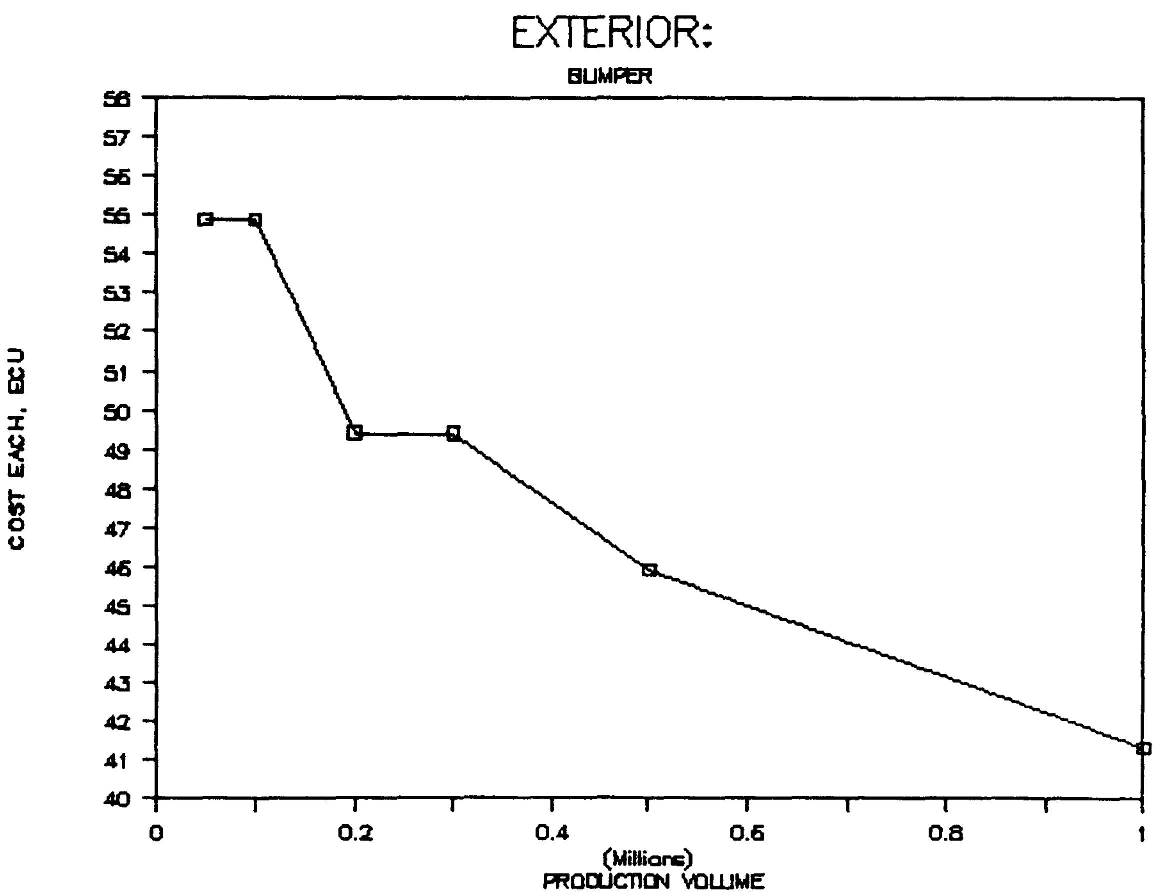

INTERIOR:
FRONT DOOR TRIM
COST EACH, ECU
52
51
50
49
48
47
46
45
44
43
42
41
40
39
38
37
36
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

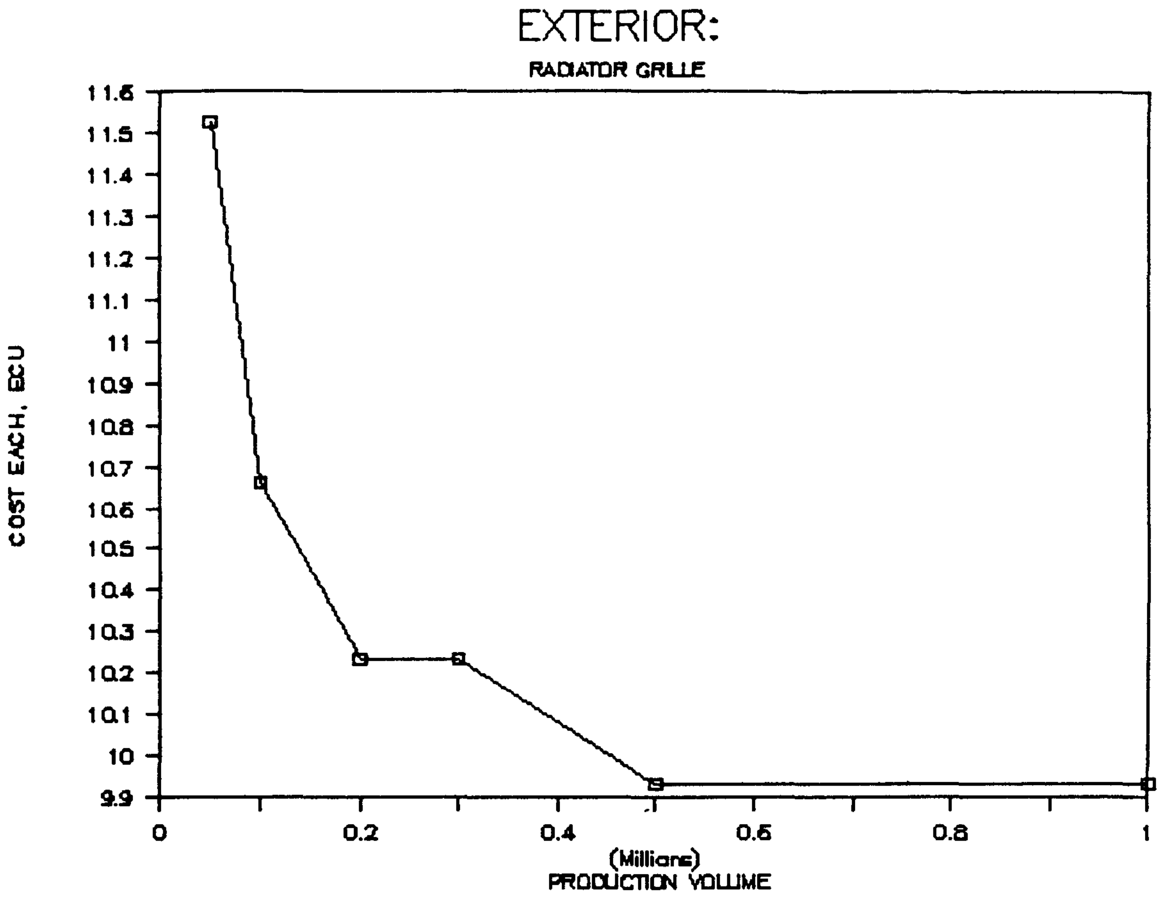

EXTERIOR:
REPRESENTATIVE SAMPLE OF COMPONENTS
COST, ECU
104
102
100
98
96
94
92
90
88
86
84
82
80
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

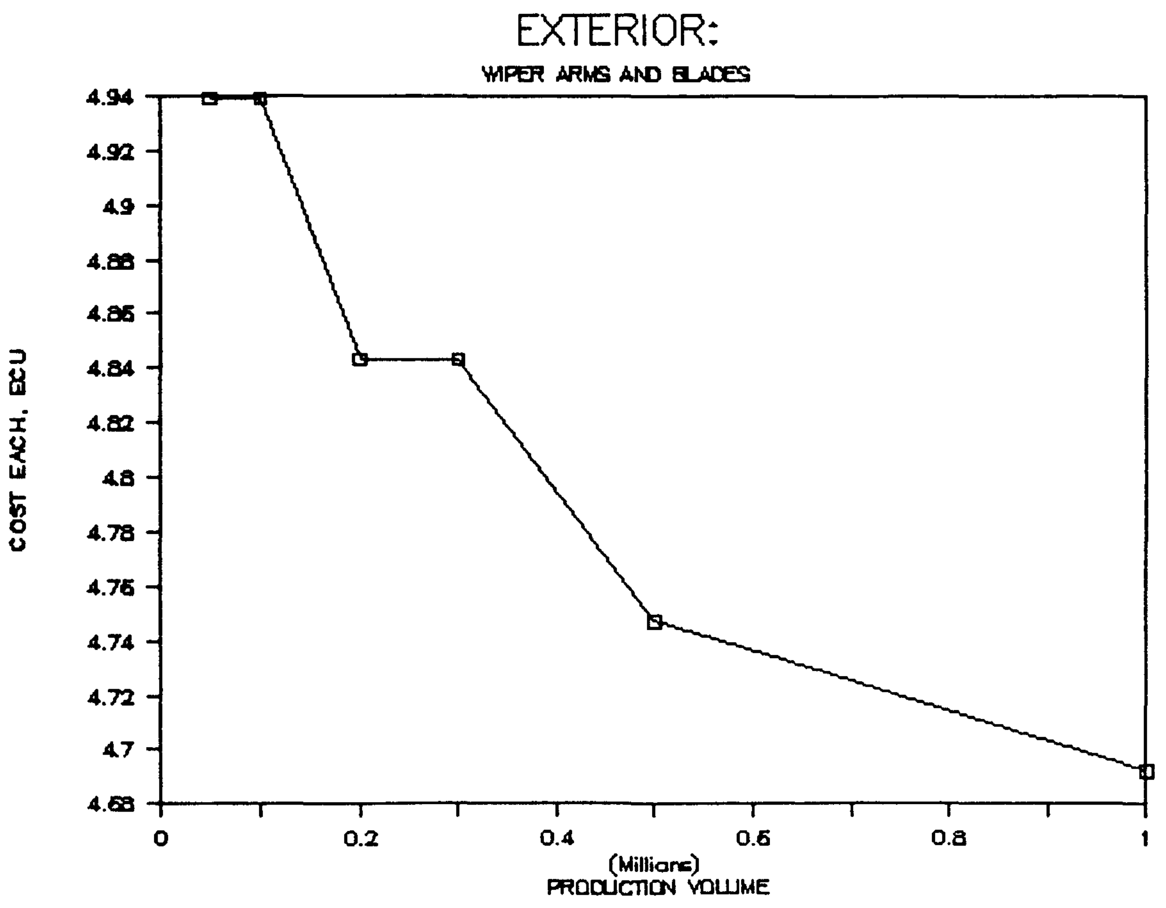

EXTERIOR:
EXTERIOR MIRROR (MANUAL)
COST EACH, ECU
11.4
11.3
11.2
11.1
11
10.9
10.8
10.7
10.6
10.5
10.4
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

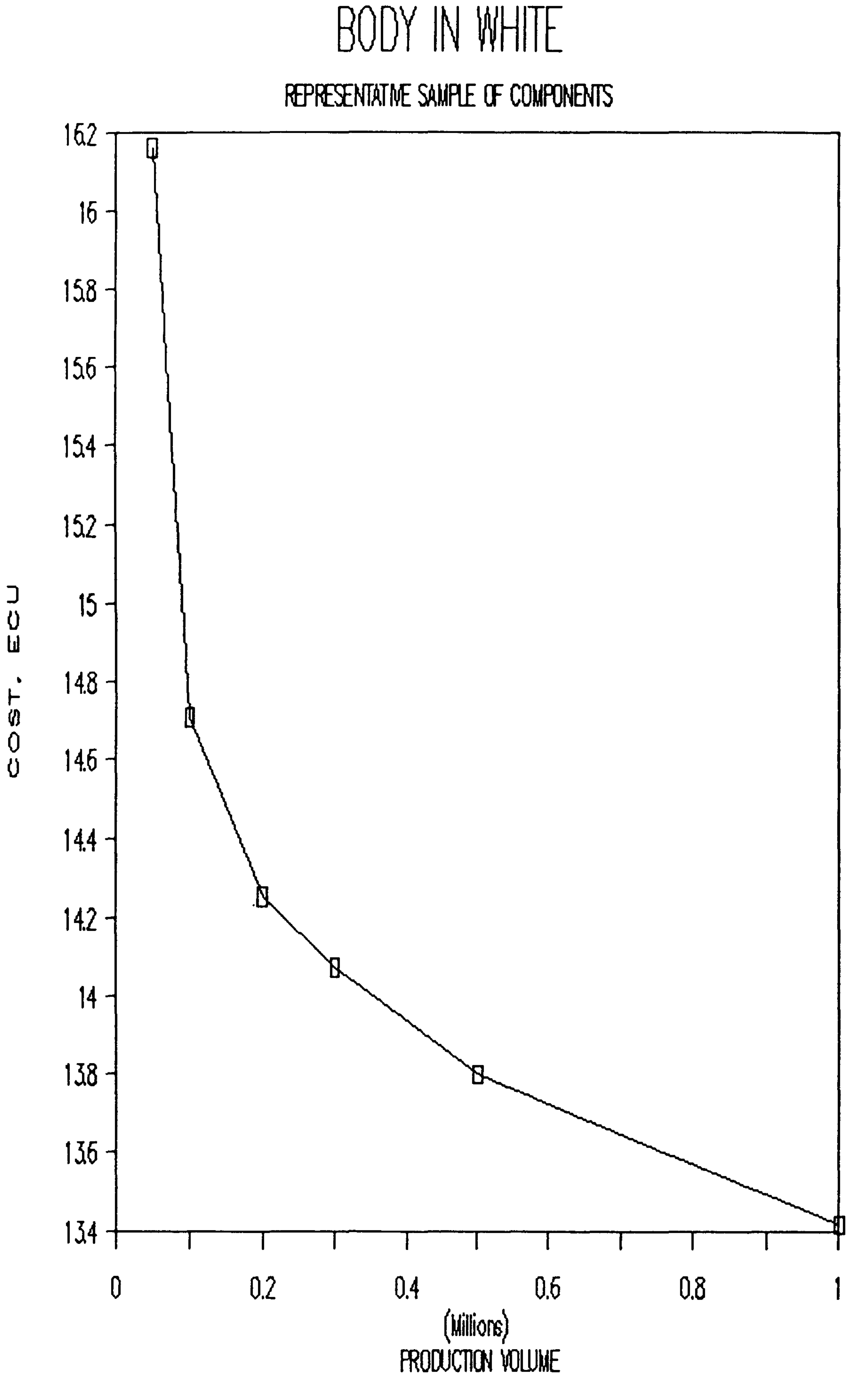

EXTERIOR:
BUMPER END CAP
COST EACH, ECU
4.2
4.1
4
3.9
3.8
3.7
3.6
3.5
3.4
3.3
3.2
3.1
3
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

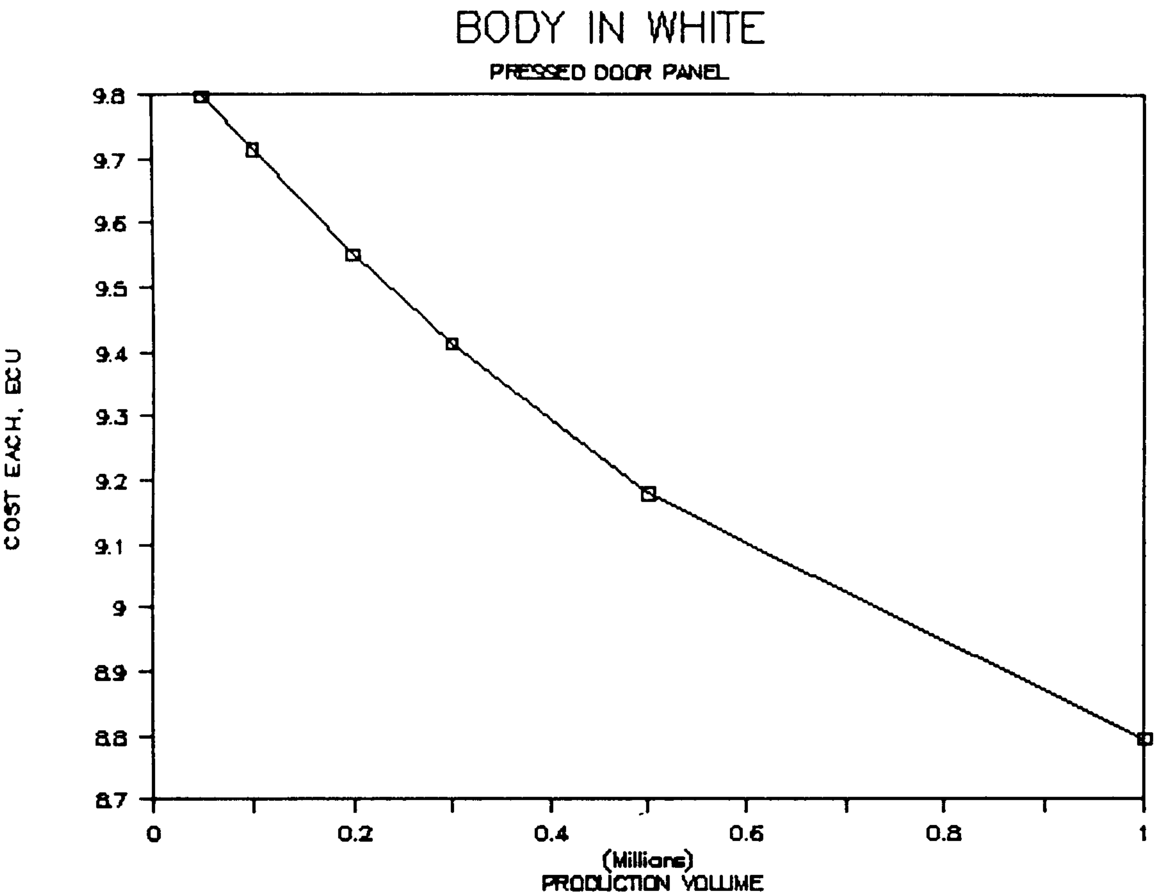

EXTERIOR:
SPOILER
COST EACH, ECU
16.5
16
15.5
15
14.5
14
13.5
13
12.5
12
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

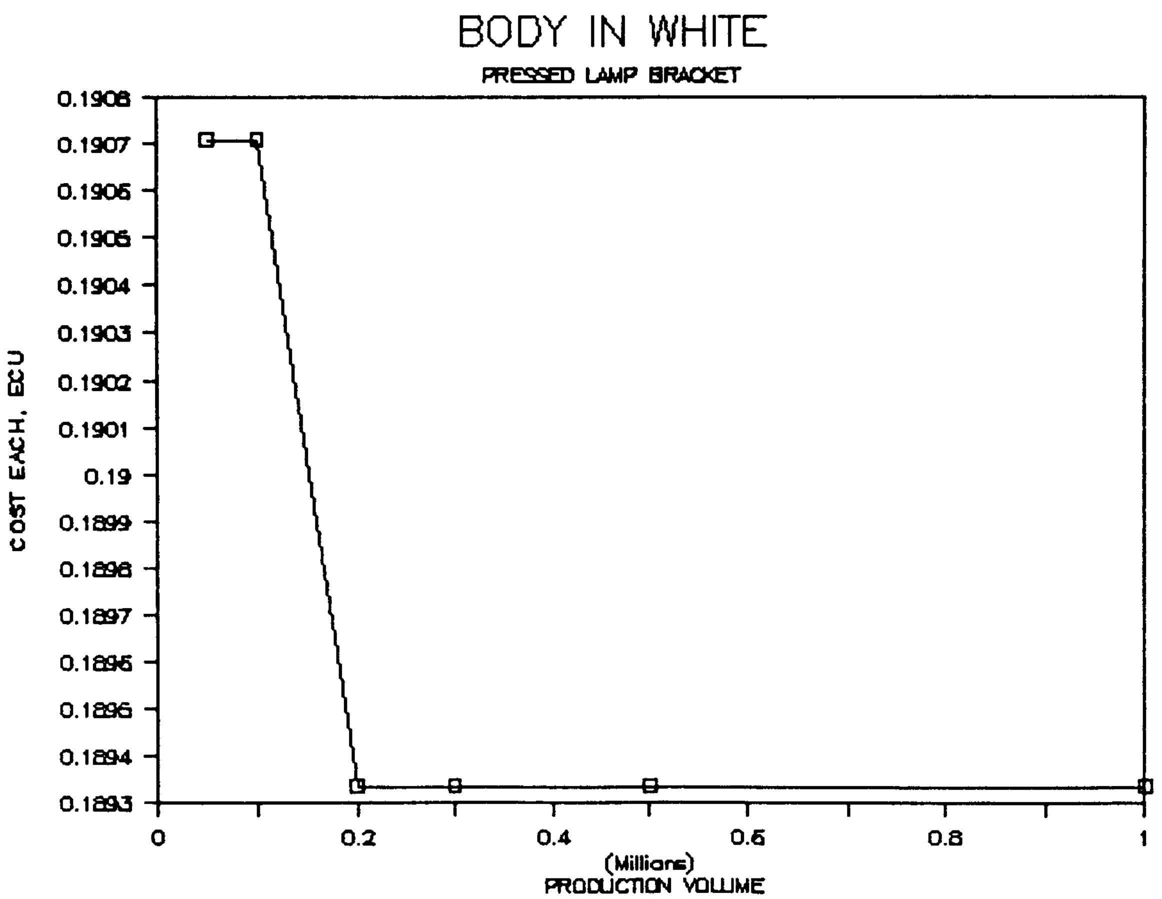

EXTERIOR:
BUMPER
COST EACH, ECU
58
57
56
55
54
53
52
51
50
49
48
47
46
45
44
43
42
41
40
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

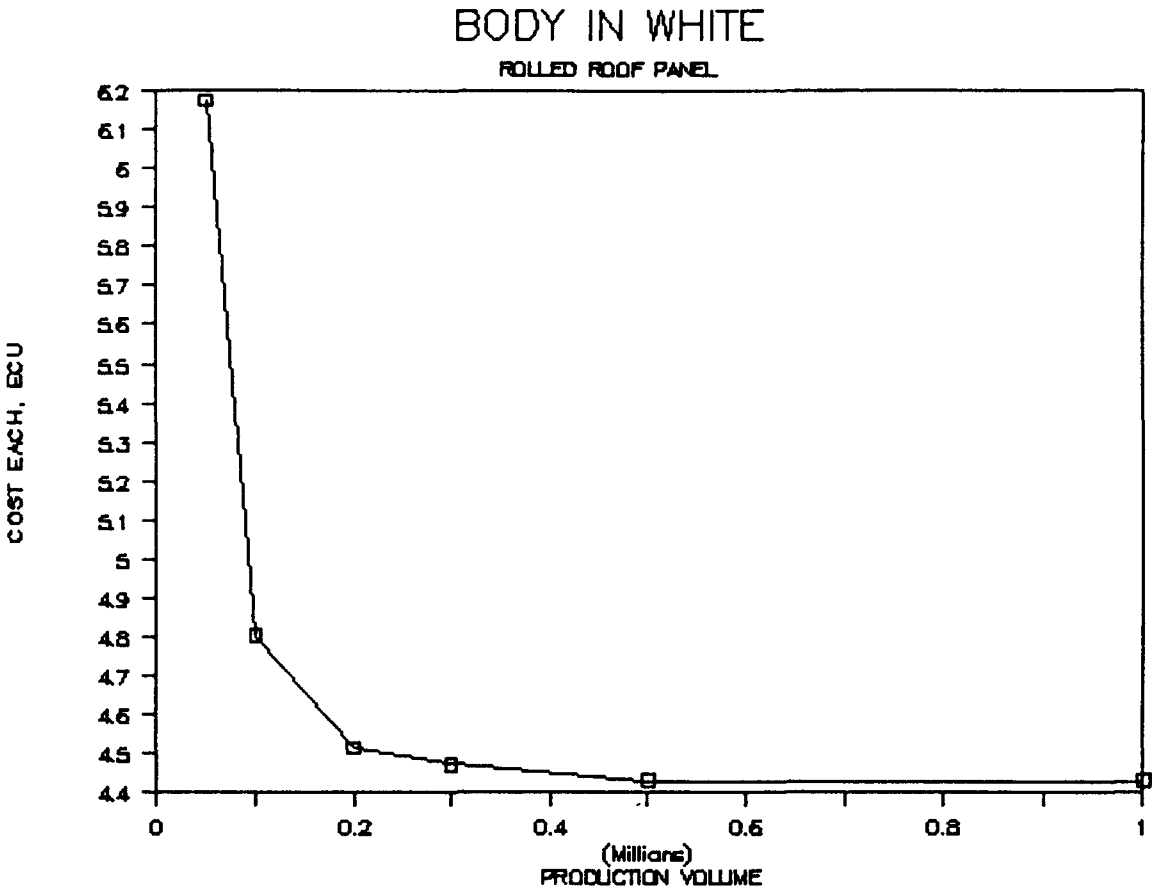

EXTERIOR:
RADIATOR GRILLE
COST EACH, ECU
11.6
11.5
11.4
11.3
11.2
11.1
11
10.9
10.8
10.7
10.6
10.5
10.4
10.3
10.2
10.1
10
9.9
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

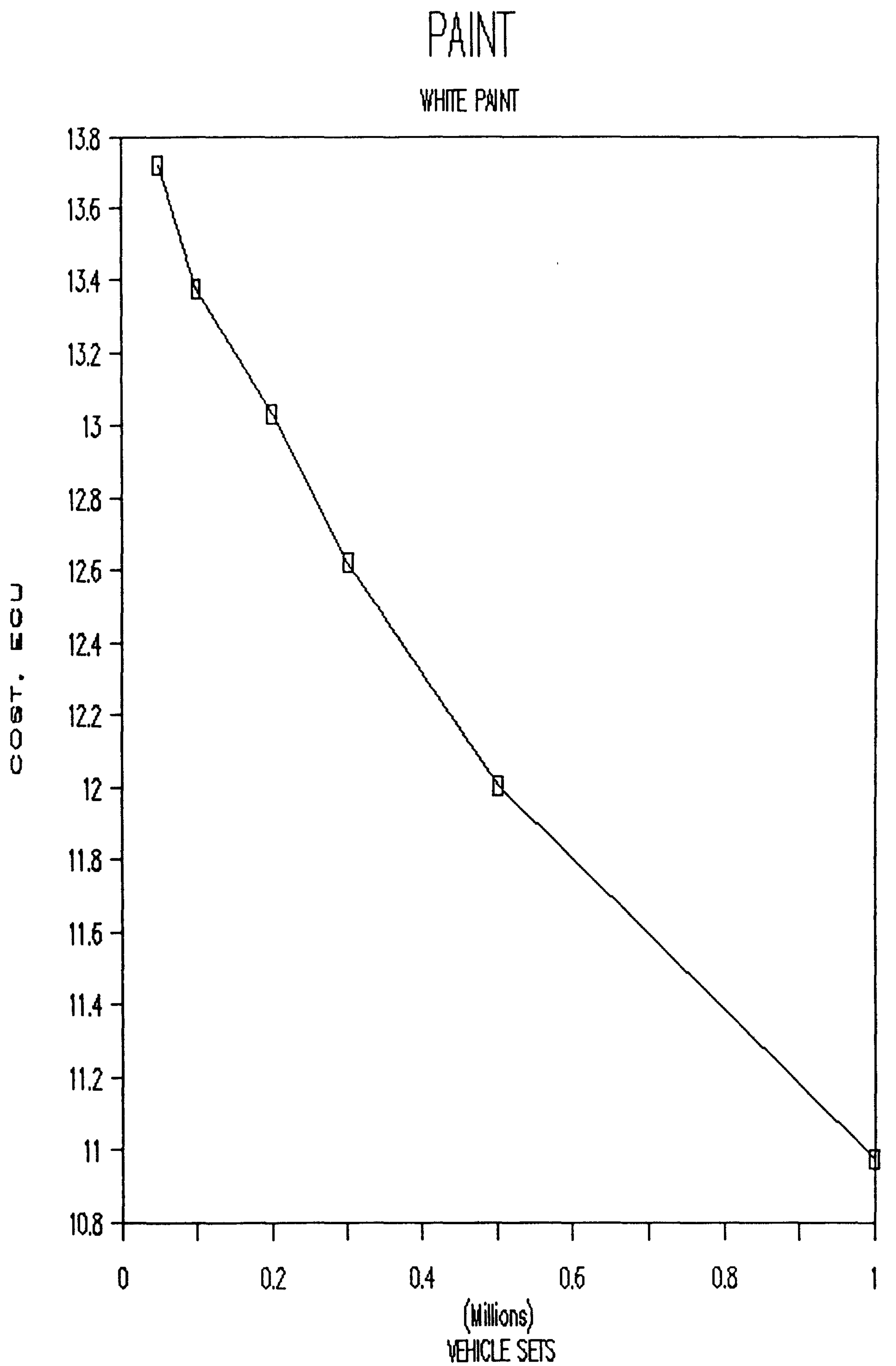

EXTERIOR:
WIPER ARMS AND BLADES
COST EACH, ECU
4.94
4.92
4.9
4.88
4.86
4.84
4.82
4.8
4.78
4.76
4.74
4.72
4.7
4.68
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

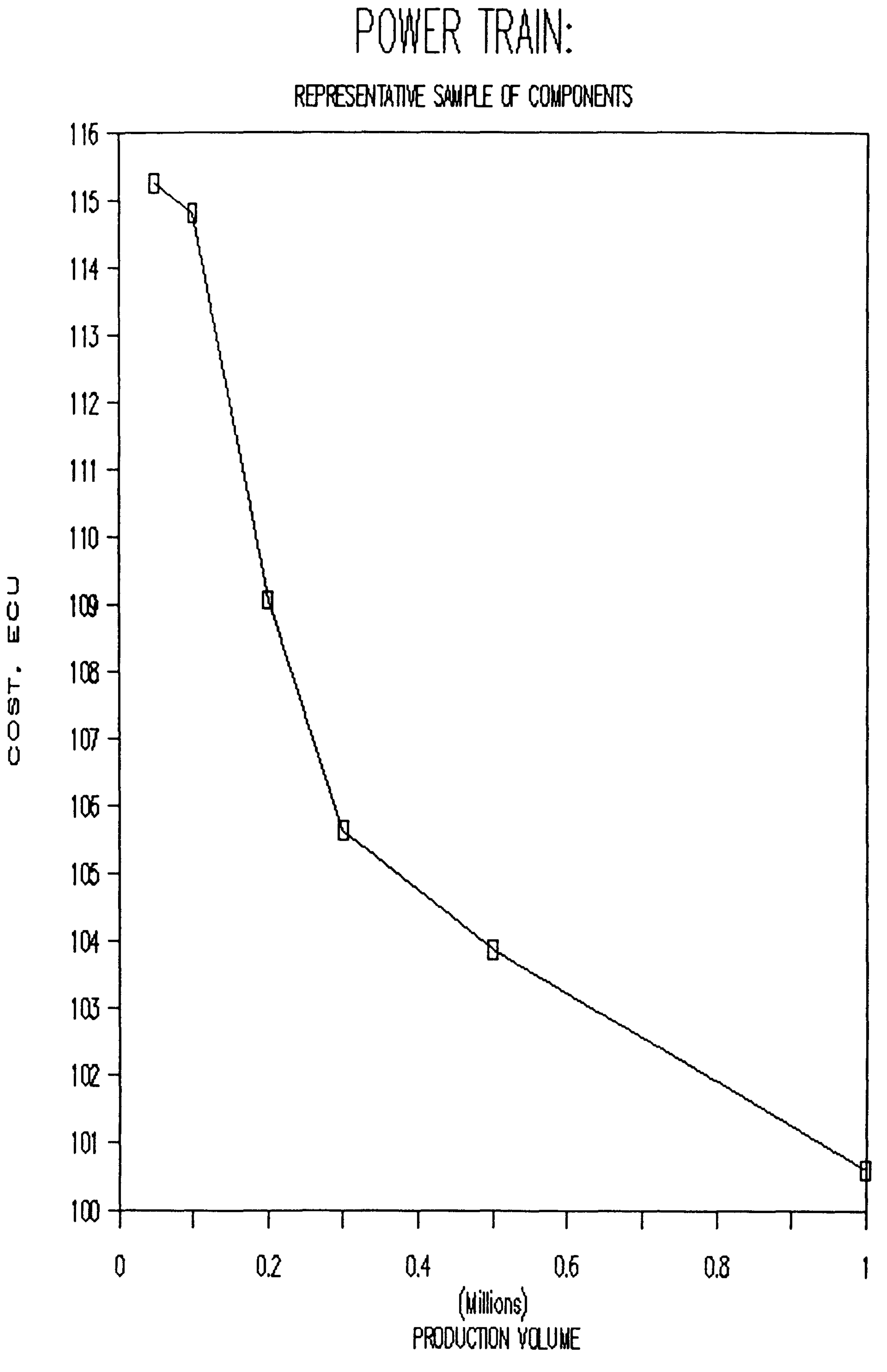

BODY IN WHITE
REPRESENTATIVE SAMPLE OF COMPONENTS
COST, ECU
16.2
16
15.8
15.6
15.4
15.2
15
14.8
14.6
14.4
14.2
14
13.8
13.6
13.4
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

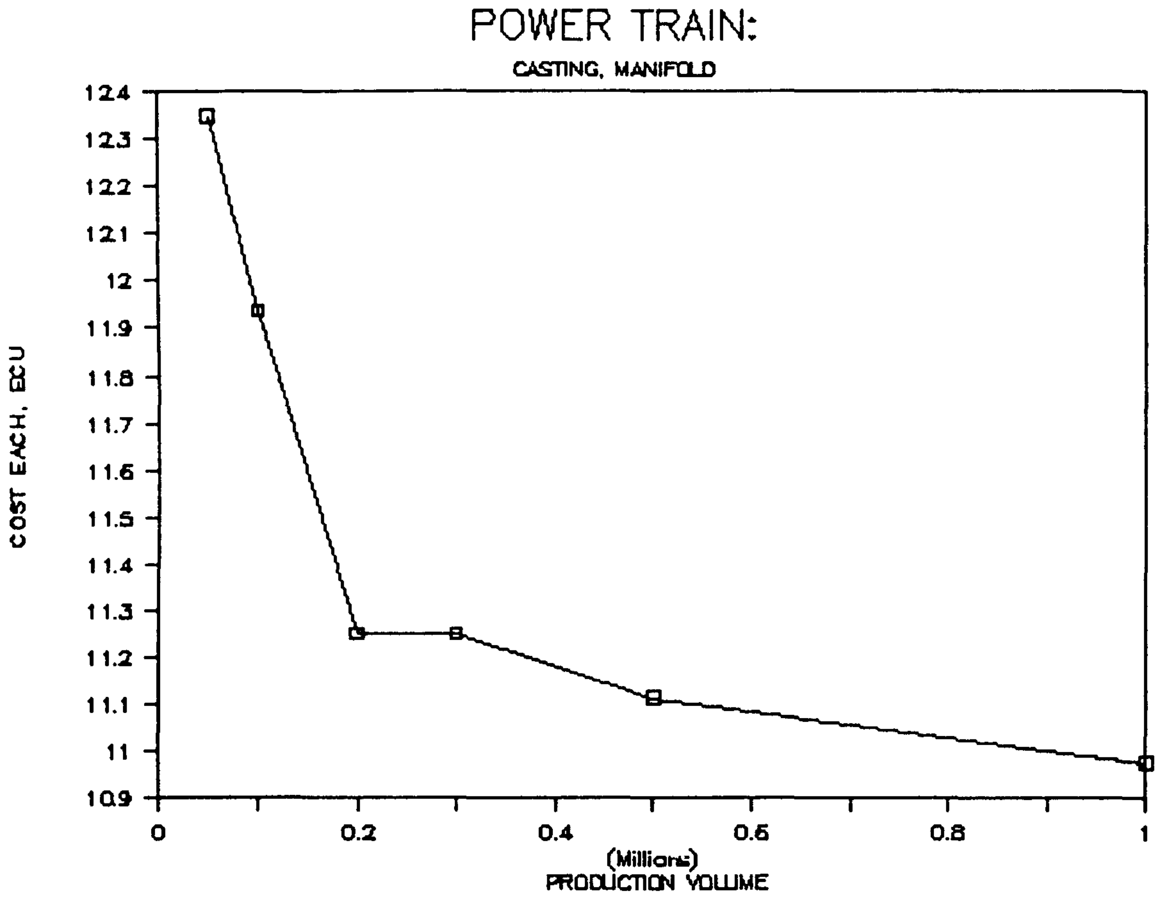

BODY IN WHITE
PRESSED DOOR PANEL
COST EACH, ECU
9.8
9.7
9.6
9.5
9.4
9.3
9.2
9.1
9
8.9
8.8
8.7
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

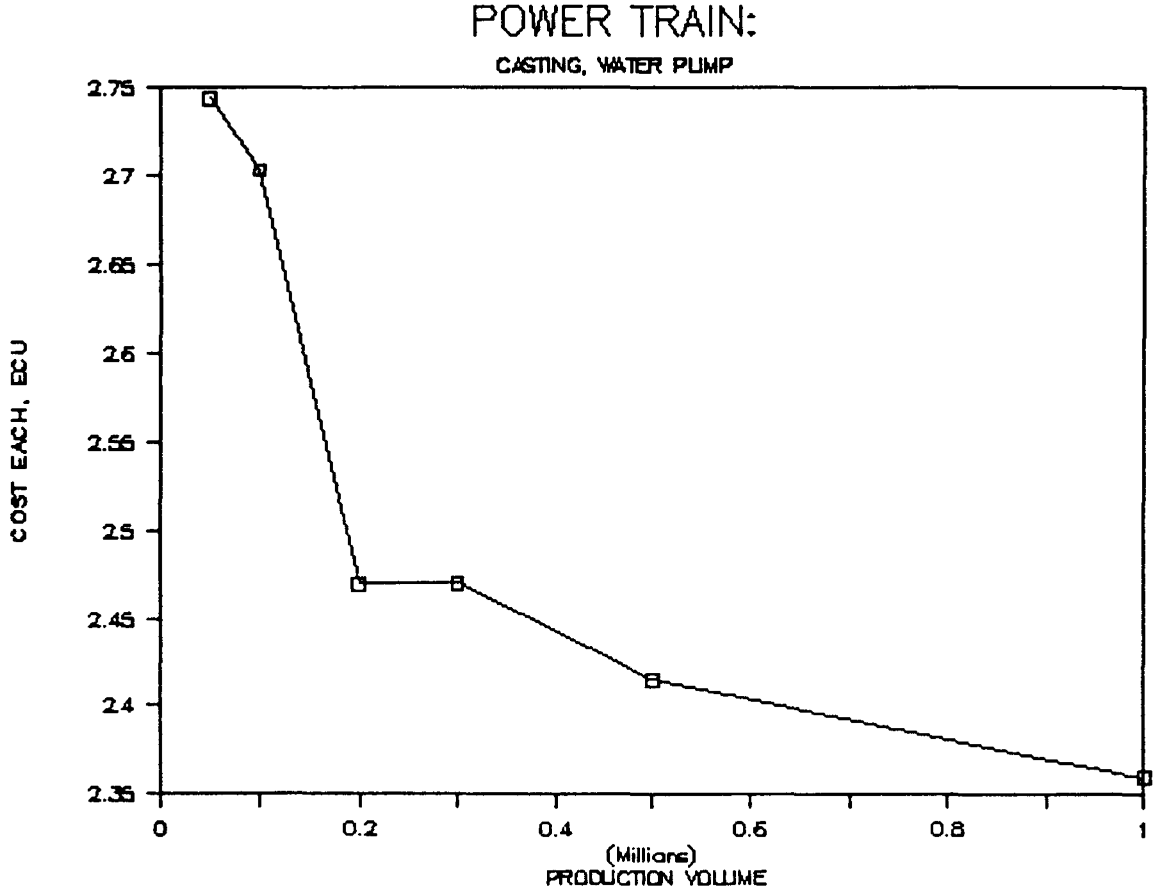

BODY IN WHITE
PRESSED LAMP BRACKET
COST EACH, ECU
0.1908
0.1907
0.1906
0.1905
0.1904
0.1903
0.1902
0.1901
0.19
0.1899
0.1898
0.1897
0.1896
0.1895
0.1894
0.1893
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

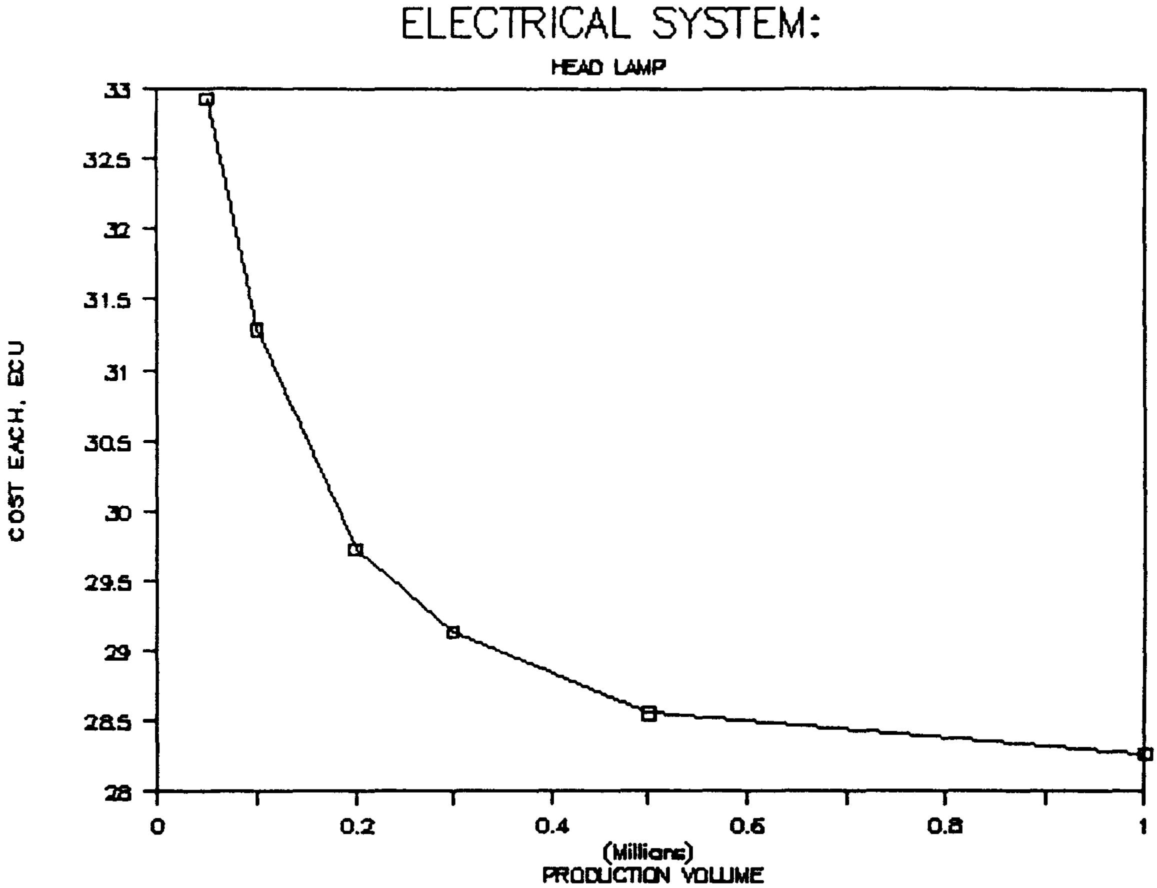

BODY IN WHITE
ROLLED ROOF PANEL
COST EACH, ECU
6.2
6.1
6
5.9
5.8
5.7
5.6
5.5
5.4
5.3
5.2
5.1
5
4.9
4.8
4.7
4.6
4.5
4.4
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

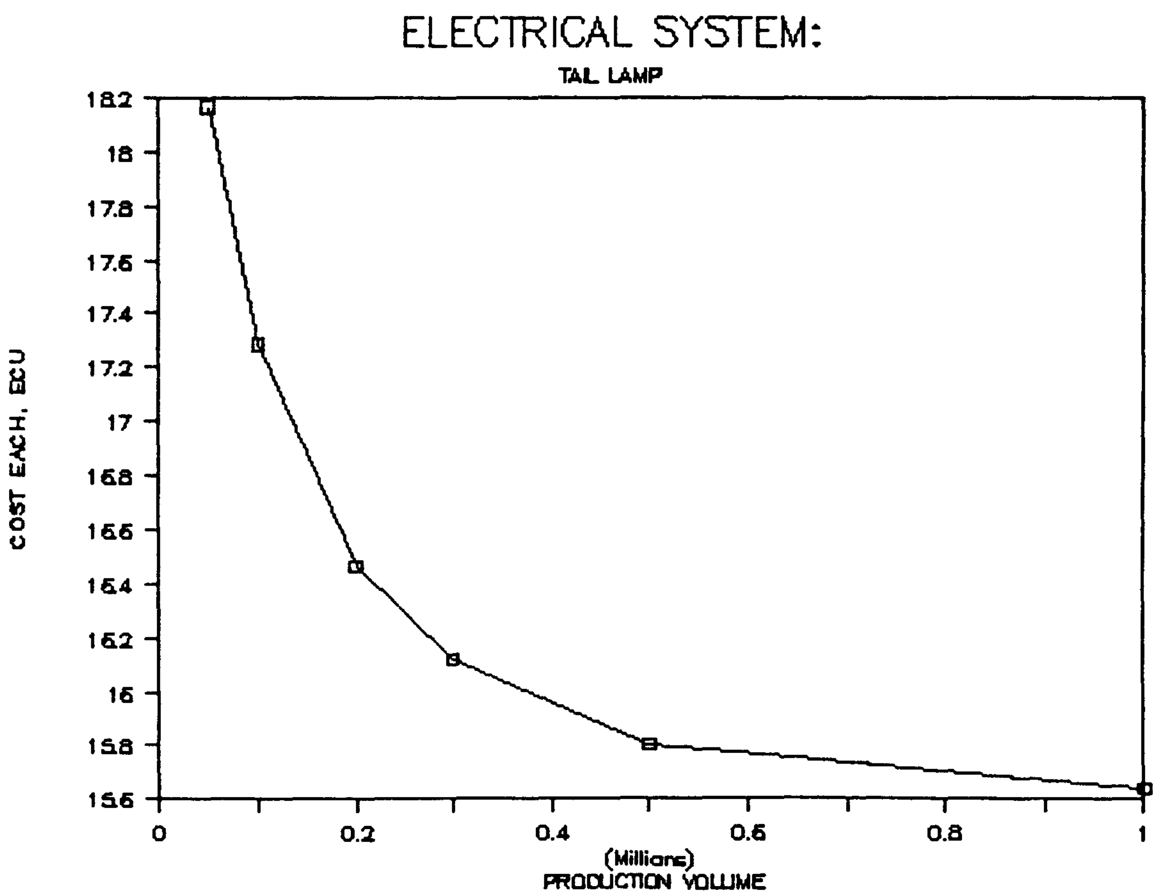

PAINT
WHITE PAINT
COST, ECU
13.8
13.6
13.4
13.2
13
12.8
12.6
12.4
12.2
12
11.8
11.6
11.4
11.2
11
10.8
0
0.2
0.4
0.6
0.8
1
(Millions)
VEHICLE SETS

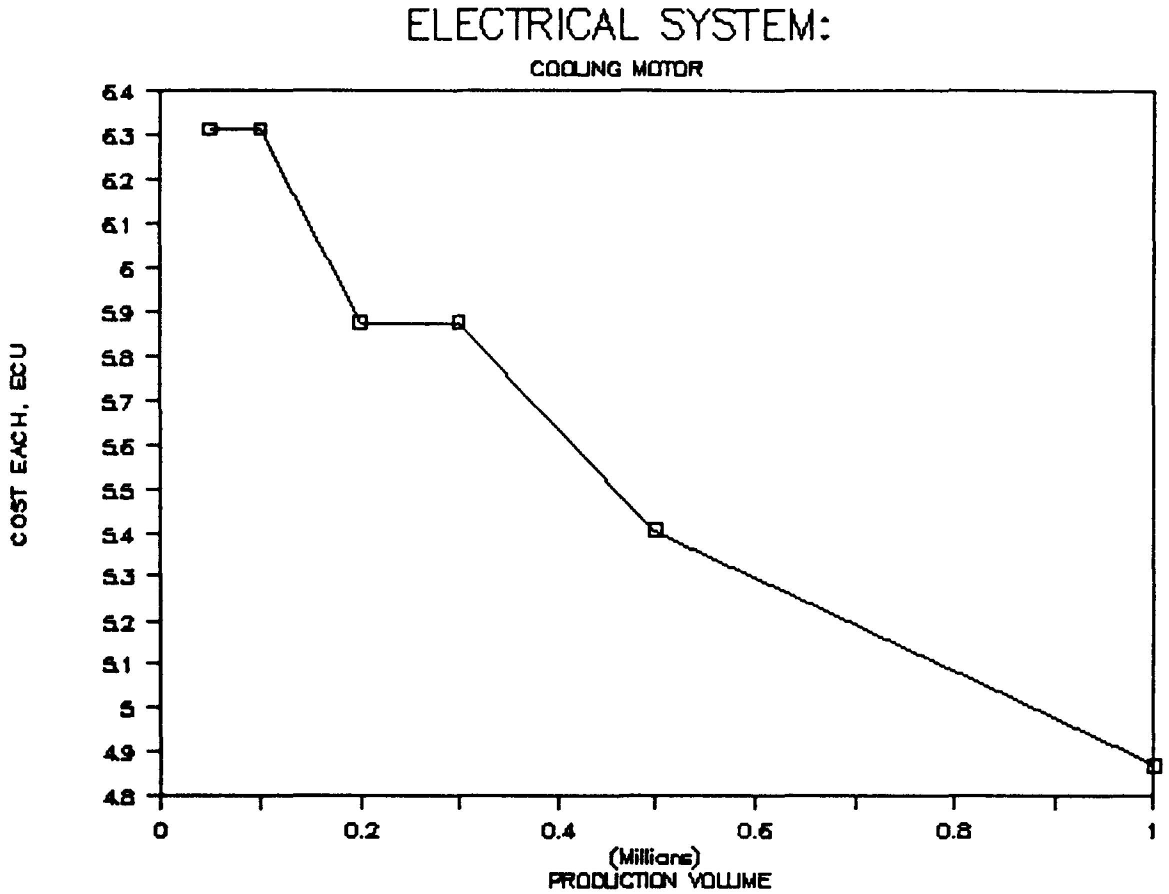

POWER TRAIN:
REPRESENTATIVE SAMPLE OF COMPONENTS
COST, ECU
116
115
114
113
112
111
110
109
108
107
106
105
104
103
102
101
100
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

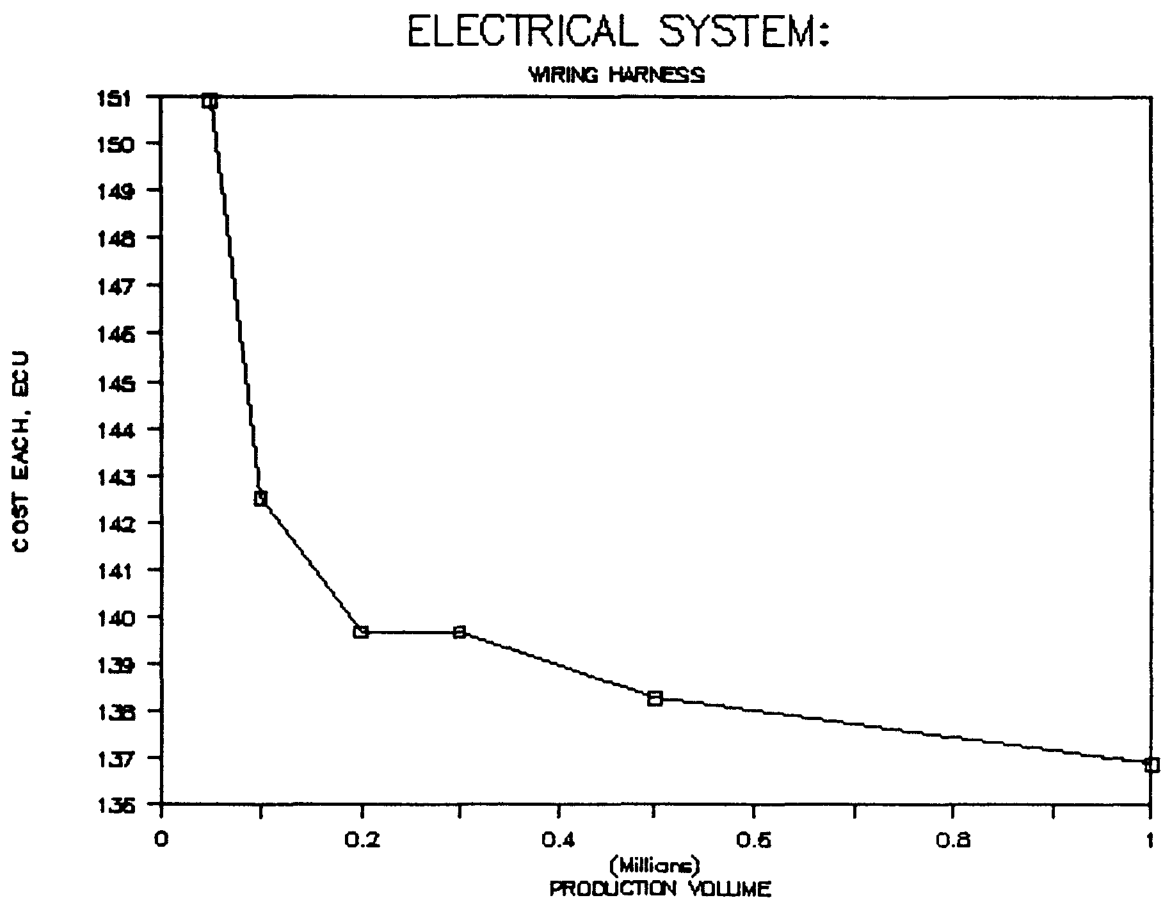

POWER TRAIN:
CASTING, MANIFOLD
COST EACH, ECU
12.4
12.3
12.2
12.1
12
11.9
11.8
11.7
11.6
11.5
11.4
11.3
11.2
11.1
11
10.9
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

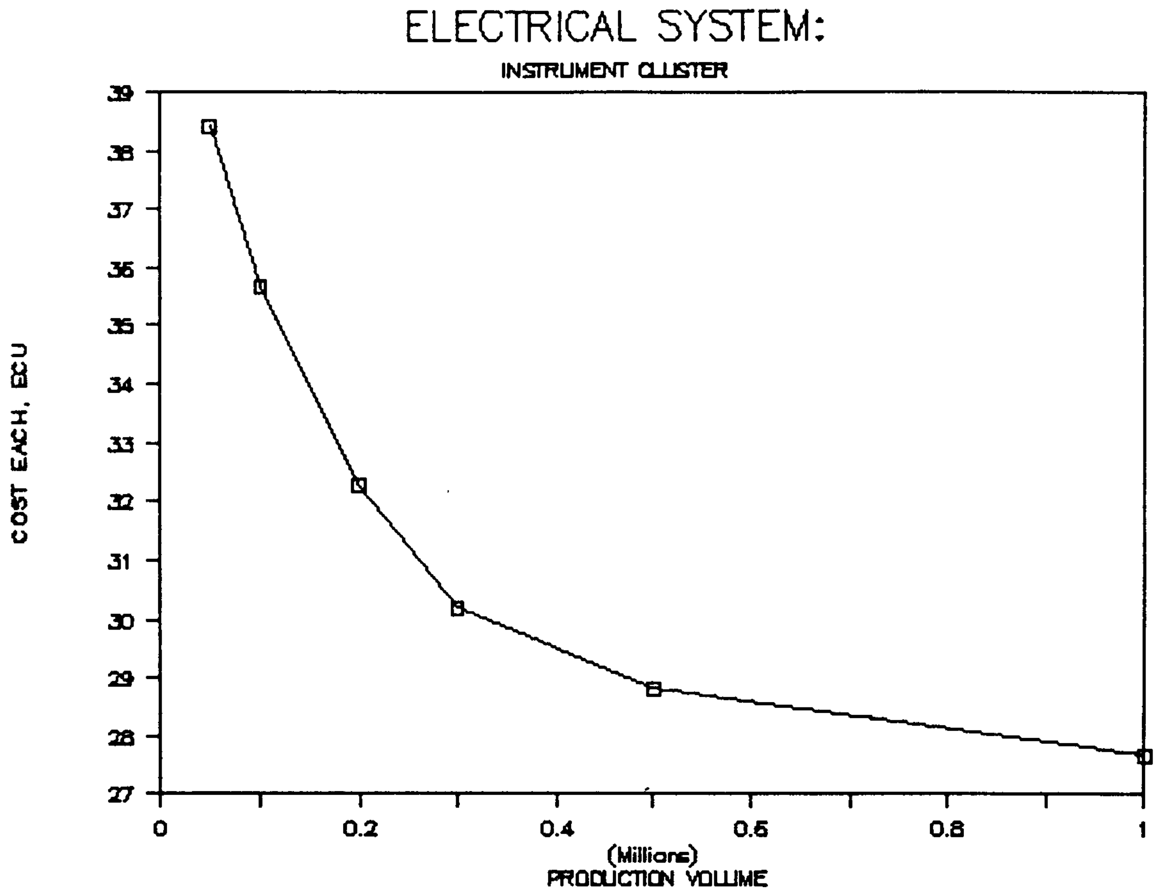

POWER TRAIN:
CASTING, WATER PUMP
COST EACH, ECU
2.75
2.7
2.65
2.6
2.55
2.5
2.45
2.4
2.35
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

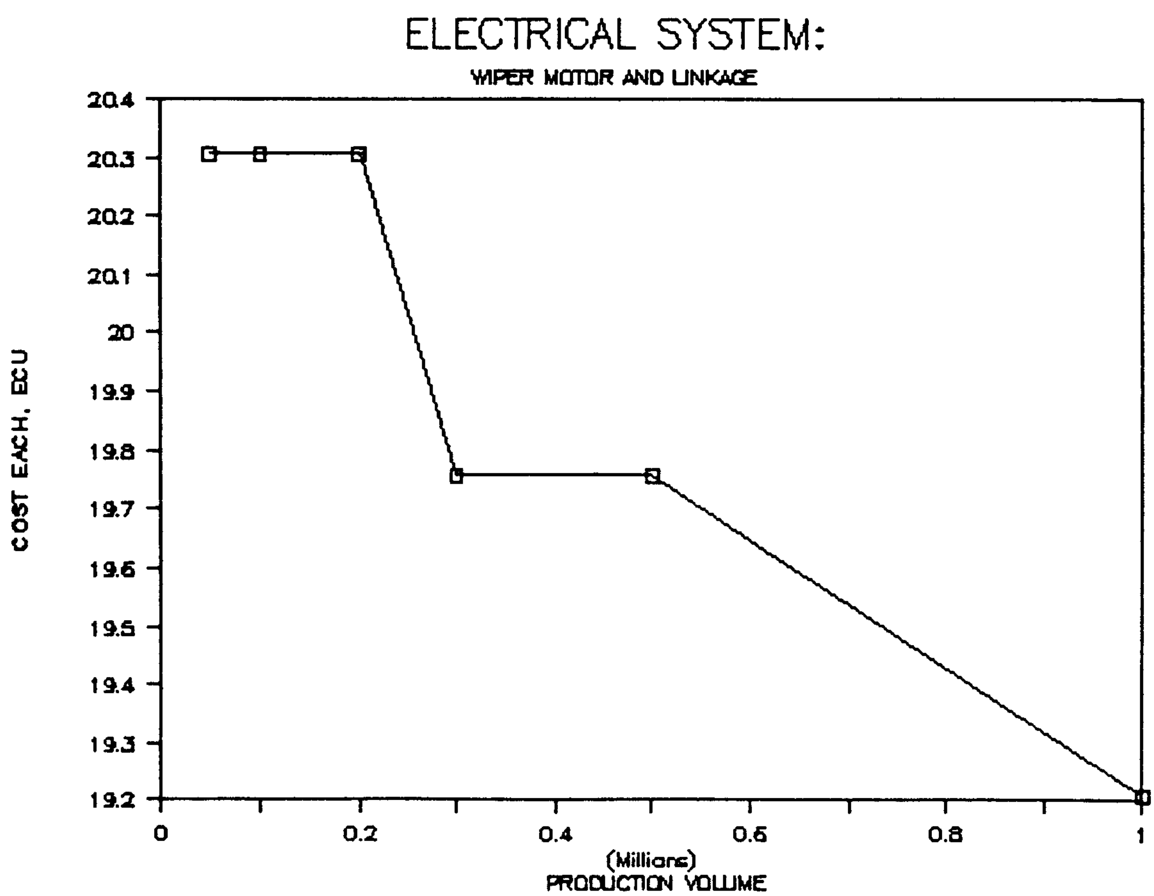

ELECTRICAL SYSTEM:
HEAD LAMP
COST EACH, ECU
33
32.5
32
31.5
31
30.5
30
29.5
29
28.5
28
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

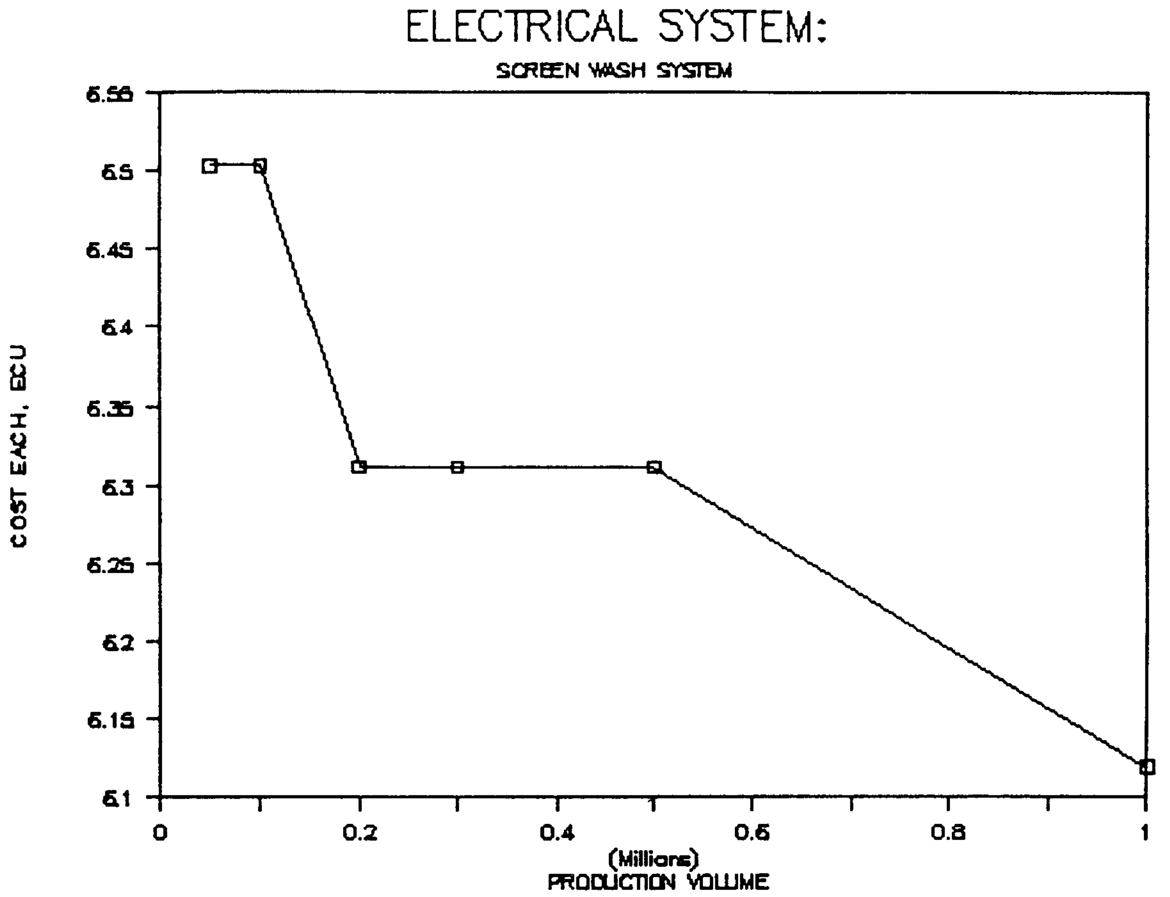

ELECTRICAL SYSTEM:
TAIL LAMP
COST EACH, ECU
18.2
18
17.8
17.6
17.4
17.2
17
16.8
16.6
16.4
16.2
16
15.8
15.6
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

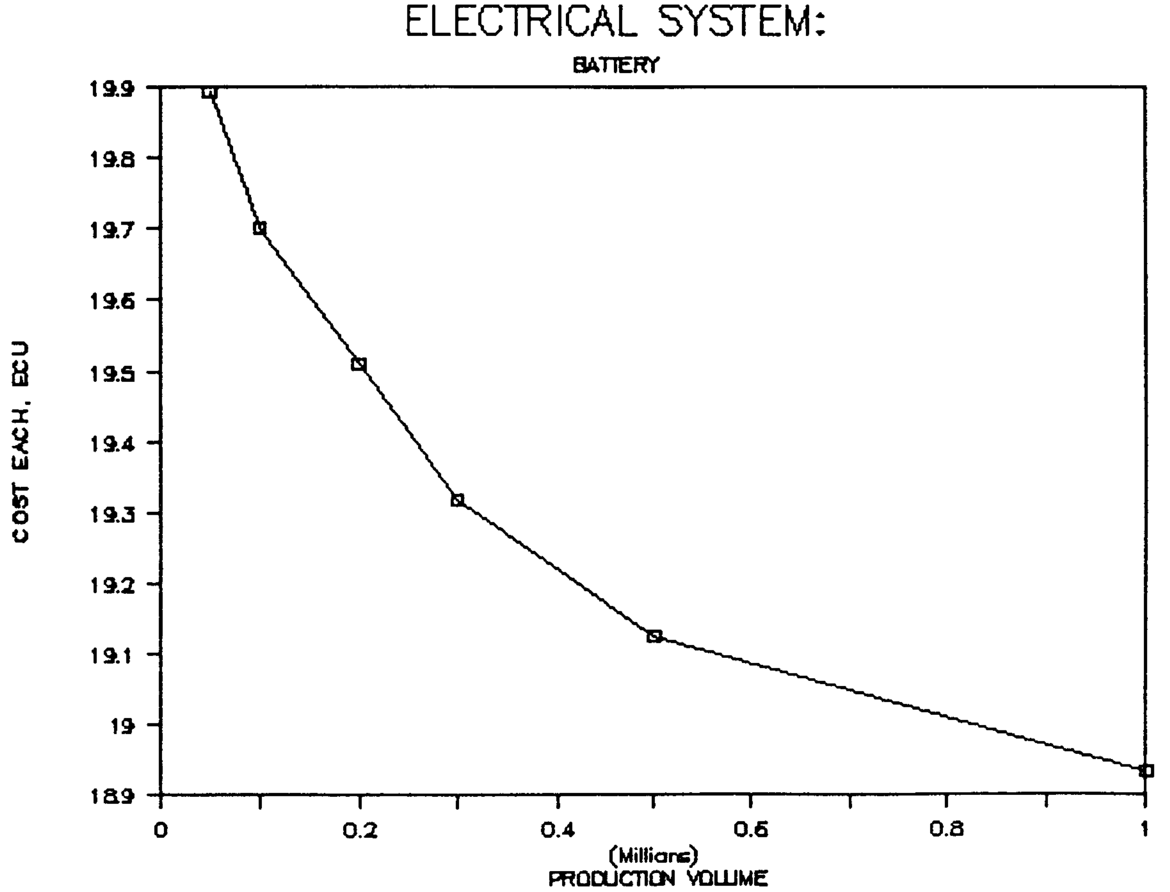

ELECTRICAL SYSTEM:
COOLING MOTOR
COST EACH, ECU
6.4
6.3
6.2
6.1
6
5.9
5.8
5.7
5.6
5.5
5.4
5.3
5.2
5.1
5
4.9
4.8
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

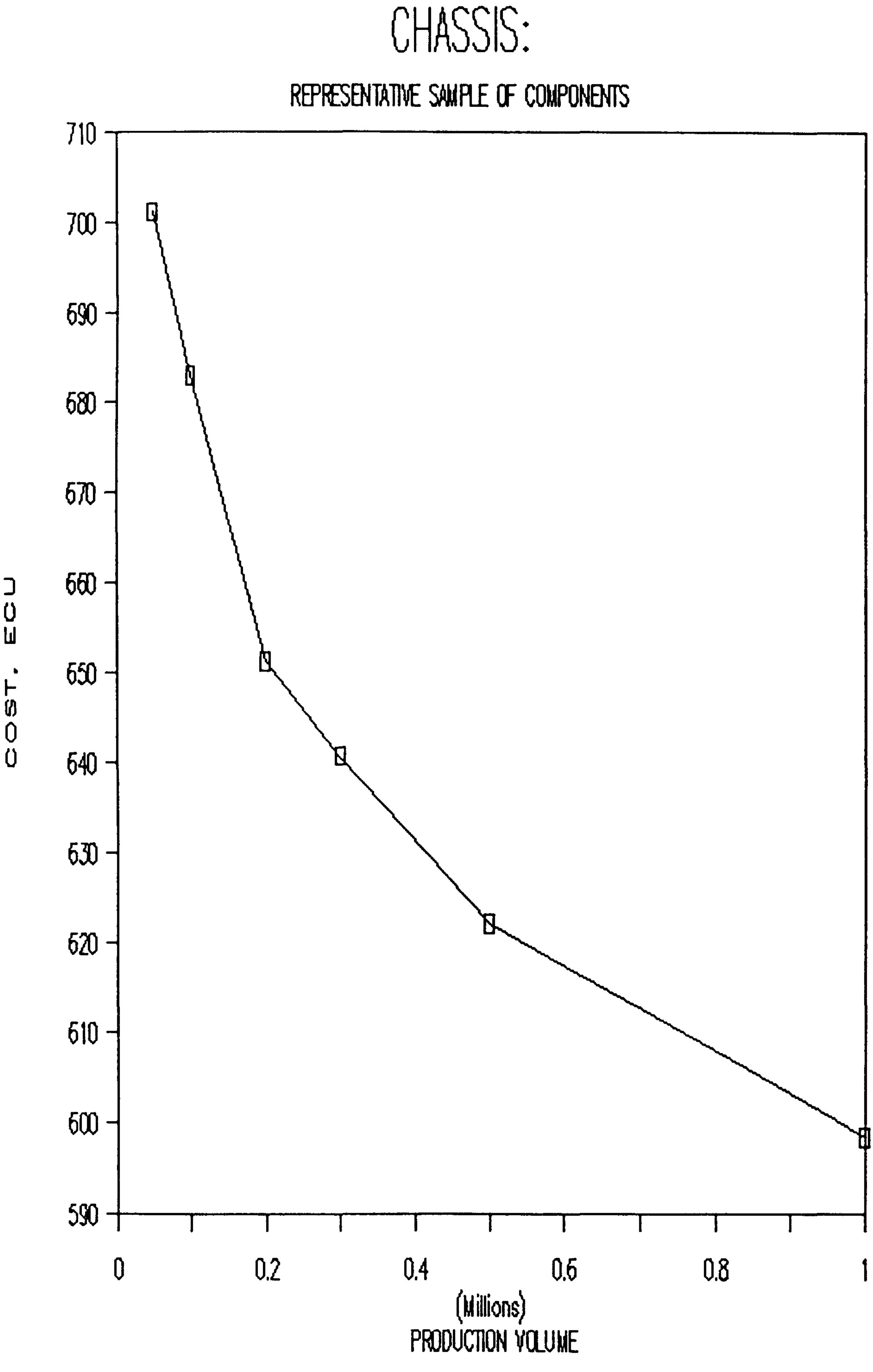

ELECTRICAL SYSTEM:
WIRING HARNESS
COST EACH, ECU
151
150
149
148
147
146
145
144
143
142
141
140
139
138
137
136
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

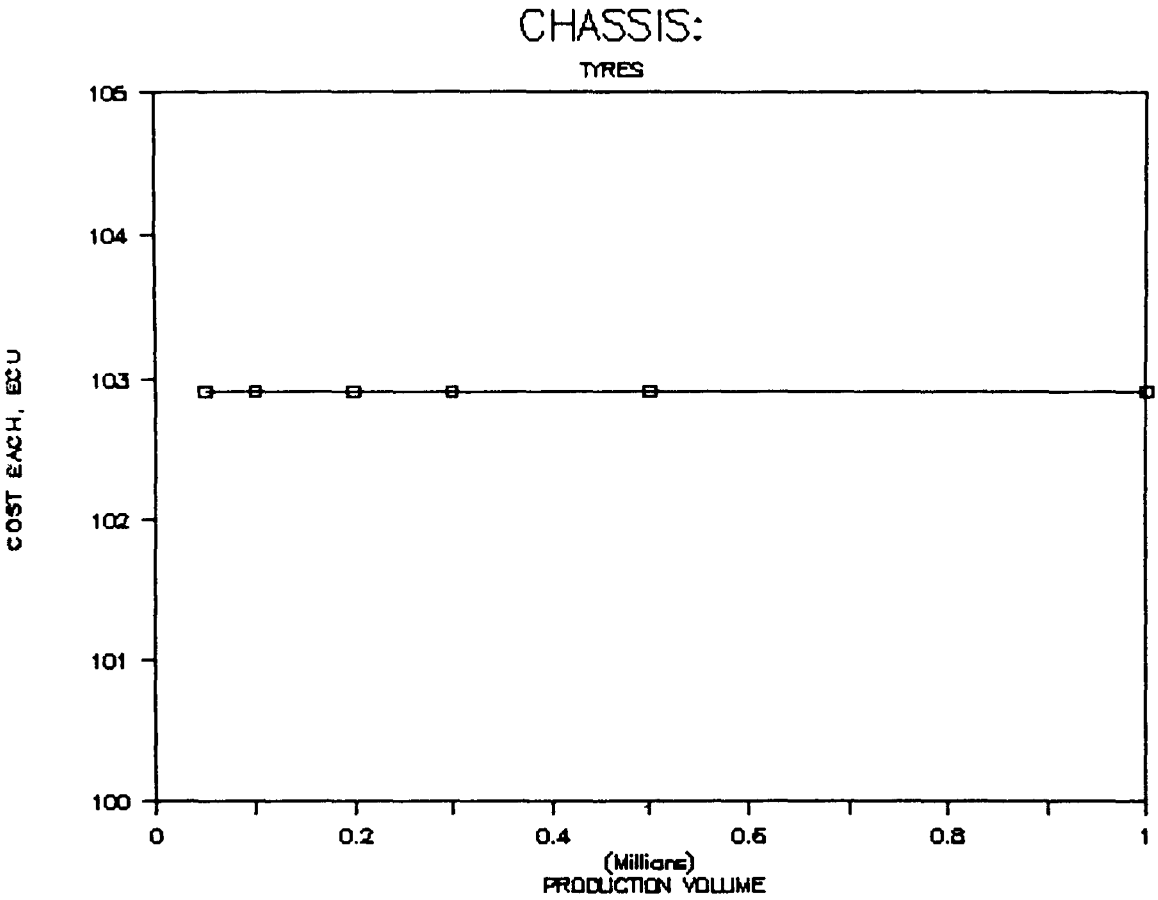

ELECTRICAL SYSTEM:
INSTRUMENT CLUSTER
COST EACH, ECU
39
38
37
36
35
34
33
32
31
30
29
28
27
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME


ELECTRICAL SYSTEM:
WIPER MOTOR AND LINKAGE
COST EACH, ECU
20.4
20.3
20.2
20.1
20
19.9
19.8
19.7
19.6
19.5
19.4
19.3
19.2
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

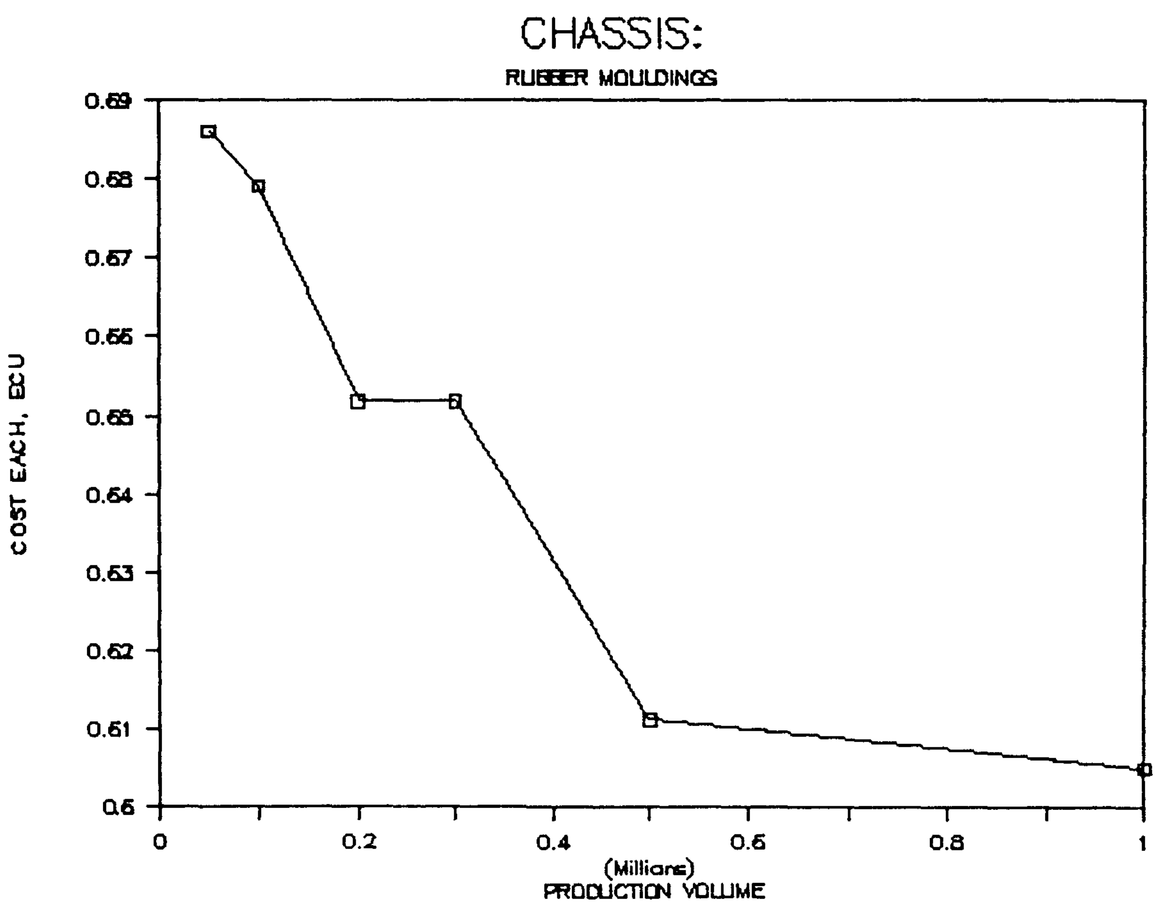

ELECTRICAL SYSTEM:
SCREEN WASH SYSTEM
COST EACH, ECU
6.55
6.5
6.45
6.4
6.35
6.3
6.25
6.2
6.15
6.1
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME


ELECTRICAL SYSTEM:
BATTERY
COST EACH, ECU
19.9
19.8
19.7
19.6
19.5
19.4
19.3
19.2
19.1
19
18.9
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

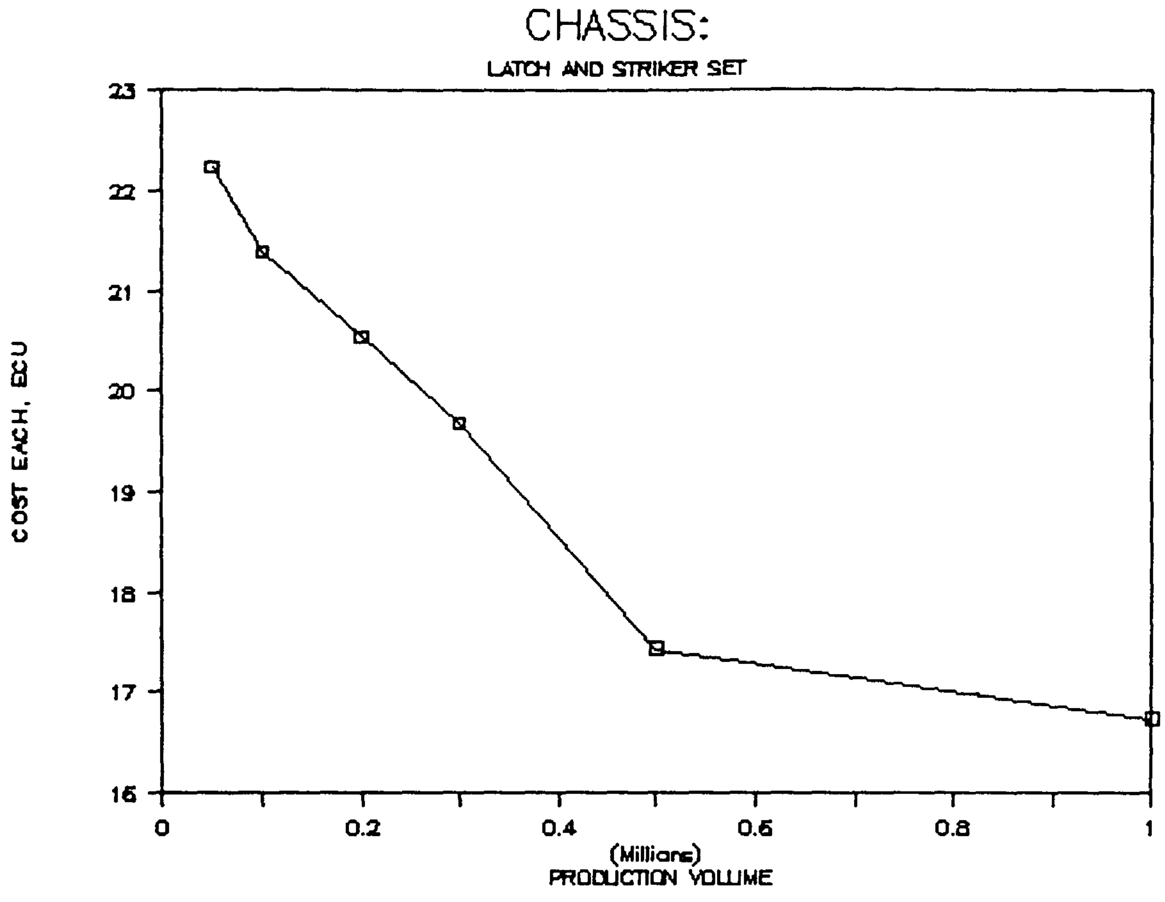

CHASSIS:
REPRESENTATIVE SAMPLE OF COMPONENTS
COST, ECU
710
700
690
680
670
660
650
640
630
620
610
600
590
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

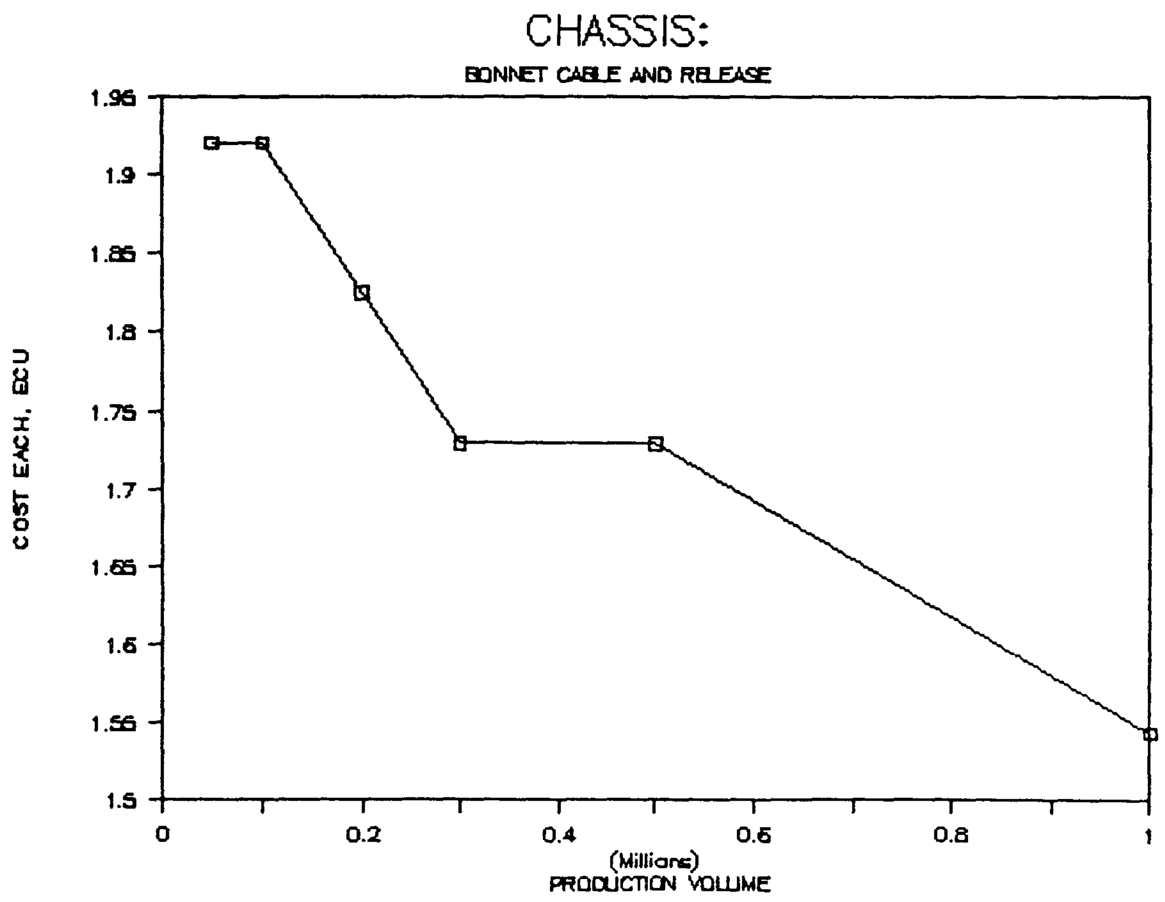


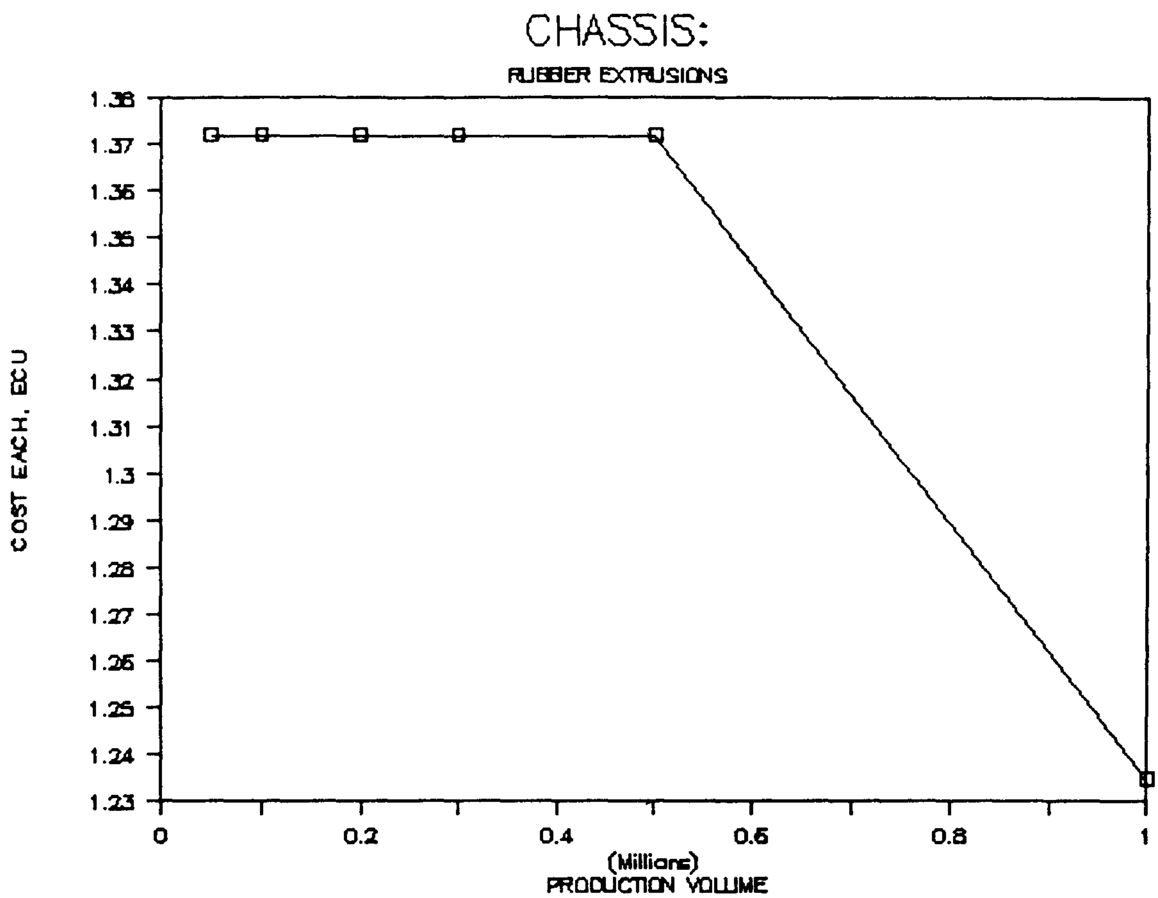
CHASSIS:
TYRES
105
104
103
102
101
100
COST EACH, ECU
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

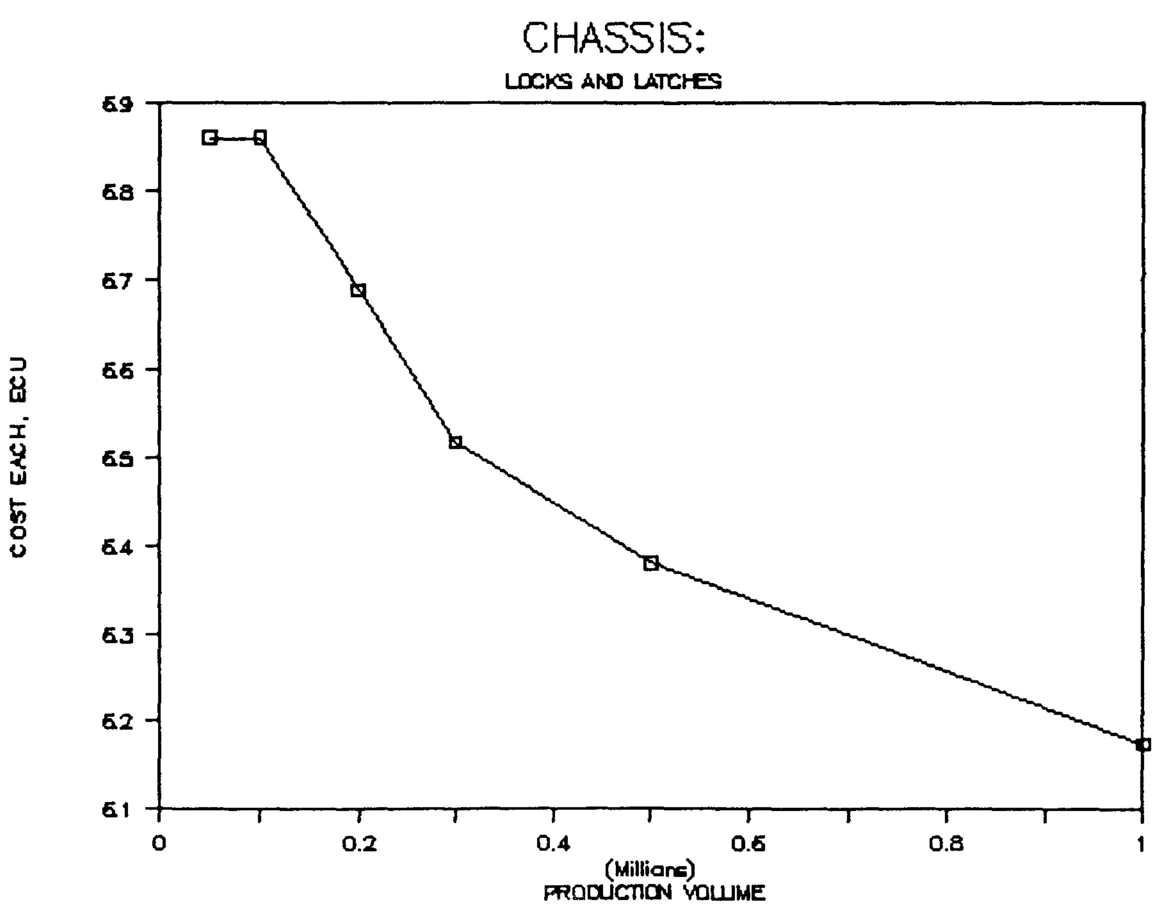


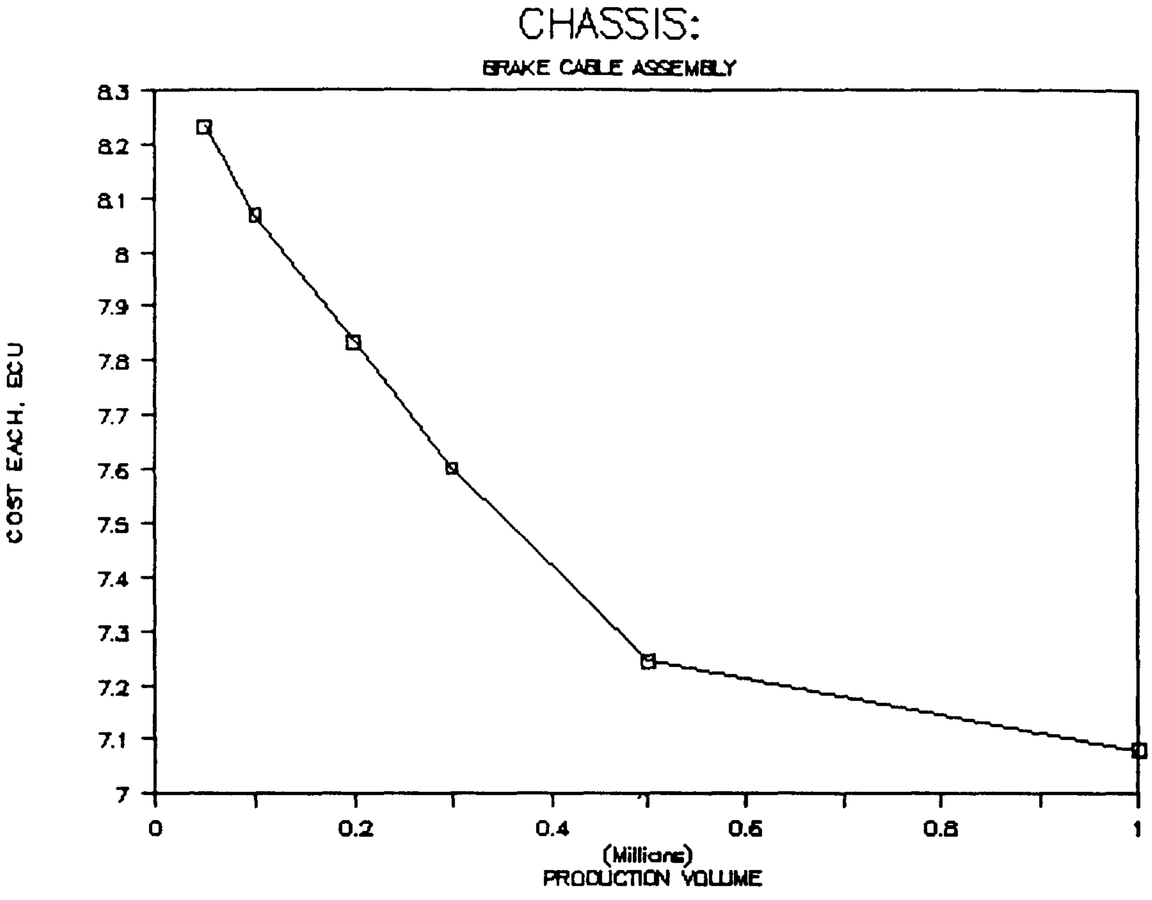
CHASSIS:
RUBBER MOULDINGS
0.69
0.68
0.67
0.66
0.65
0.64
0.63
0.62
0.61
0.6
COST EACH, ECU
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

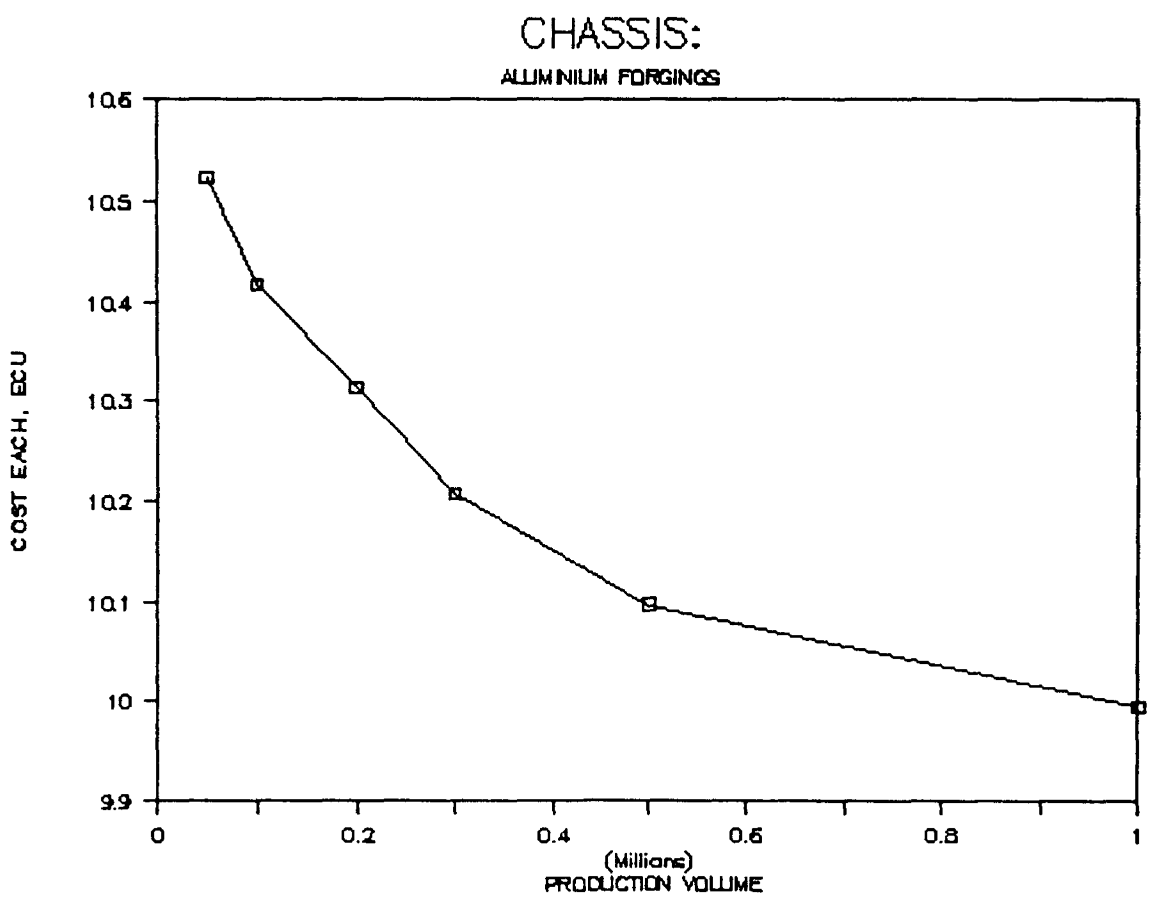

CHASSIS:
LATCH AND STRIKER SET
COST EACH, ECU
23
22
21
20
19
18
17
16
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

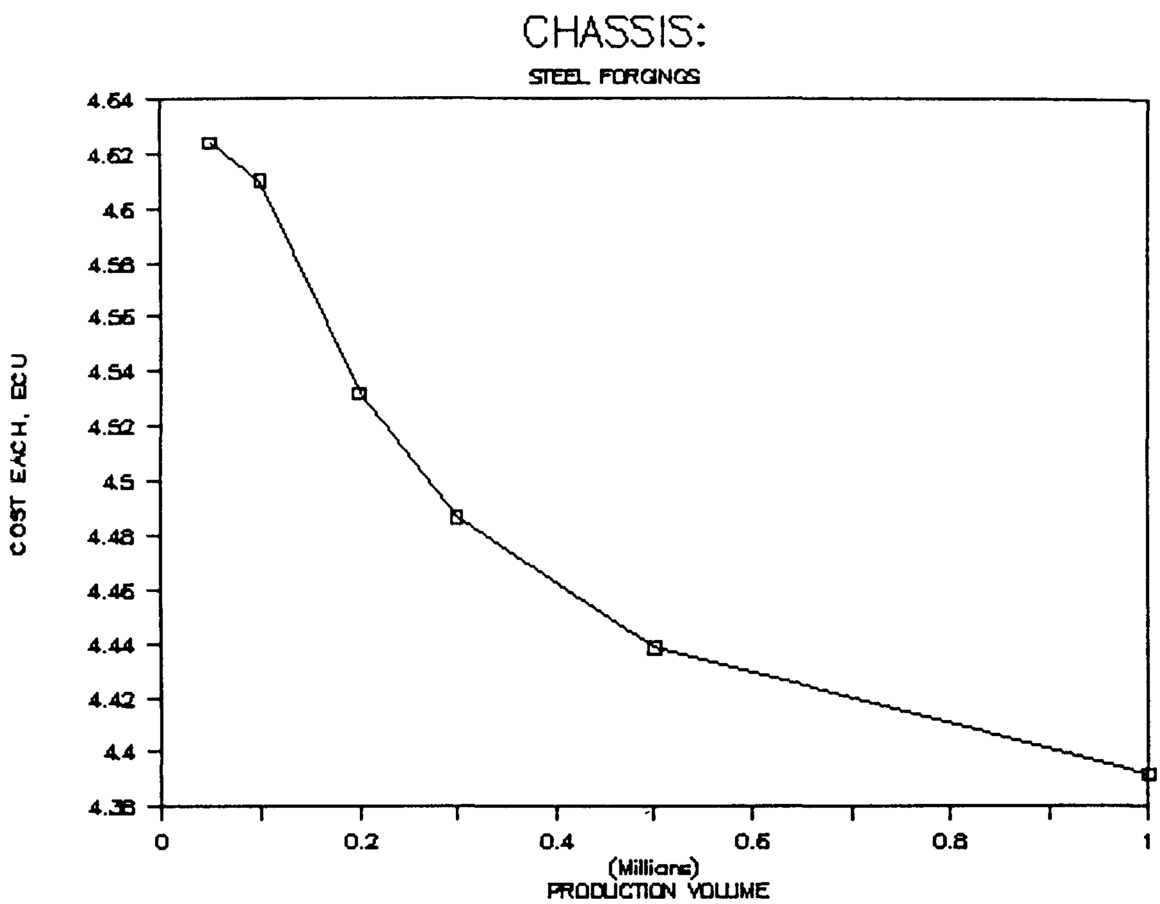

CHASSIS:
BONNET CABLE AND RELEASE
COST EACH, ECU
1.95
1.9
1.85
1.8
1.75
1.7
1.65
1.6
1.55
1.5
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME


CHASSIS:
RUBBER EXTRUSIONS
1.38
1.37
1.36
1.35
1.34
1.33
1.32
1.31
1.3
1.29
1.28
1.27
1.26
1.25
1.24
1.23
COST EACH, ECU
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

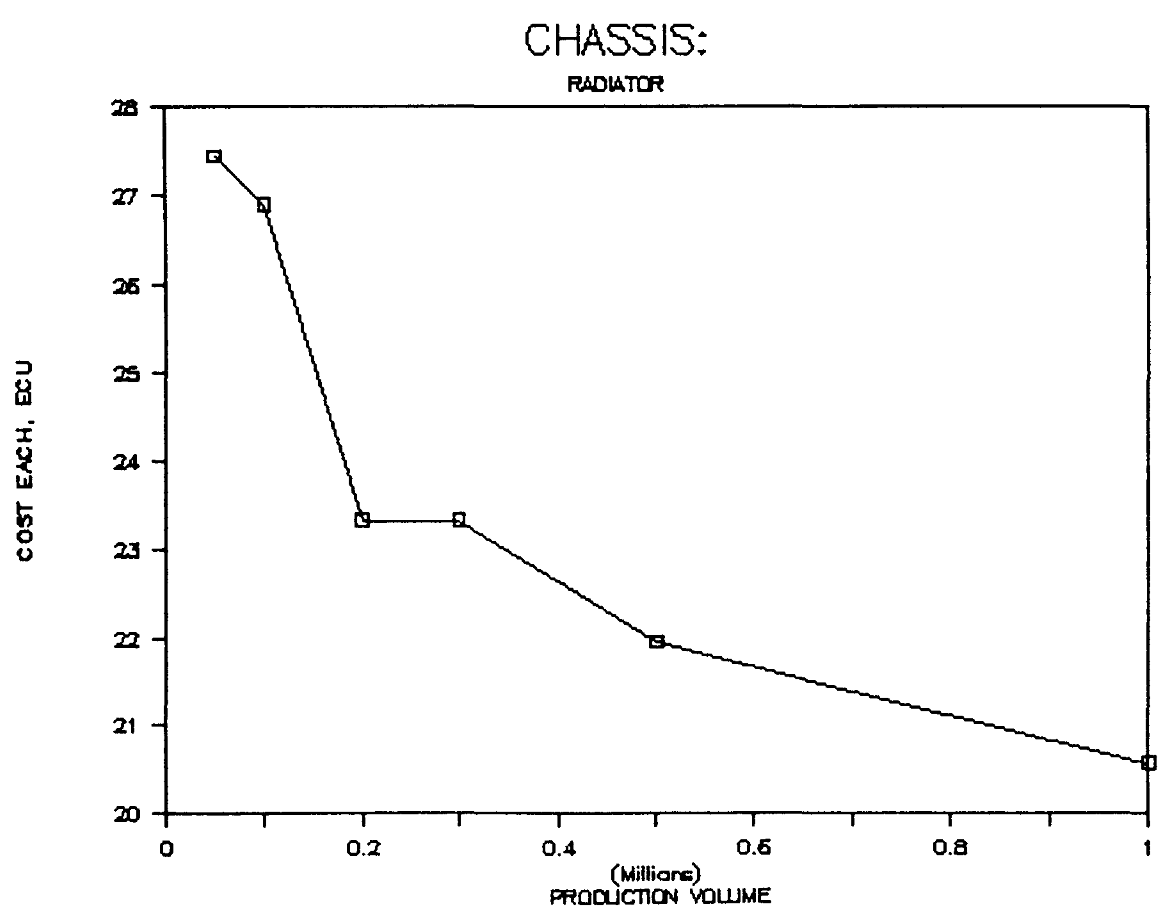

CHASSIS:
LOCKS AND LATCHES
6.9
6.8
6.7
6.6
6.5
6.4
6.3
6.2
6.1
COST EACH, ECU
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME


CHASSIS:
BRAKE CABLE ASSEMBLY
COST EACH, ECU
8.3
8.2
8.1
8
7.9
7.8
7.7
7.6
7.5
7.4
7.3
7.2
7.1
7
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

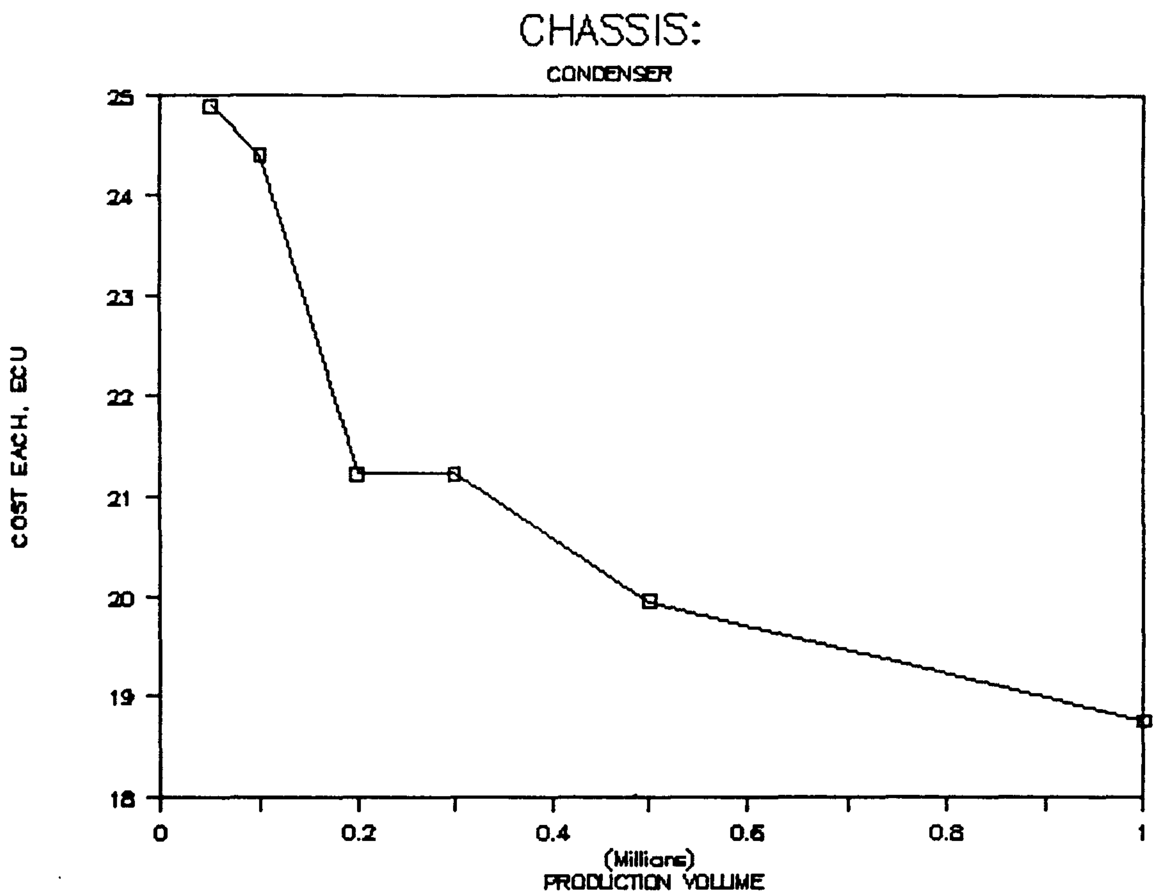

CHASSIS:
ALUMINIUM FORGINGS
COST EACH, ECU
10.6
10.5
10.4
10.3
10.2
10.1
10
9.9
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

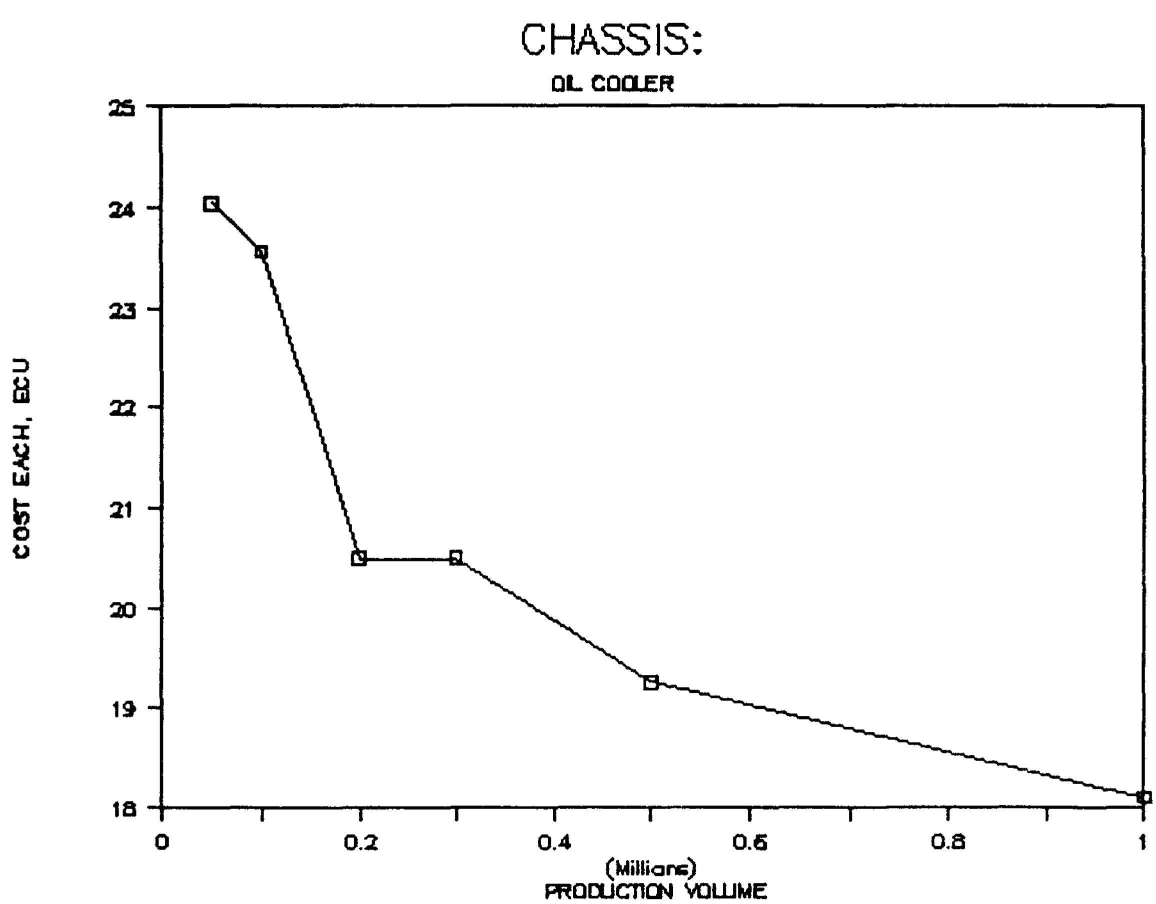


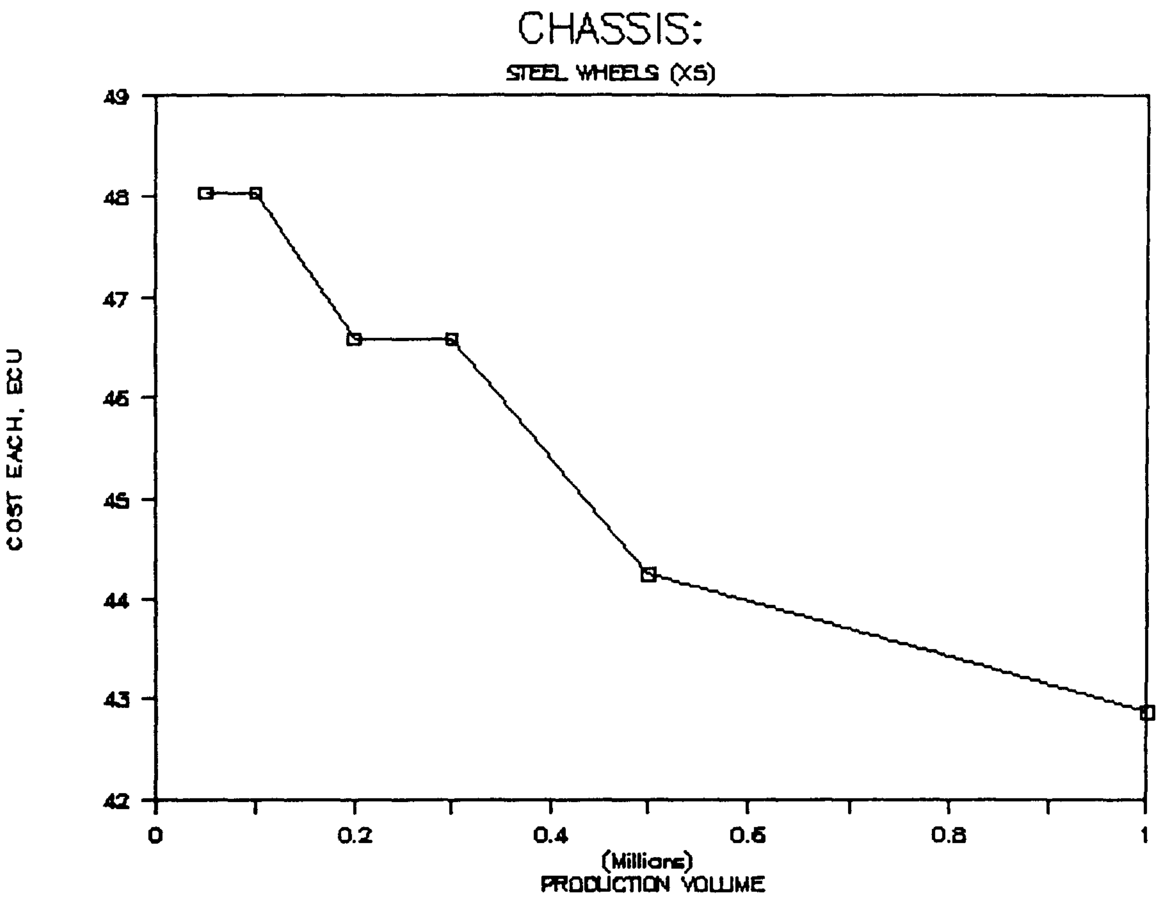
CHASSIS:
STEEL FORGINGS
COST EACH, ECU
4.64
4.62
4.6
4.58
4.56
4.54
4.52
4.5
4.48
4.46
4.44
4.42
4.4
4.38
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

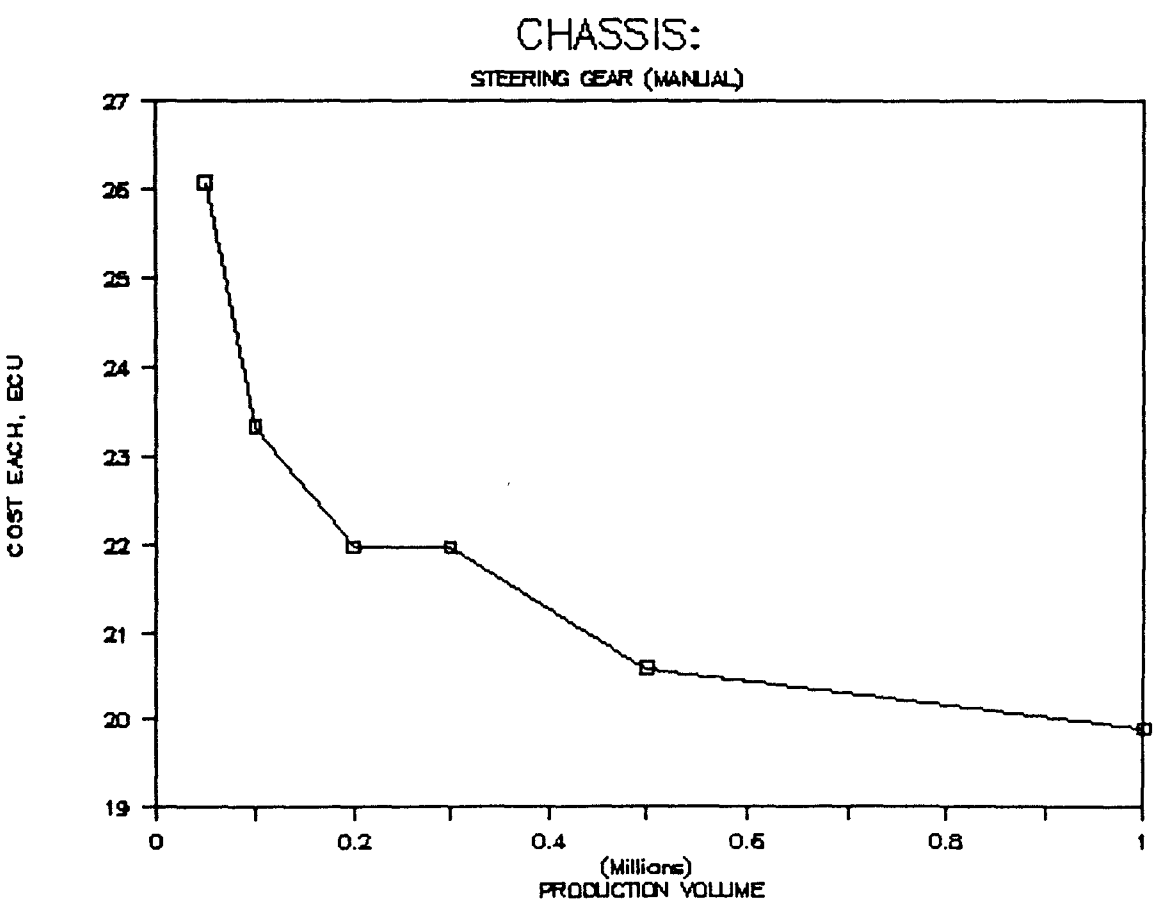


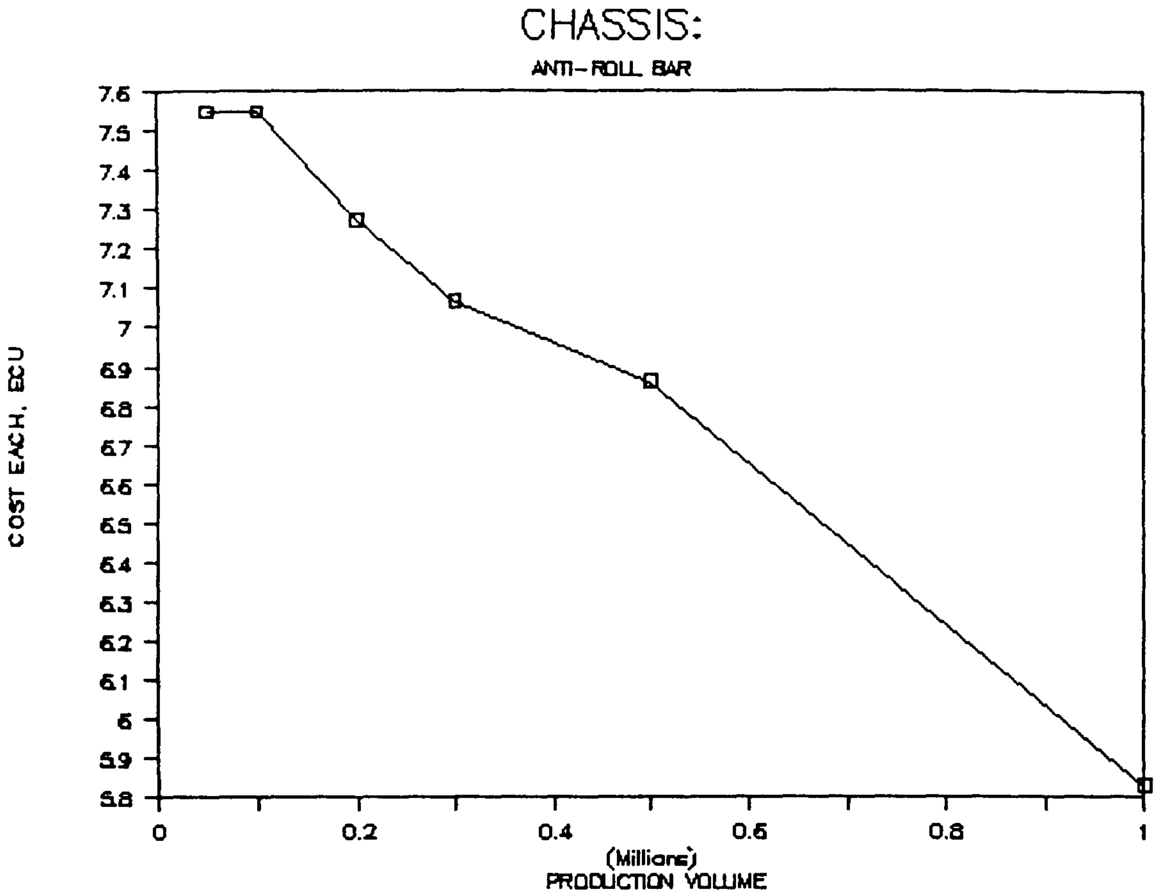
CHASSIS:
RADIATOR
COST EACH, ECU
28
27
26
25
24
23
22
21
20
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

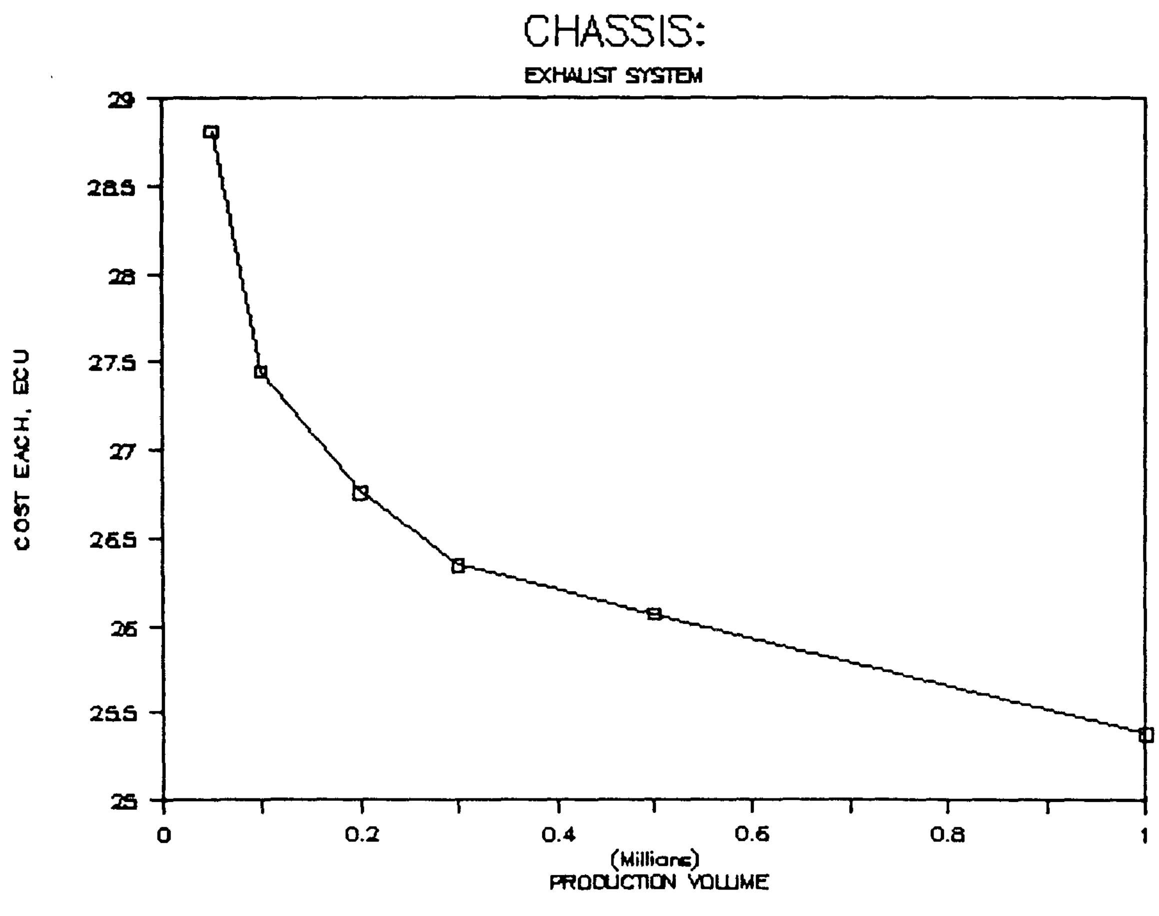

CHASSIS:
CONDENSER
COST EACH, ECU
25
24
23
22
21
20
19
18
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

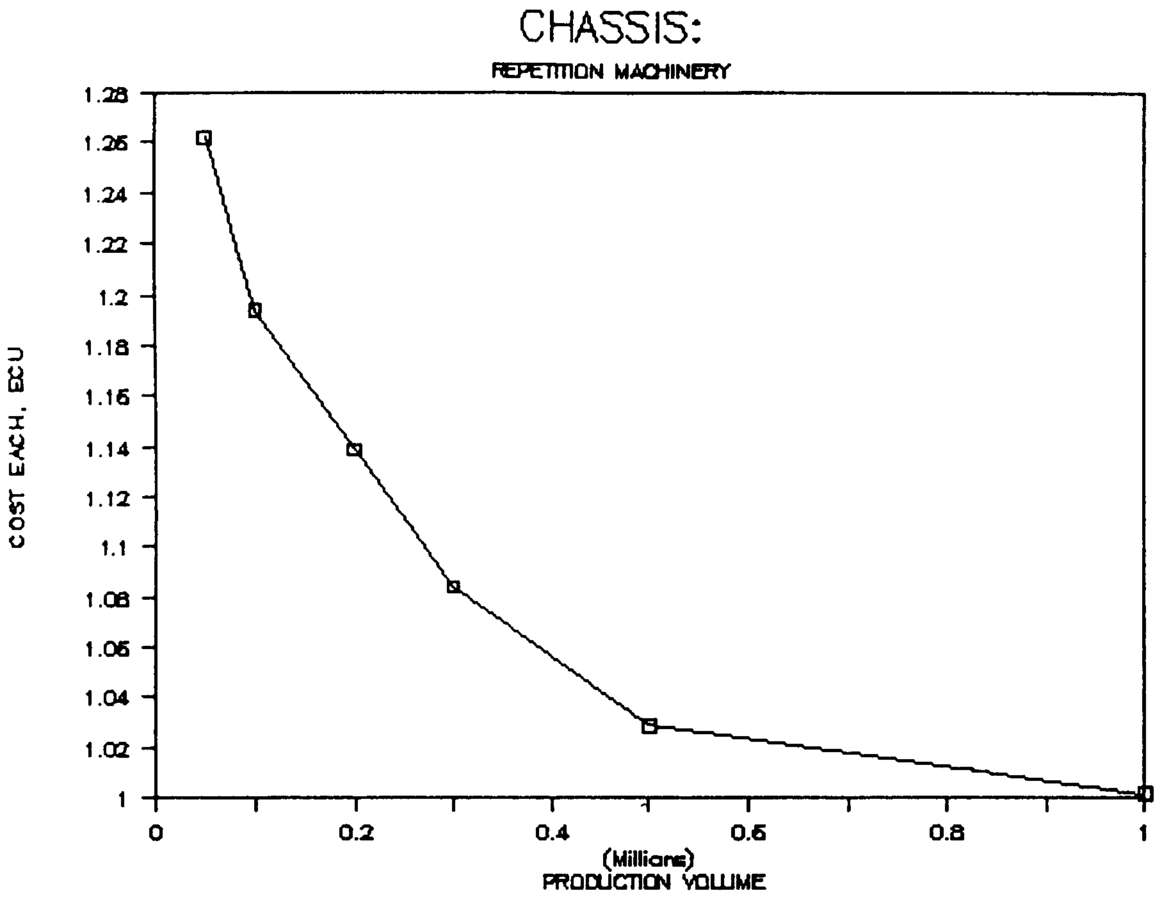

CHASSIS:
OIL COOLER
COST EACH, ECU
25
24
23
22
21
20
19
18
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

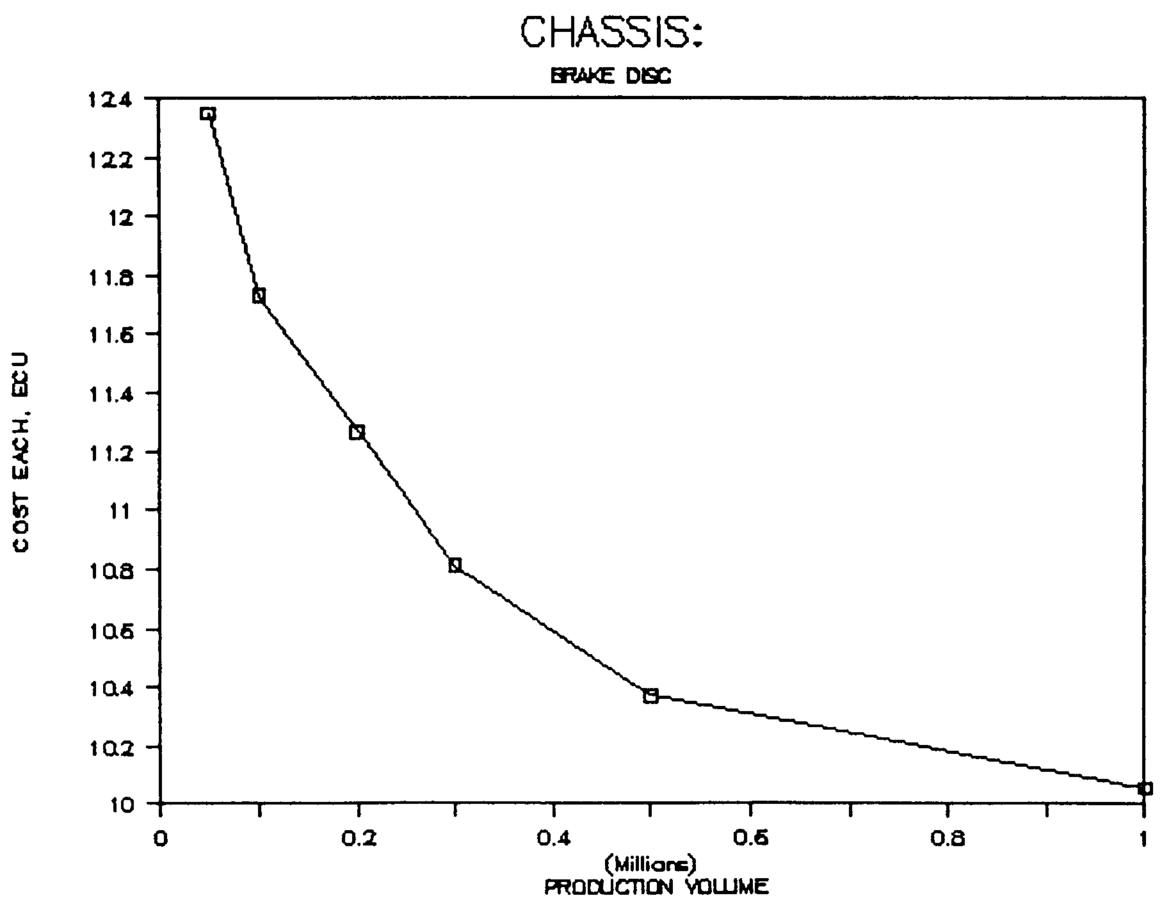

CHASSIS:
STEEL WHEELS (X5)
COST EACH, ECU
49
48
47
46
45
44
43
42
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

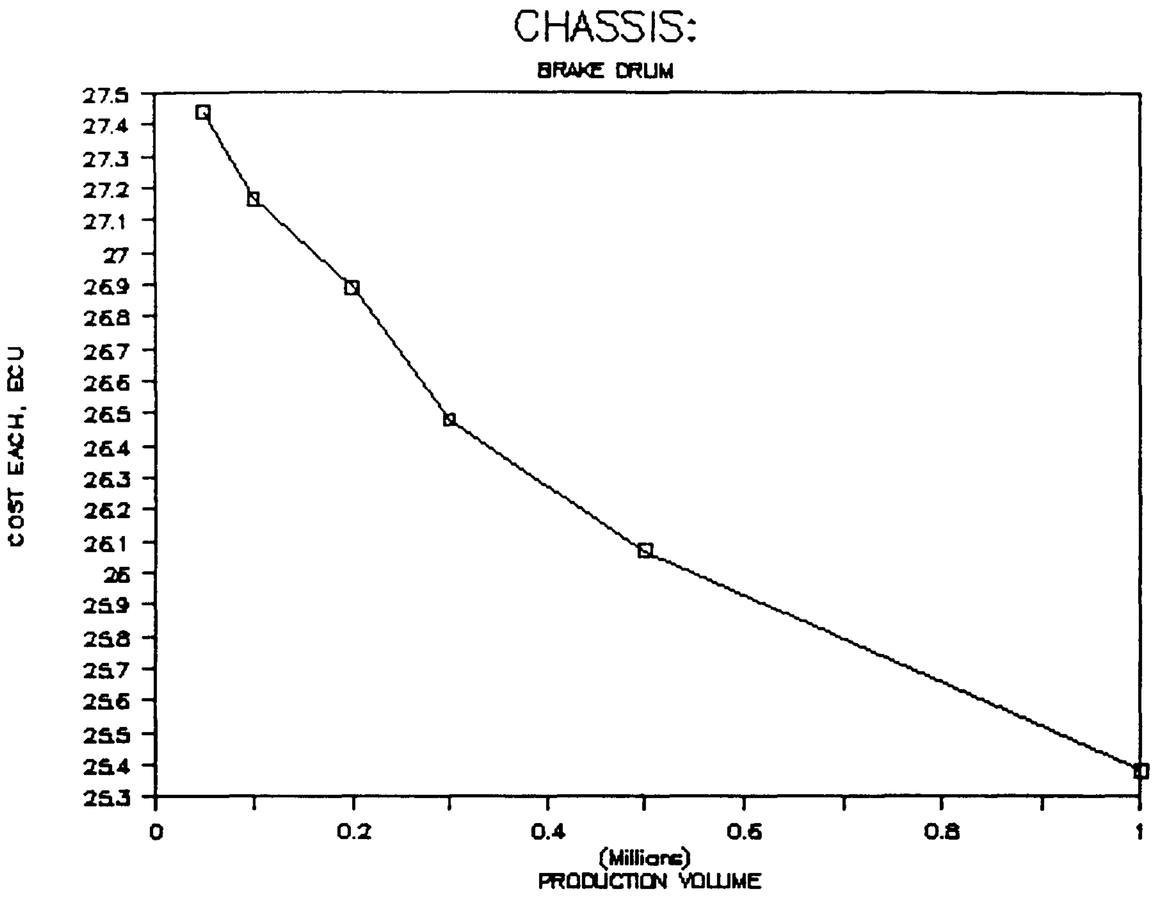

CHASSIS:
STEERING GEAR (MANUAL)
COST EACH, ECU
27
26
25
24
23
22
21
20
19
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

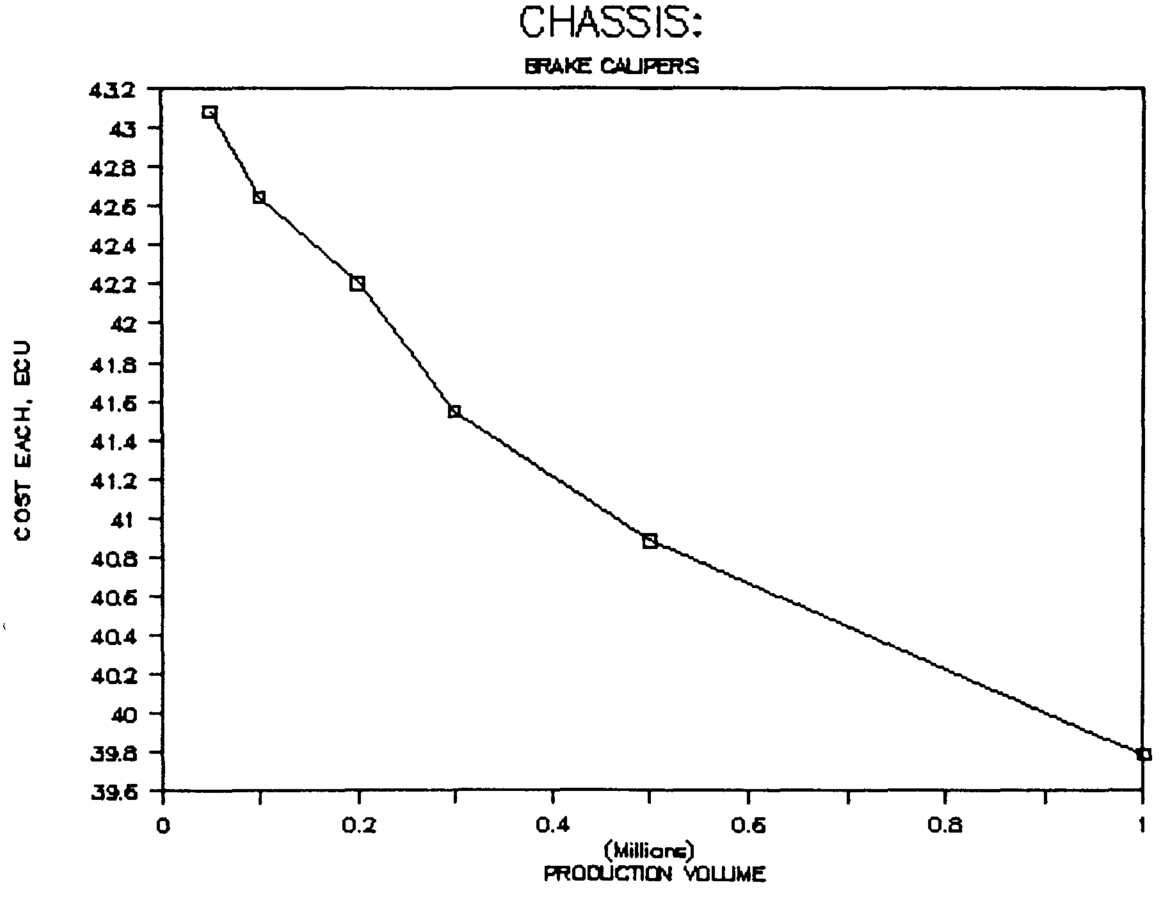

CHASSIS:
ANTI-ROLL BAR
COST EACH, ECU
(Millions)
PRODUCTION VOLUME
7.6
7.5
7.4
7.3
7.2
7.1
7
6.9
6.8
6.7
6.6
6.5
6.4
6.3
6.2
6.1
6
5.9
5.8
0
0.2
0.4
0.6
0.8
1


CHASSIS:
EXHAUST SYSTEM
COST EACH, ECU
(Millions)
PRODUCTION VOLUME
29
28.5
28
27.5
27
26.5
26
25.5
25
0
0.2
0.4
0.6
0.8
1


CHASSIS:
REPETITION MACHINERY
COST EACH, ECU
1.28
1.26
1.24
1.22
1.2
1.18
1.16
1.14
1.12
1.1
1.08
1.06
1.04
1.02
1
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME


CHASSIS:
BRAKE DISC
COST EACH, ECU
12.4
12.2
12
11.8
11.6
11.4
11.2
11
10.8
10.6
10.4
10.2
10
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME


CHASSIS:
BRAKE DRUM
COST EACH, ECU
27.5
27.4
27.3
27.2
27.1
27
26.9
26.8
26.7
26.6
26.5
26.4
26.3
26.2
26.1
26
25.9
25.8
25.7
25.6
25.5
25.4
25.3
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME


CHASSIS:
BRAKE CALIPERS
COST EACH, ECU
43.2
43
42.8
42.6
42.4
42.2
42
41.8
41.6
41.4
41.2
41
40.8
40.6
40.4
40.2
40
39.8
39.6
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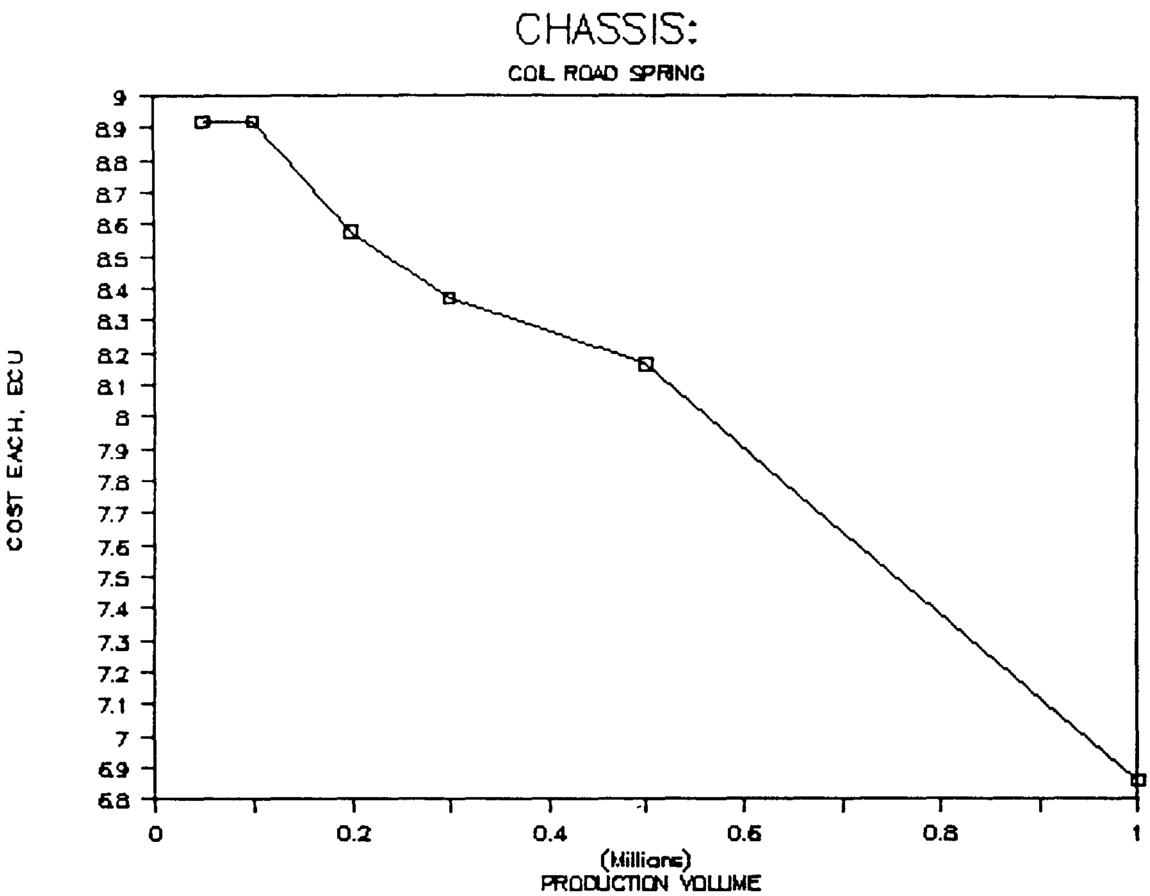
0.8
1
(Millions)
PRODUCTION VOLUME


CHASSIS:
COIL ROAD SPRING
COST EACH, ECU
9
8.9
8.8
8.7
8.6
8.5
8.4
8.3
8.2
8.1
8
7.9
7.8
7.7
7.6
7.5
7.4
7.3
7.2
7.1
7
6.9
6.8
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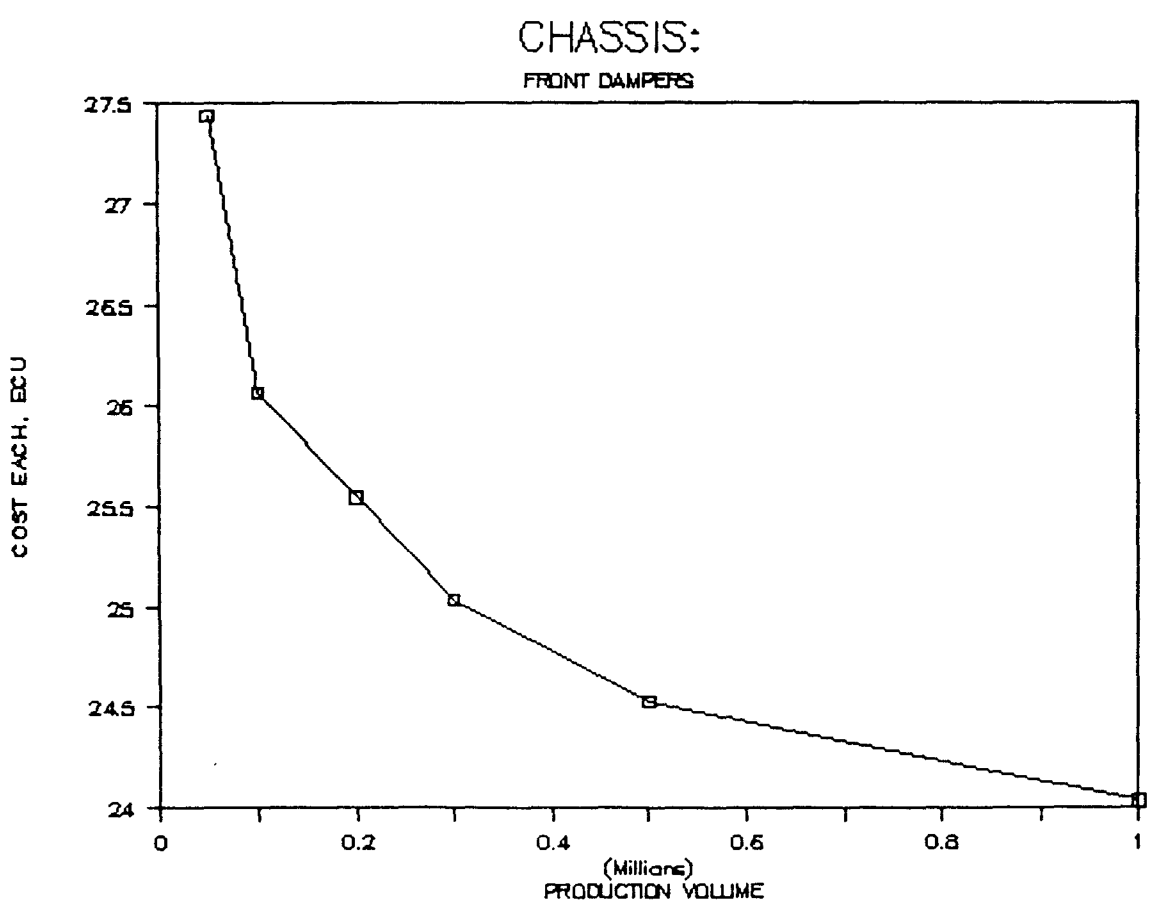
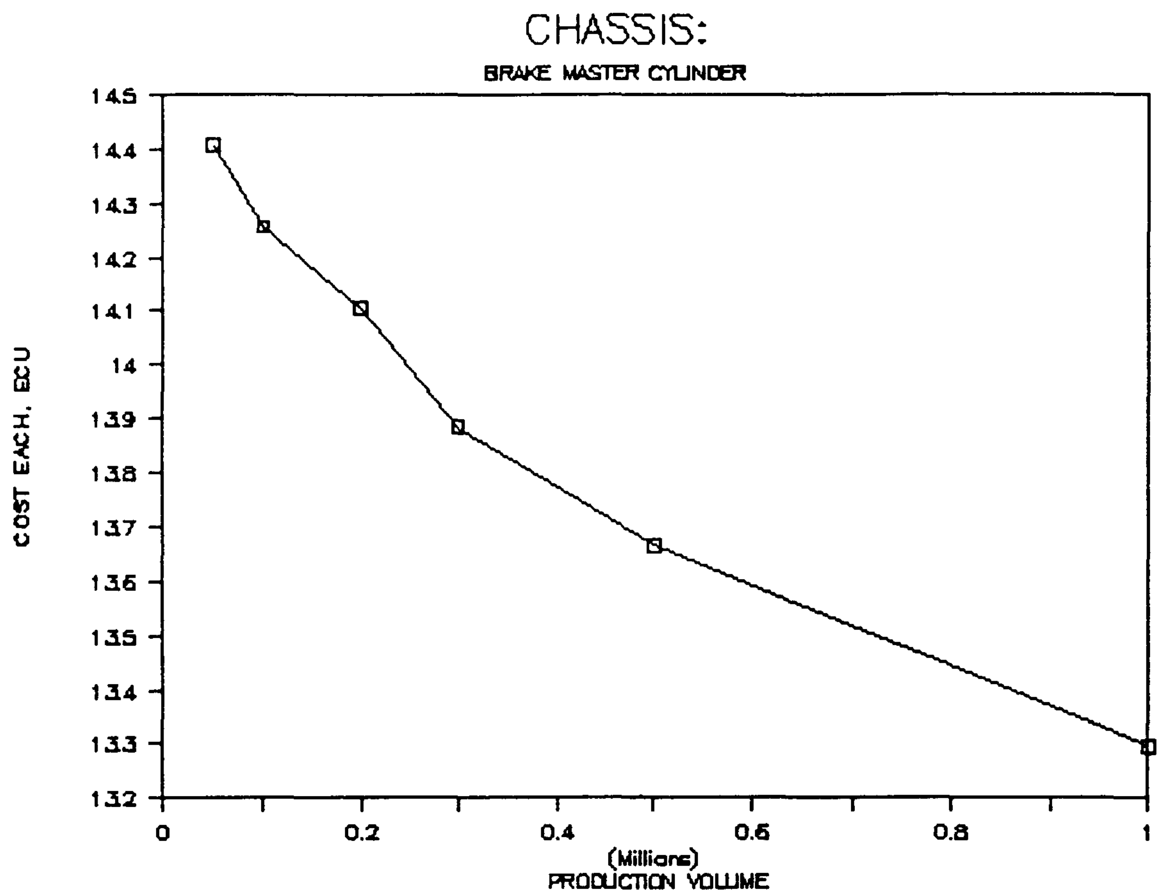
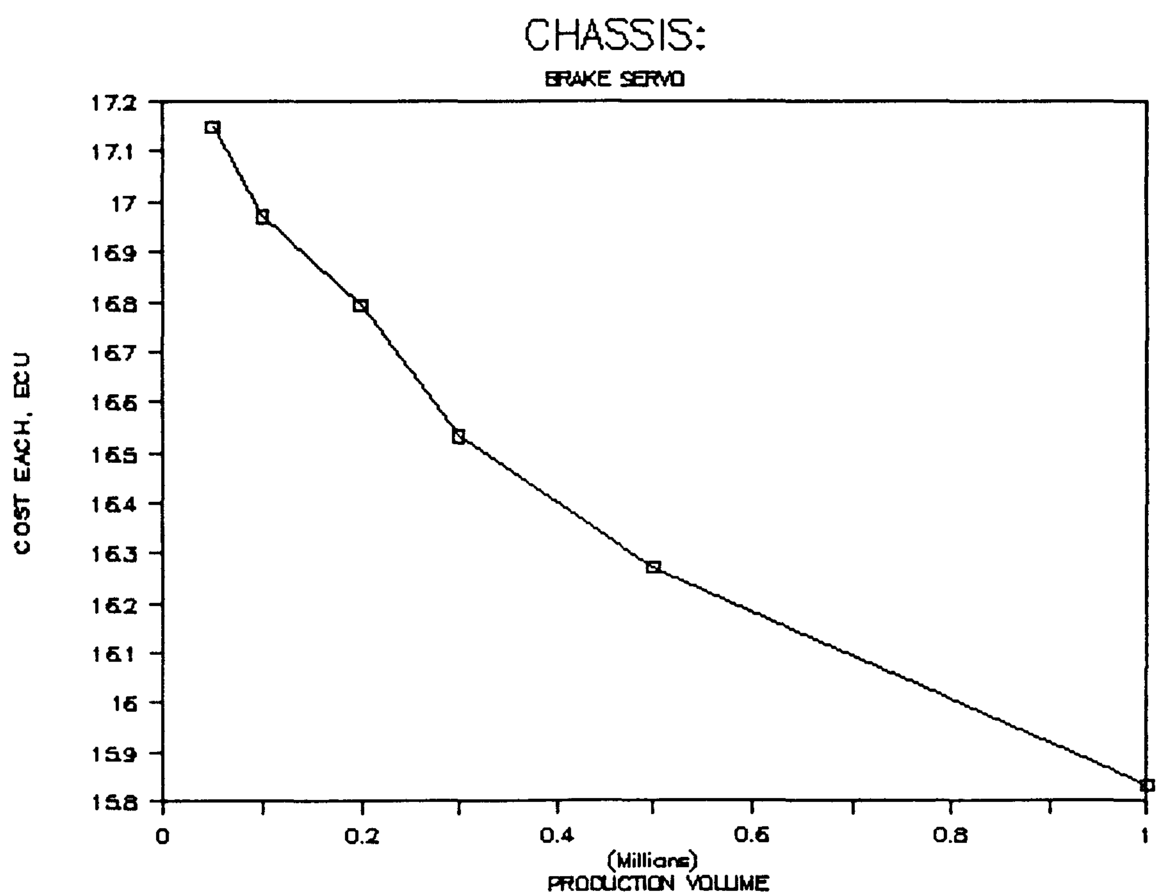
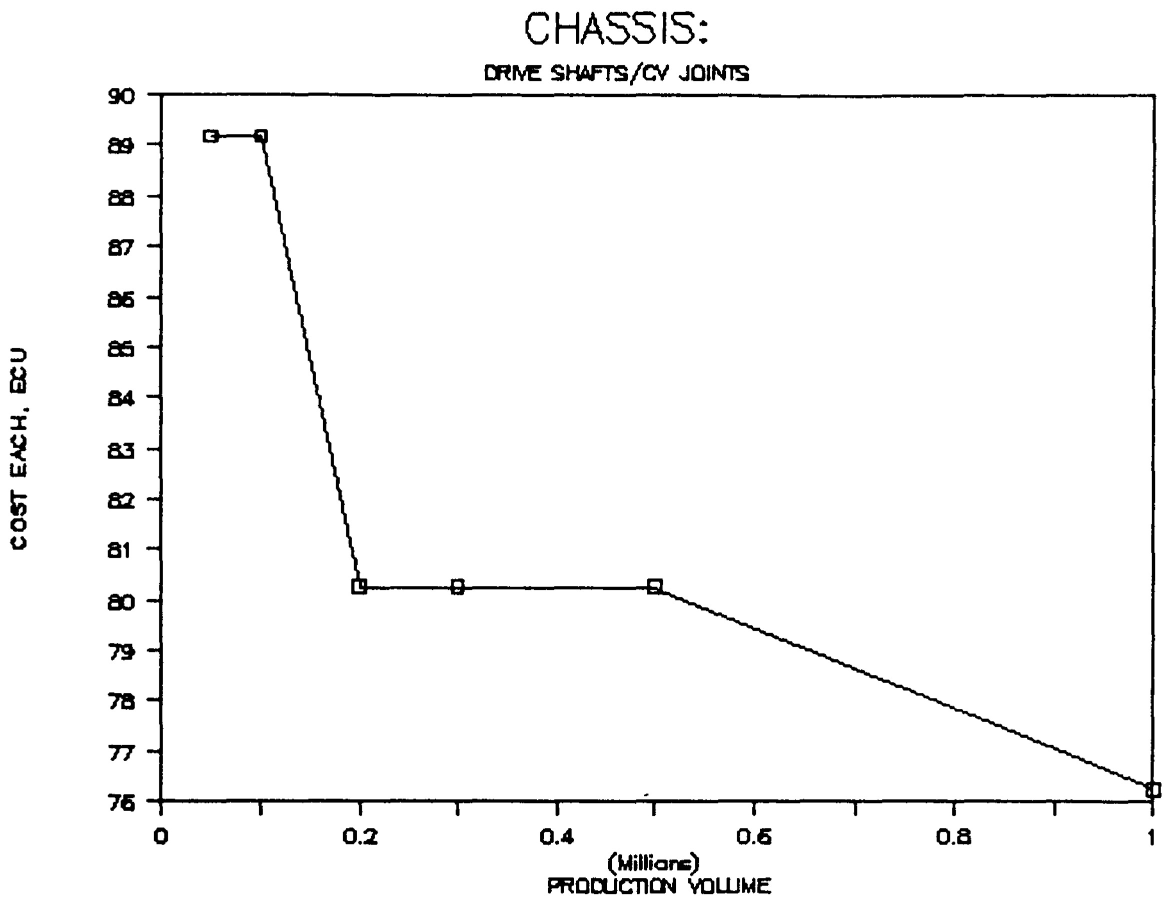
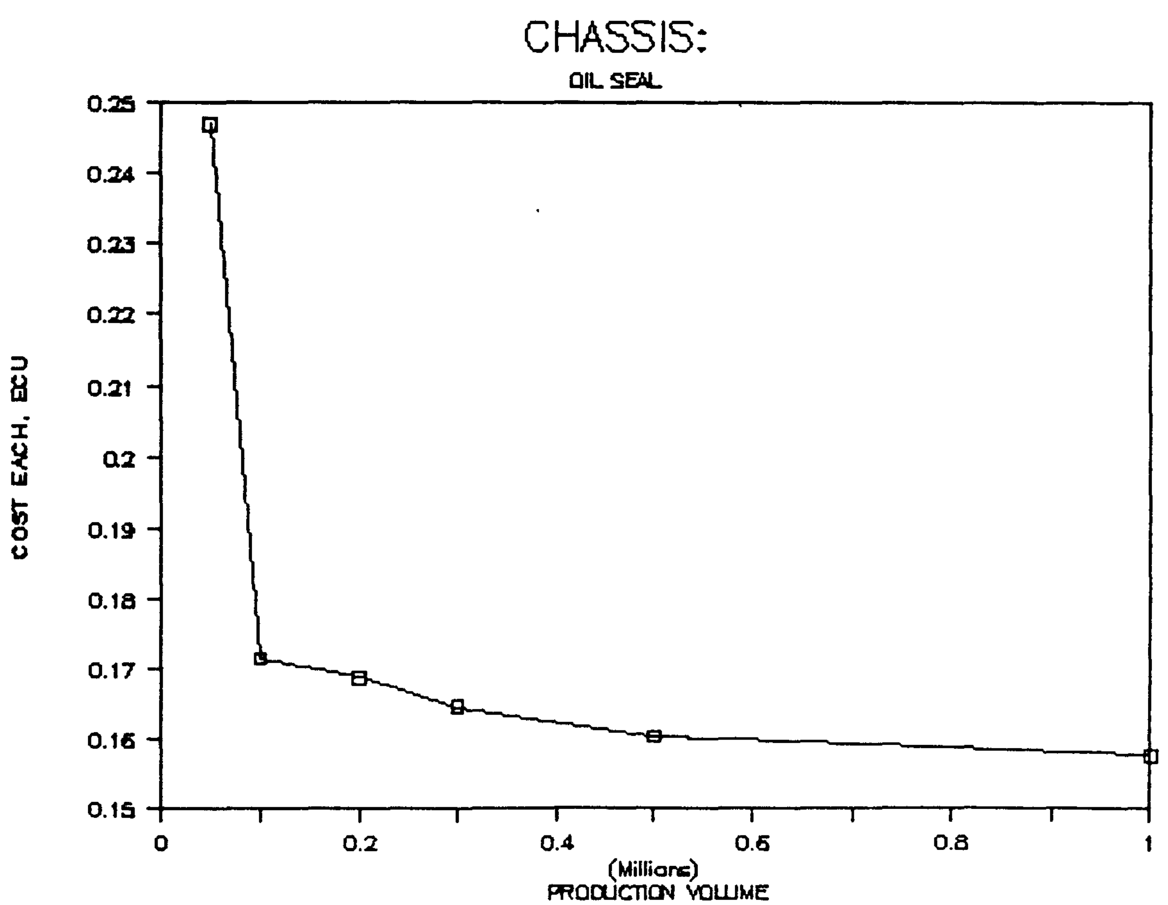
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

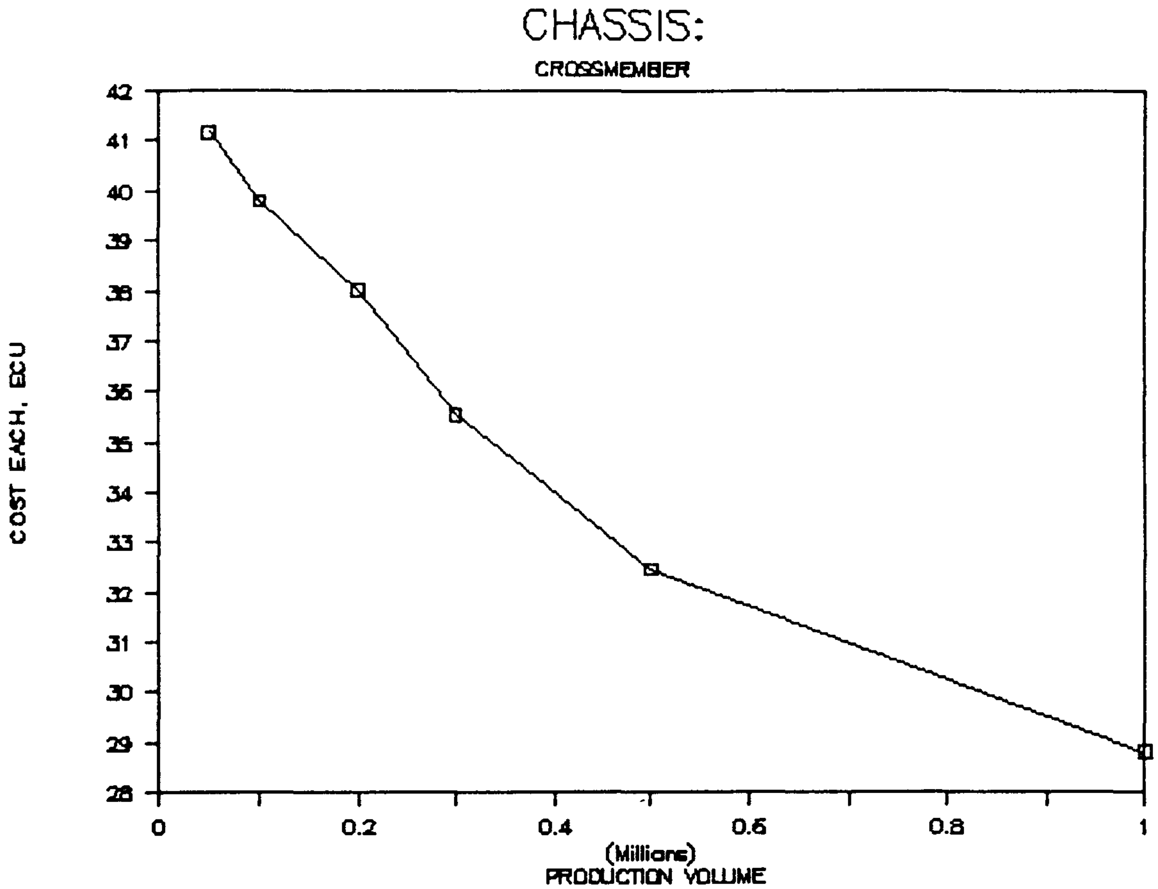

CHASSIS:
FRONT DAMPERS
COST EACH, ECU
27.5
27
26.5
26
25.5
25
24.5
24
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

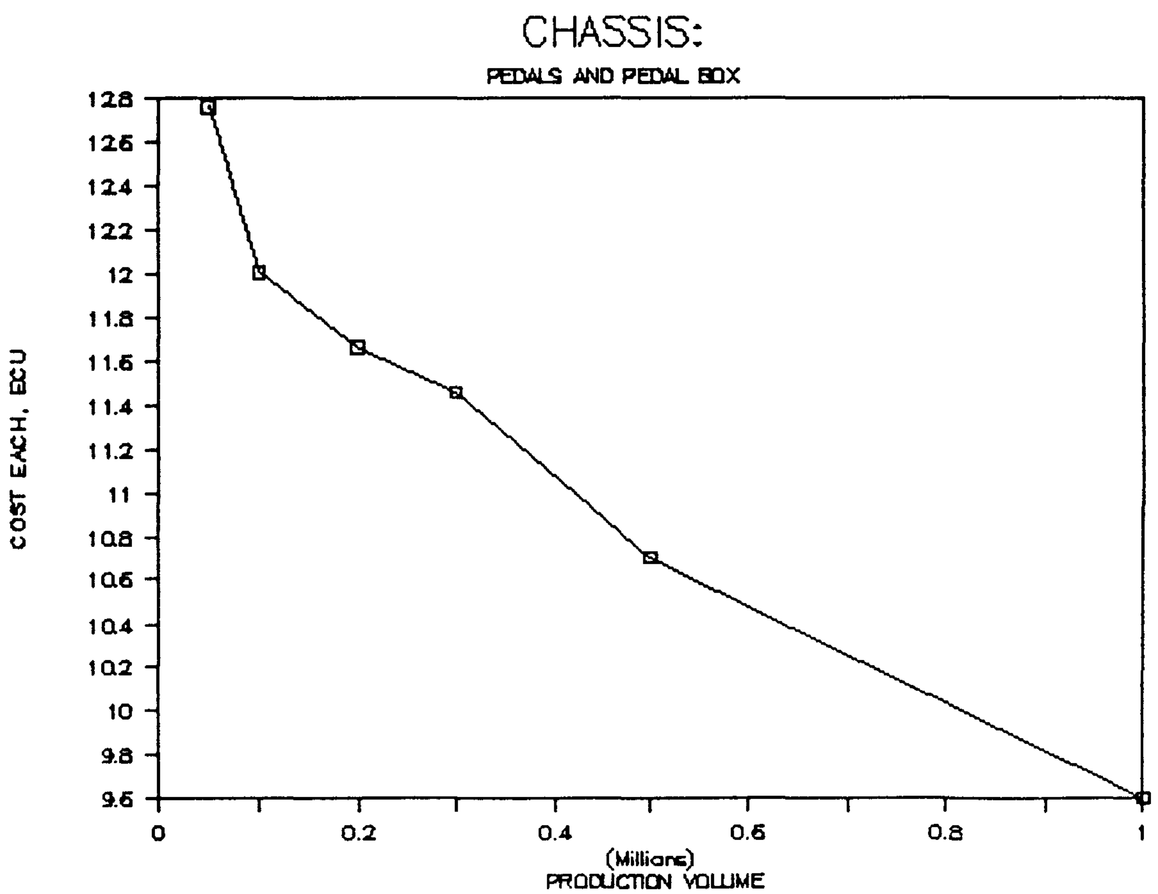

CHASSIS:
BRAKE MASTER CYLINDER
COST EACH, ECU
14.5
14.4
14.3
14.2
14.1
14
13.9
13.8
13.7
13.6
13.5
13.4
13.3
13.2
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

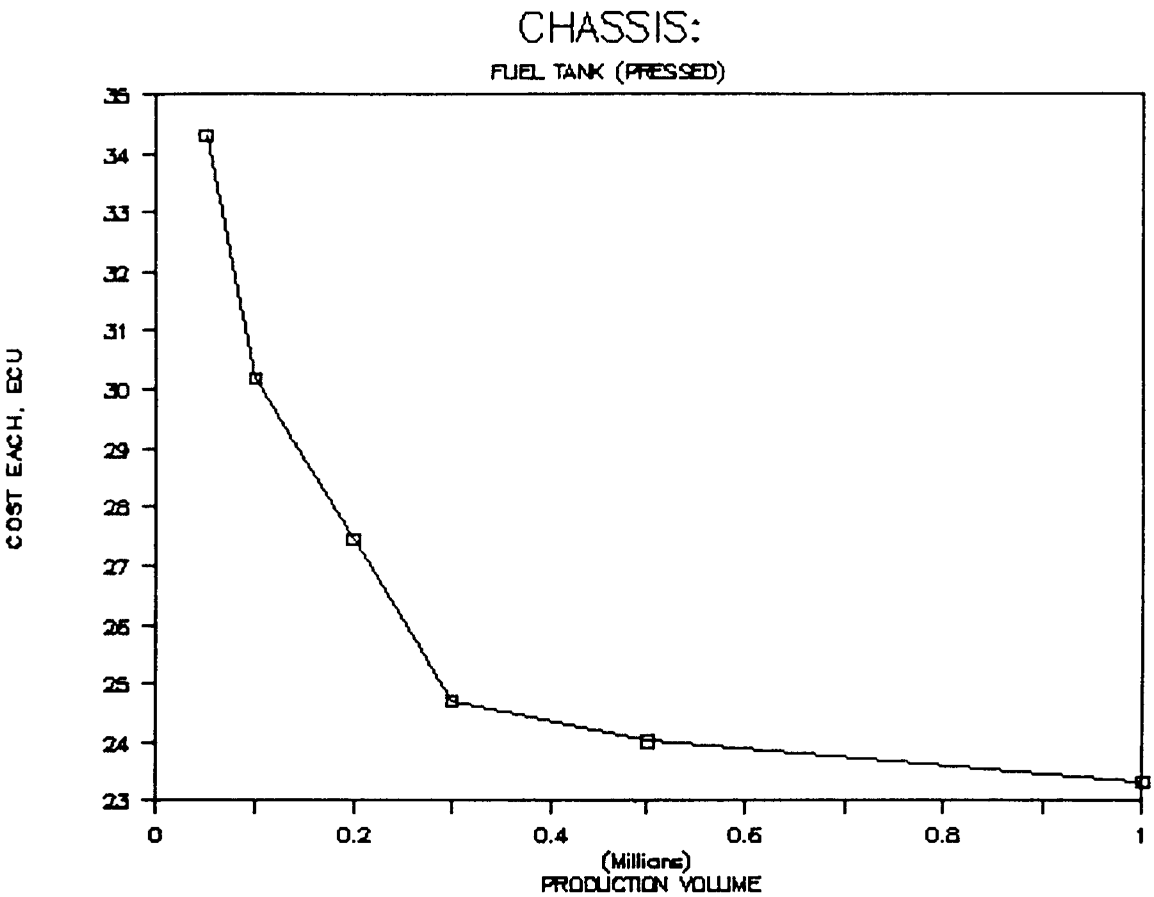

CHASSIS:
BRAKE SERVO
COST EACH, ECU
17.2
17.1
17
16.9
16.8
16.7
16.6
16.5
16.4
16.3
16.2
16.1
16
15.9
15.8
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

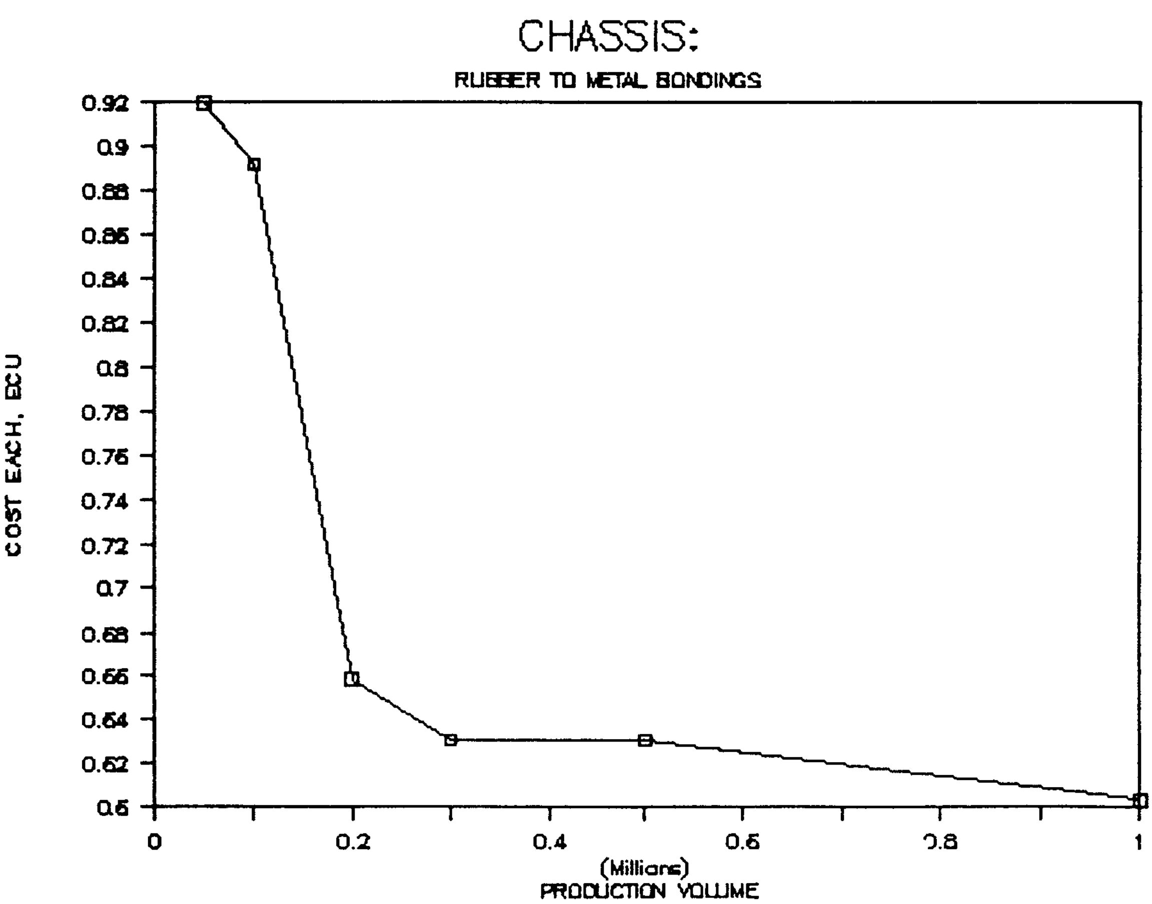

CHASSIS:
DRIVE SHAFTS/CV JOINTS
COST EACH, ECU
90
89
88
87
86
85
84
83
82
81
80
79
78
77
76
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

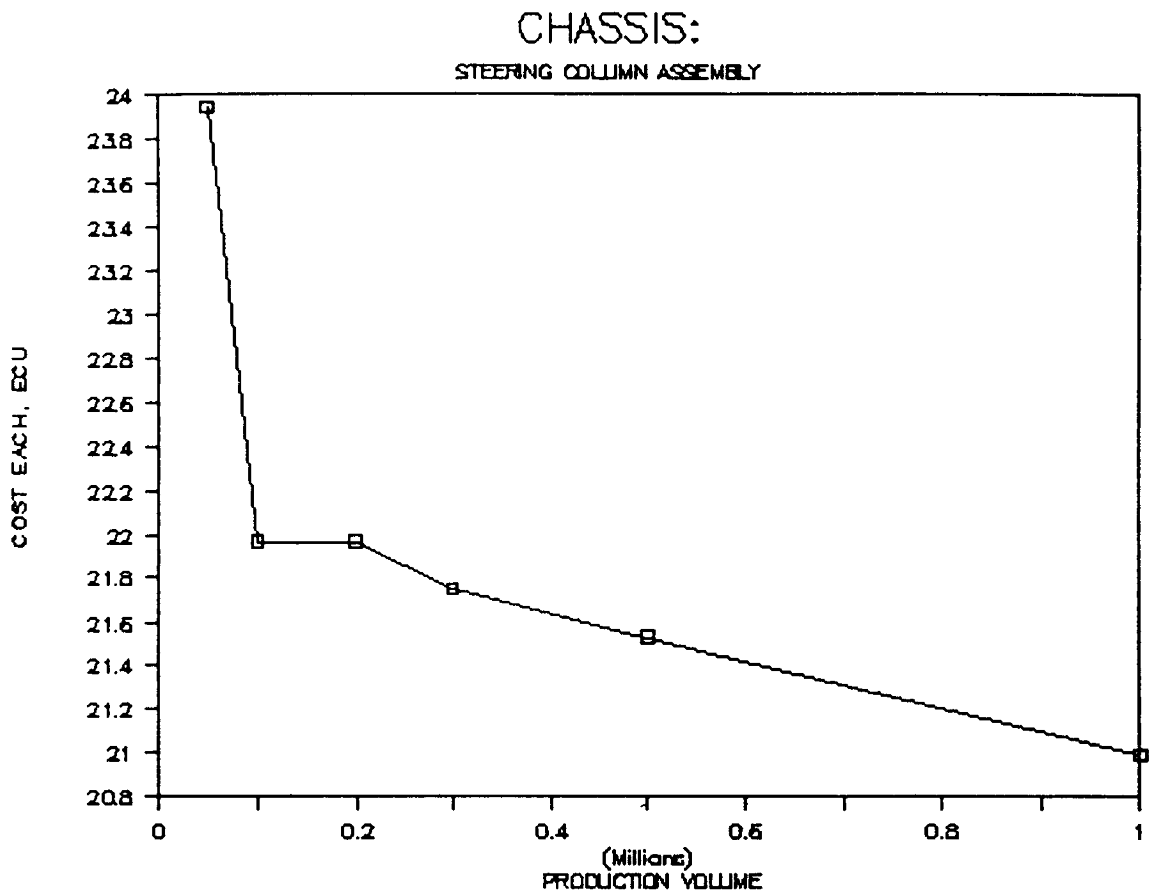

CHASSIS:
OIL SEAL
COST EACH, ECU
0.25
0.24
0.23
0.22
0.21
0.2
0.19
0.18
0.17
0.16
0.15
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

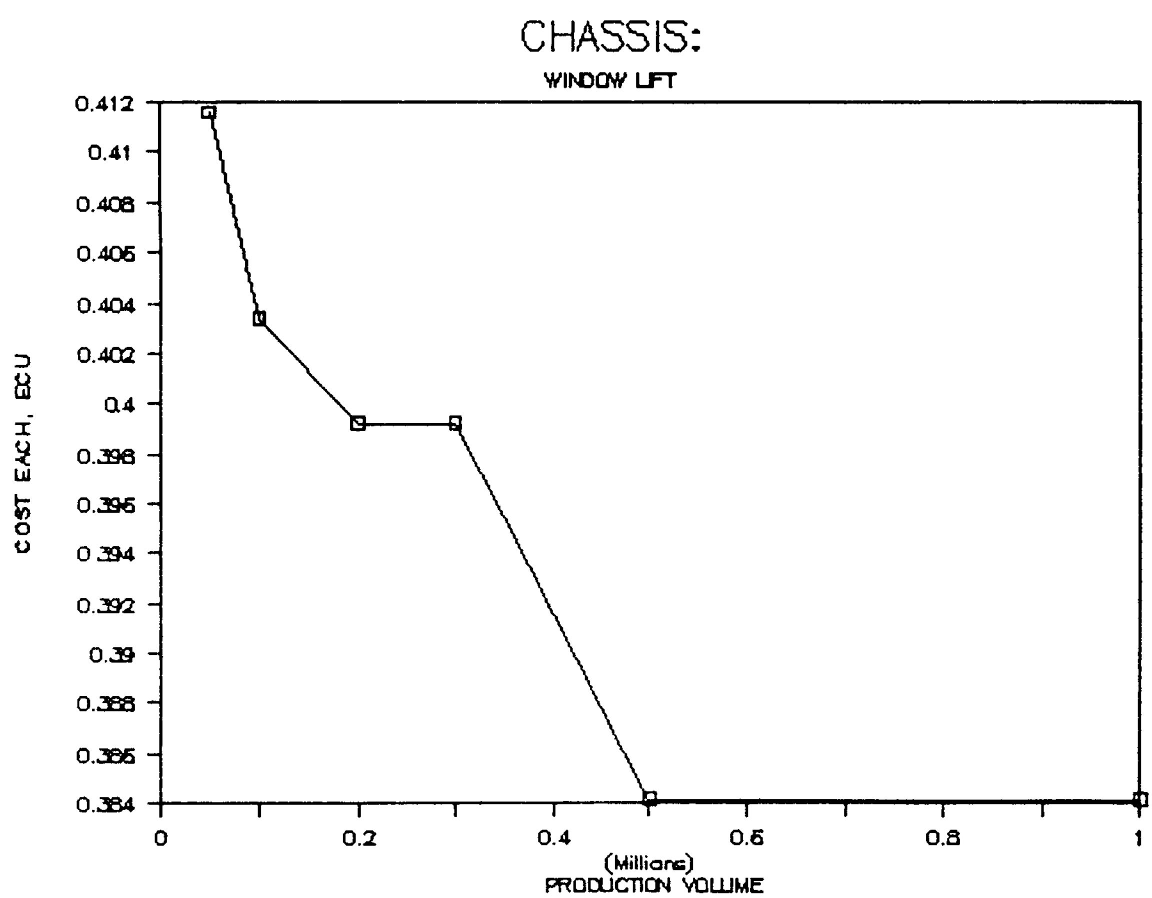

CHASSIS:
CROSSMEMBER
COST EACH, ECU
42
41
40
39
38
37
36
35
34
33
32
31
30
29
28
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME


CHASSIS:
PEDALS AND PEDAL BOX
COST EACH, ECU
12.8
12.6
12.4
12.2
12
11.8
11.6
11.4
11.2
11
10.8
10.6
10.4
10.2
10
9.8
9.6
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME


CHASSIS:
FUEL TANK (PRESSED)
COST EACH, ECU
35
34
33
32
31
30
29
28
27
26
25
24
23
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME


CHASSIS:
RUBBER TO METAL BONDINGS
COST EACH, ECU
0.92
0.9
0.88
0.86
0.84
0.82
0.8
0.78
0.76
0.74
0.72
0.7
0.68
0.66
0.64
0.62
0.6
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME


CHASSIS:
STEERING COLUMN ASSEMBLY
COST EACH, ECU
24
23.8
23.6
23.4
23.2
23
22.8
22.6
22.4
22.2
22
21.8
21.6
21.4
21.2
21
20.8
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME


CHASSIS:
WINDOW LIFT
COST EACH, ECU
0.412
0.41
0.408
0.406
0.404
0.402
0.4
0.398
0.396
0.394
0.392
0.39
0.388
0.386
0.384
0
0.2
0.4
0.6
0.8
1
(Millions)
PRODUCTION VOLUME

Annexe 3

EUROPEAN MARKETING STUDY

Objective

To determine the economic benefits of 'True-Europe' following the adoption of a direct dealer supply relationship incorporating Pan-European Marketing policies, by the EC Automobile producers in supplying to member countries.

Background Assumptions

It is assumed that automobile specifications and prices have been standardised in all member countries, as anticipated earlier in this report. Also the Right Hand Drive design exists for the UK without price penalty, and further that distribution costs from factory to each member country have been rationalised without individual penalty. Similarly European Currency exchange rates are stabilised at current rates and that agreement has been reached to standardsise automobile special tax rates and levels of VAT, or its equivalent.

It is further assumed in the True-Europe of 1992 that EC Automobile manufacturers will be dealing directly in a 2 tier distribution system directly with Retail Dealers/outlets appointed in member countries. Inferring therefore that traditional importers, be they privately owned currently or existing manufacturer owned operations, will have disappeared. Their place will be taken by automobile distribution through direct links with manufacturers and dealers as described, assisted by skeletal member Country Regional offices for local liaison purposes. Centralised Marketing plans and policies will emanate from the Manufacturer assisted by the Regional offices and agencies. Pan-European Marketing strategys will be enforced and advertising material rationalised and campaigns directed by the manufacturer.

Task Parameters

The first task in assessing the cost benefits of True-Europe is to examine all the traditional Marketing actions and costs (where relevant) of an EC produced Automobile in member countries. The Marketing costs reviewed are all those incurred between arrival of Automobiles to the member country, and their eventual retail sale to a Consumer in that country.

We seek to compare all current costs under Non-Europe Marketing conditions with a realistic estimate of True-Europe Marketing costs and quantify the benefits which could be anticipated by EC Automobile Manufacturers.

This study will therefore consider all significant actions and costs of Marketing Brand and Product, Automobile ordering and Stocking, Storage and Distribution, Dealer Operations and Training.

Analysis

Firstly the anticipated True-Europe action of Manufacturers liaising and selling their Automobile products directly to each EC Country Dealer/outlet network will in itself eliminate a very substantial Non-Europe cost... the traditional Automobile importer. Importers be they privately owned or Manufacturer owned have profited and grown fat with the continuing successful growth of EC Automobile Markets. For example today a typical UK Importer in the UK, representing a German franchise, directly employs 1000 people to sell in that market 100,000 Automobiles a year through its 380 strong Dealer network. Profits are high and would be likely to exceed £25,000,000 a year for this sales volume, assisted by income derived from a 6-8% Importer Gross Margin on Automobile sales and a 15-25% Gross Margin on Parts and Accessories.

Direct dealing between Manufacturer and Dealer, with only a skeletal Country Regional Office structure representing the Manufacturer, would release substantial cash sums to assist price support and hence growth through enhanced profitability. Modern Computer data links can provide instant information exchange, and in todays high speed Europe you can in fact travel faster from Paris to London than Durham to London. Cost benefits can confidently be anticipated from True-Europe by this elimination of the traditional 'middle-man' Importer structure, and replacement with Country Regional Office and Manufacturer direct dealing with Sales dealers/outlets in each member Country.

The cost of Non-Europe is also apparent in additional resources and communications costs, due to the information filter effect of the current Importer organisations, and as we will reveal in more detail later, the duplication of similar Marketing programmes and in particular Advertising Campaigns.

Each EC member country houses a number of privately owned profitable Automobile Importers as well as high overhead Manufacturers owned Importer organisations. If we assume a modest improvement, accruing from a True-Europe Manufacturer/Direct Dealer relationship, is a saving of 50% of the Automobile and Parts Gross Margin referred to earlier, this could result in 2.3 bn Ecu being available to EC Automobile Manufacturers.

EXAMPLE - Gross Margin Income recovery (Importers)

1985 EC Manufacturers
Automobile Sales value (Exports) = 45.9 bn Ecu

1985 EC Manufacturers
Auto Components Sales Value (Exports) 7.9 bn Ecu

Note

Assuming 50% saving of traditional EC Importer Gross Margin on Automobiles (6-8%) due to Manufacturer Direct Dealing arrangements, we can therefore anticipate on saving of 3.5% on Automobile Export Sales turnover.

45.9 bn Ecu x 3.5%
= 1.6 bn Ecu

Assuming 50% saving of traditional EC Importer Gross Margin on Parts (15-25%) due to Manufacturer Direct Dealing arrangements, we can therefore anticipate a saving of 10% on Parts Export Sales turnover.

7.9 bn Ecu x 10%
= .79 bn Ecu

Therefore total savings on Automobile and Parts

2.39 bn Ecu

Now taking in chronological order the elements of the Automobile Marketing Mix, we can analyse each separate function under Non-Europe conditions, relate these to the anticipated True-Europe situation, and highlight benefits for Summary later in this report.

a) Automobile Orders and Stocking

Under Non-Europe conditions each Automobile Importer decides his own Automobile Specification and order quantity needs, which may, or may not coincide with the manufacturers production objectives, or for that matter bear any resemblance to his Dealers wishes or even their Customers demand. This Importer 'middle-man' role effectively acts as a filter between true sales demand, as felt at Dealer level, and the Automobile Manufacturers capacity, and production strategy.

It encourages the anomalous situation that up to 30% of registered Imported cars in the UK from one EC Manufacturer, had been transferred internally within the Dealer network, before they reached the natural customer. This confirms not just the inefficiency of the Importers ordering system, in wrongly positioning the vehicle in the first instance, but highlights also unnecessary improvement costs, probably accruing delivery mileage.

The cost of Non-Europe is difficult to quantify in this instance, but this inefficient ordering and despatching system has a second and more quantifiable effect on National Automobile Stock Inventory levels.

stock or orders it independently, the autos are despatched from the Coastal Compound to the Dealer. With the attendant need for haste in either instance and for informity, established contracts exist with Automobile Transporter companies on a National average delivery cost basis. This 1 delivery charge, is traditionally extracted from the Retail Customer at the Point of Sale. Not before however, it has been inflated substantially to add to the Importers already 'swollen' gross margins.

In the United Kingdom where the cost of Nationally distributing Automobiles may be around £50 per unit, for volume Importers, the customer will be charged at least £120 for delivery of the Automobile.

When the advantages of True-Europe materialise, Manufacturers will find that because of the anticipated policy that dealers will pay for their Automobile products in advance at the factory gate, they will also effect Dockside collection. Or alternatively Dealer Groups might engage a Transporter company to effect clearance, collection and desptach on their behalf.

Importantly for the Industry and the customer, the principle of holding vehicle stocks on Importers premises could be eliminated. Dealers would have more commitment to the product, costs would be reduced and the age and condition of vehicles delivered to the customer would improve.

The cost of Non-Europe in this example can be conservatively estimated at .....Ecu (see EXAMPLE) using the 4 major EC Automobile markets and estimating the likely savings with EC Manufacturers from this True-Europe policy.

EXAMPLE - delivery charge Income (Importers)

	UK	France	Germany	Italy
1985 Average Automobile Delivery Charges	£120 (164 Ecu)	" (Ecu)	" (Ecu)	" (Ecu)
True-Europe Estimated Savings on Delivery Charge	£40 (41 Ecu)	" (Ecu)	" (Ecu)	" (Ecu)
1985 EC Produced Imported Automobiles Total by Country (000s)	1832?	1766?	2379?	1664?
Estimated True Europe savings total (All Countries above)				

NOTE

Awaiting figures from Peter Burgess for EURO car delivery charges, and checking of J Browns EC produced vehicle sales figures.

In the current Non-Europe market condition an Importer completes a monthly Automobile stock order conforming to his annual agreement with the Manufacturer. He maintains a considerable investment in a coastal Import and Storage facility and normally holds there 4-6 weeks Automobile Sales stock. Since he pays his Manufacturer at factory despatch point this vehicle stock represents a non inconsiderable monetary investment to him. Additionally in order to lessen the financial effects of his inefficient Automobile order and distribution system he usually continues to finance his Dealers stock for a defined further period. In the UK for example Importers practically without exception are obliged to finance an Automobile Unit stocking plan for their Dealers. This scheme typically extends by a further 28 days their commitment to monetary Interest accuring from their Automobile Stock in the UK.

In the True-Europe scenario it is anticipated that dealers will order and pay directly for their own vehicle stock, direct to the Manufacturer. Although this policy might have the effect of reducing the volume of Automobiles ordered by a Dealer, the supply volume could be maintained by extending the numbers of his franchised Dealer network, by using multi-franchised outlets as predicted. Given this situation the manufacture could elect to offer direct discount incentives with their Dealers, to ease stock problems with certain Automobile products.

A shortening of the EC Automobile Stock Inventory period in Europe by 1 month could save the EC producers as much as 1.15 bn Ecu (see EXAMPLE) over the current system, this sum should be regarded as a most conservative estimate.

EXAMPLE Stocking loan interest (Importers)

1985 EC Manufacturers Automobile
Sales Value (Exports) = 45.9 bn Ecu

Assumptions

1. 1985 Bank Interest rates on typical Importers Stocking loan at 10%

2. Average Automobile stocking period is 3 months (factory to Retail dealer adoption)

Therefore Bank Loan Interest for an average stocking month is 45.9 bn Ecu x 25% (3 months) x 10% (Interest Rate)

= 1.15 bn Ecu

b) Automobile Storage and Distribution

Most EC Importers in member countries currently own their Coastal Automobile Storage compounds. This policy stems from a wish to control their own activities directly and of course 'screen' their own Automobile stock build up problems. This action ties up capital unecessarily and increases automobile movement costs and stock maintenance charges. When a Dealer is topped up with

c) Dealer Operations

This function covers all areas of contact with Dealers such as, communication of Importers policies, recording Sales Progress, force feeding Automobile stock etc. In addition they are required to search for and follow up New Dealer prospects. Thus the burden of communication with Dealers on all subjects is the responsibility of the Dealer Operations Field Force.

Since the established EC Importers all insist on 'Solus' franchise policies for their dealers and this conflicts with the Markets needs, there is a correspondingly regular turnover of new Dealer appointments. In any typical year of operation an EC franchise can expect to lose 10% of its Dealer network by outlet volume.

This is inefficient and taking a more market tolerant approach by allowing multi-franchise Dealer network development would have the added benefit of meeting more closely Dealers and Retail Customers needs. In our consumer age customers want choice when buying a high value item, but the current system denies this, unless they are prepared to travel and shop around.

With the removal of the traditional Importer a great deal of the communication task will diminish and accordingly the numbers of Field force personnel can be expected to decline.

In True-Europe conditions, a Dealer Operations activity will dominate the Manufacturers Regional Office function, but it will be necessarily scaled down to suit the revised communication task. It is worth repeating here of how the accuracy of a message passed on, varies in proportion to the numbers of people relaying it. So it can be safely assumed that a True-Europe benefit will be that Dealers and customers will receive more directly and accurately any messages from Manufacturers. Since we are dealing here with people principally and the function of Dealer Operations will remain in True-Europe. I shall not quantify savings. But savings there will undoubtedly be, from greater efficiency of communication as well as revisions of headcount levels of Operational and Office back-up Staff.

d) Training

Another obvious aspect of traditional importers in Non-Europe is the observed growth of their Training Departments.

There are Management, Sales, and after Sales Training acivities all within house and employing costly teaching staff and resources. Training is of course an essential activity, and given the turnover of Franchised Dealer outlets a year described earlier a continous need exists. However, what is often underestimated is the Dealers Staff turnover element particularly on the Retail Sales side which often passes unnoticed.

The advantage True-Europe structures bring, will be the direct link from manufacturer to Dealer Staff. Programmes will be more directly communicated and Training materials and Staff Costs will then become more cost effective. Training activities are also invariably Profit Centres to the Non-Europe Importer, and so further cost savings in True-Europe are predictable.

Within the economies of scale anticipated, and given a common language, or languages system we would anticipate cost effective use of Interactive Video disc techniques becoming cost justifiable. This system is impressive in its Training potential, being truly 'interactive' man to machine this reducing costly training course attendance time. Although expensive its effectiveness was amply demonstrated by the UK manufacturer Jaguar, for their International Training requirements of the new XJ series.

Thus training costs could be reduced in True-Europe but we prefer to think the efficiency and service in this vital area would be more likely improved, to the benefit of the Euro Consumer.

e) Marketing

The costs of Marketing European produced Automobiles in Non-Europe today is a most significant element in an Importers costs. For even the smallest European producers we are talking of Millions of Ecu expenditure in most EC countries.

Automobile Marketing monies are traditionally broadly spent on:

Advertising (National, Regional or local
Television/Radio/Newspapers
Magazines or Posters etc)

Product/Brand literature	(Catologues/Brochures/Leaflets Price lists/Stickers Dealer Communications etc)
Promotional Costs	(Exhibits/Motor Shows/Conferences (Sponsorship/Films/Videos /Giveaways etc)
Public Relations	(Literature/Entertainment/Travel/Press Fleet etc)

In Non-Europe it is traditional for Importers in member countries to produce advertising campaigns independent of the manufacturers. Few Manufacturers attempt to produce Pan-European advertising material and fewer still insist on its use. Yet production costs for Television Commercials or Advertisements account for 10% of the total media Budget spent, in most countries, a not inconsiderable investment. Importers claim the case for specialised advertising for their national needs to maintain image and awareness, and certainly the smaller manufacturers continually need to communicate their message regularly to the consumer.

However in True-Europe with the demise of traditional Importers and their Budgets, the opportunity arises to centrally produce advertising material using a European wide Advertising Agency to gain also maximum media buying cost effectiveness. This policy closely followed, will create lasting European Images with messages building in strength, thanks to Pan-European exposure.

Product literature is however most often Manufacturer produced on a Pan-European basis so True-Europe savings will be necessarily limited. Remaining literature defined, is often country specific, and correspondingly no great savings can be estimated in True-Europe.

Similarly Promotional activities use a mixture of existing factory produced films and Video material, whilst the events themselves are often country specific. An exception is the European Motor Show Circuit, but materials and stand construction for this is normally manufacturer supported and reused at later events in the calendar.

Public relations so not offer any significant savings in True-Europe since manufacturers and Importers currently collaborate closely to re-inforce product and Brand messages. In True-Europe there will still be the need for individual EC Country local PR representation, guided, as now, from the manufacturer at the centre.

Briefly summarising the Marketing Costs for Non and True Europe it is evident that the most significant and definable cost savings could come from the adoption of genuine Pan-European Advertising programmes in True-Europe.

One could predict savings in Media spend levels accruing from the True-Europe policy of extending Dealer networks/outlets following multi franchising and also the closer examination by the manufacturer of the advertising proposals of the new country Regional Offices and Agencies.

One could assume therefore a direct saving of all EC European production costs in this area in the order of....Ecu (See EXAMPLE) since it is apparent that material is produced currently usually for the manufacturers Home Market and the small Importers Internationally located.

EXAMPLE Advertising Production Costs (Importers)

1985 UK Advertising Spend
by EC Manufacturers (inc TV. Radio and
all printed National Media = £123,859,000 =
169.902,600 Ecu

Since National Media spend figures are not collected for other EC Countries. We could conservatively assume as UK represents 20% by Value of 1985 EC Automobile Retail Sales that the remaining countries would yield similar production costs.

Hence if UK advertising production spend = 16,990,260 Ecu

then EC.Production Spend is 84,951,300 Ecu.
Let us select 50% of this figure as a likely saving, this amounts to 42,475,650 Ecu

NOTE

Hold for 1985 figures outstanding from Germany France and Italy.

Conclusions

From this Marketing section of the report we can anticipate True-Europe savings by the EC Automobile producers in supplying their member countries in the order of .....bn Ecu (See EXAMPLE)

EXAMPLE

Gross Margin Income recovery	2.39 bn Ecu
Stocking Loan Interest	1.15 bn Ecu
Delivery Income	.... Ecu
Advertising Production Costs	.... Ecu
Total Marketing/Distribution Savings Estimate	.... Ecu

Annexe 4

COMPANY RESPONSES

TO

EC92 QUESTIONNAIRE

VOLKSWAGEN

VOLKSWAGEN AG Postfach 3180 Wolfsburg 1

Ludvigsen Associates Limited
Attn. Mr. Cohen
105/106 New Bond Street

London W1Y 9LG

Great Britain

Ihre Zeichen	Ihre Nachricht vom	Unsere Zeichen	Unser Hausapparat	Datum
	25.08.87	1884/2-Gi-ne Foreign Legal Dept.	2 24 36	21.12.87

Dear Mr. Cohen,

enclosed, please, find our answers to your questionnaire. Unfortunately we had not been able to response to all of your questions in the required form, because VWAG as a company that is doing business worldwide is not always affected by problems that only exist in Germany and/or the EC, e.g. RHD-vehicles are not only sold in GB, but also in Japan and Australia.

A few questions have to remain unreplied because we are not involved in that kind of problems that form the subject of those questions.

We are sorry for a certain delay in corresponding to your questionnaire but we had to compile the incoming answers from the different departments within our house; we do hope, however, that the answers are even today of assistance for your study.

If you have any more questions, please, feel free to contact us.

Best wishes for Christmas and a Happy New Year.

Yours faithfully,

i. V.

H. Giebel

Encl.

QUESTIONNAIRE

1. Specific Equipment Costs

The currently-experienced add-on costs of specific equipment items can provide a useful guide to the benefits that will result when regulations are conformed throughout the EC. Please provide the cost to the consumer of the following items:

A. The dim/dip lighting provision in the UK:

DM 55,--

B. Side repeater flashers in the UK and Italy:

DM 59,-- (in "True Europe" this is required anyway)

C. Third central rear brake light as required in the US and as being discussed for the UK:

DM 60,--

D. Yellow headlamps for France:

DM 28,--

E. Special windscreens for Italy:

not applicable for VW,
otherwise : DM 24,--

F. Other or others judged to be of interest:

seatbelts

Please qualify as needed according to model lines and markets in which prices are applicable.

2. Emissions Workload Staffing

The establishment of uniform EC emissions rules, on the basis of the 'Luxembourg Compromise', will clarify the position as far as the EC is concerned. Separate emissions rules are in effect now, and may still remain in effect, for EFTA countries. Guidance is requested on the relevant personnel and facility requirements.

A. Please provide information on the numbers of people who are currently working specifically on the meeting of emissions standards, according to the following table. Please include all personnel so involved, including those in national sales companies and/or national distributors:

	For the EC market alone:	In addition for EFTA:
design/engineering	30 p.a.	.....
engine/car testing	8 p.a.	.....
homologation	2 p.a.	6 (incl. Audi)
legal affairs	1 p.a.	.....
purchasing	-	.....
manufacturing /quality ensurance	1 p.a.	
government liaison	0,5 p.a.	.....
sales/marketing	29 p.a.	14 p.a.
other	-	.....
TOTAL	71,5 p.a.	20 p.a.

B. Please indicate the percentage reduction in personnel that you foresee as being possible and/or likely when the 'Luxembourg Compromise' rules take effect for the EC. Show either in overall terms or against each of the personnel categories shown above.

not evaluable

C. Certain of the activities required to implement emissions rules have substantial facilities requirements. Please list below the three activities that have the largest such requirements in your company and show the percentage reduction in their size that will be possible with the implementation of the 'Luxembourg Compromise'.

activity	percentage reduction
1.	1.
2.	2.
3.	3.

3. Type Approval Workload Staffing

The establishment of Whole Vehicle Type Approval for the EC will lead to the simplification of the activities needed to gain homologation to safety and equipment standards. Separate technical and equipment requirements are in effect now, and may still remain in effect, for EFTA countries. Guidance is requested on the relevant personnel and facility requirements.

A. Please provide information on the numbers of people who are currently working specifically on the meeting of safety and equipment standards, according to the following table. Please include all personnel so involved, including those in national sales companies and/or national distributors:

For the EC market alone:		In addition for EFTA:	
design/engineering	.....	.....	no significant differences concerning safety between EEC and EFTA
validation testing	.....	.....	
homologation	.....	.....	
legal affairs	.....	.....	
purchasing	.....	.....	
manufacturing	.....	.....	
government liaison	.....	.....	
sales/marketing	.....	.....	
other	.....	.....	
TOTAL	.....	.....	

B. Please indicate the percentage reduction in personnel that you foresee as being possible and/or likely when Whole Vehicle Type Approval to a single consistent set of standards takes effect in the EC. Show either in overall terms or against each of the personnel categories shown above.

no reduction in personnel

C. Certain of the activities required to implement safety and equipment standards have substantial facilities requirements. Please list below the three activities that have the largest such requirements in your company and show the percentage reduction in their size that will be possible with the implementation of Whole Vehicle Type Approval.

activity	percentage reduction
1.	1.
2.	2.
3.	3.

4. Impact of Complexity

A. Though it may be desirable to offer a power train variant in a national market, your firm may have a rule of thumb for the annual level of volume below which it is not economically feasible to offer such a variant in a given single market. Please indicate the typical threshold volume or range of volume:

individual decision subject to economy

B. Conflicting technical requirements within the EC will limit your marketing flexibility by preventing you from filling a demand in one country with cars that were initially shipped to another country. This situation will cease in True-Europe. Please indicate the degree to which this problem now exists and provide a guideline to the cost penalty that it currently causes:

- not applicable; for the time being not relevant for VW
- vehicles are manufactured according to specifications required
- steady stream of sales / no cost penalty

5. The Right-Hand-Drive Issue in the UK

A. Please state the percentage share of the vehicles you produce for EC sale that have right-hand drive:

16 % (UK)

B. If you judge that the design and production of RHD models incurs an incremental cost, please state the percentage of the average per-vehicle cost increment that you experience:

no variable surplus costs, because other RHD-countries are supplied; complexity costs

C. In the view of your company, should the UK change over to left-hand steering and driving on the right?

no coment (a change-over contains advantages and disadvantages)

What would be the principal cost benefit to the industry and to the car buyer of such a changeover, in your view?

complexity cost would be reduced

6. European Market Data

Inconsistencies of reporting from one EC country to another require companies to have their own staffs for the timely gathering and interpretation of Community sales and production data.

Please state the size of the staff that your company maintains in order to carry out the gathering and interpretation of European market data:

no particularly identifyable staff

7. Personnel Accommodation

Differing residence requirements and national paperwork needs within the EC continue to make it difficult for EC residents to move from one Community country to another to work in the same company. Motor companies provide special staffs to deal with these problems.

Please state the size of the staff at your company that is engaged in dealing with the problems of EC residents (both white- and blue-collar workers) moving from country to country:

no effects

8. Differing Engineering Standards

Vehicle design and engineering are made more costly in the EC by differences between member countries in the technical standards of design and research methods themselves: incompatibility of computer systems, differing test standards, communications problems, etc.

Please indicate the three types of differences in this respect that your company judges to be the most cost-incurring. Please also state the percentage by which you estimate that each type of difference increases your cost of research, design and/or engineering.

type of difference	percentage increase
1.	1.
2. no significant differences	2.
3.	3.

Please provide any other comments that you consider relevant concerning the problems caused in the design and development phase by the remaining barriers of all kinds in the EC internal market.

see answer to no. 1

9. Just-In-Time (JIT) Sourcing

Auto makers in the EC have lowered costs through the reduction of inventories and the speeding of parts deliveries from suppliers. Nevertheless the remaining internal barriers in the EC pose obstacles to the successful achievement of JIT sourcing on a pan-European basis.

Please state the three types of EC internal barriers that you find most obstructive to successful JIT sourcing. Please also state the percentage impact you estimate that each such barrier imposes negatively on your JIT sourcing efforts.

type of barrier	percentage impact
1.	1.
2. ________	2. ________
3.	3.

Please provide any other comments you may have on the achievement and/or difficulty of JIT sourcing in the Community motor industry.

Will the ODETTE programme provide assistance in JIT sourcing? When will it take full effect and what will the nature of its impact be?

10. Company Customs Staffing

Like others that have transborder sourcing activities in the EC, your company has a staff of personnel engaged in facilitating customs and VAT inspections at borders or at receiving sites, linked with the associated road, rail, water or air transport systems.

Please advise the number of people throughout your company who are engaged in carrying out this activity.

no person engaged solely in this activity

P150
23JUL87

INTERVIEW WITH LOTUS

Questionnaire

1. SPECIFIC EQUIPMENT COSTS

A. DIM DIP LIGHTING IN UK

Development cost is main cost: 4 -- 5 weeks of staff time. Cannot be measured exactly as there are 2 people working on it. Disruption is the main cost element, say 1 hour per day extra needed over 4 -- 5 weeks, over and above existing requirements for developing lighting systems. One has to multiply development cost by number of cars.

Material on-cost £15 per car.

B. SIDE REPEATER FLASHER

Now a standard feature: NO extra cost.

C. CENTRAL REAR BRAKE LIGHT

Tooling cost	--	£10,000
Material on-cost	--	£20 per car
Labour cost	--	marginal extra cost

D. YELLOW HEADLAMPS

This is not regarded as an on-cost. Nowadays it is only a question of changing the bulb.

E. SPECIAL WINDSCREENS FOR ITALY

Do not sell cars to Italy. No idea of cost.

F. OTHERS

They have an existing extra cost in number plate series and fixings. If this could be standardised/legislated, it would save about 10% on the cost of bumpers by simplifying types required. E.g. for the Italian or Swiss markets a special moulding was required.

For each item which is modified, they have to calculate an "engineering release cost" of £300 -- £400 per item. For all variations of equipment (100 + per model), they have to budget this, i.e. total cost of modifications to meet their market requirements -- £40,000.

G. WIRING LOOMS

The amount of variations result in substantial extra costs. If wiring looms could be standardised, it would save say £25 per car. They still need, say a minimum 5 different looms, so they cannot rationalise fully -- count ¼% saving on car price if less looms variations exist.

2. EMISSIONS WORKLOAD STAFFING

A. STAFFING

Design/enginering	--	4 employees
Engine/car testing	--	1 employee
Homologation/legal	--	1 employee
Emissions related projects	--	6 employees
Maintenance	--	4 employees

The above shows that there are not many savings achievable. There will always be 10 staff working on development, and 6 staff on specific emissions related projects.

There are no savings possible on travelling/air freighting, since any staff who are involved in liaison with overseas locations would need to do so anyway, since the basic requirements still require some travelling. Main work is in homologation.

Development costs are the largest cost element. Labour/materials/R&D/homologation costs.
To develop a car, count £15 million divided by number of cars = £1,000 per car development cost.
If one could rationalise variants of model, which are forced on them by legislation, up to 10% savings could result.

The cost of legislation = £5,000 to £50,000 per component. Overall, it may cost LOTUS £40,000 to £50,000 to get compliance on emissions per model.

Savings are most likely to be a reduced workload, rather than reduced staffing levels. One has to count, say, 1 hour per day less work per man, on issues, which just reduces the overall pressure to manageable level.

3. TYPE APPROVAL WORKLOAD STAFFING

Most car producers, especially Germans, base regulations on precedents. There may be a safety problem, it is taken up by a learned body and control is introduced, industry wide.

LOTUS, in contrast, is led by legislation. They react to specific legislation. They cannot afford to preempt legislation due to lower level of funds.

LOTUS have a low output volume, hence they leave less R&D expenditure. They do not have a large R&D innovation but pay as and when required only. This means they do not produce 'CONCEPT' cars, so their development costs tend to be lower proportionately.

New model development = £20 million.

* Type approval: act of getting type approval is a substantial cost.
  4 staff required to process documentation.
* The cost of real differences is specification, caused by legislation.
* The cost of prototypes to present to each market for type approval.

In a True Europe situation, LOTUS could reduce staff by 1 engineer and 1 technician (or transfer to another part of the company), i.e. reduce staff by 50% who are involved in type approval.

A larger firm may have 20 staff on this and could save more on headcount.

The cost of legislation is <u>higher</u> for a small volume producer.
Large producers can <u>build</u> in the legislation standards into their cars.

For type approval they must build 1 of each variant: they have 5 variants.
Acel: manual/auto Esprit: carb/turbo/EU&USA, LHD&RHD.
This a minimum, which they cannot avoid.

Type approval cost:

£5,000 -- £ 50,000 depending on market x 4 variants.
For UK -- £200,000 (4 x 50,000)
For Belgium -- £80,000 (4 x 20,000)
For Ireland, France, W Germany, Luxemburg, Portugal, Spain, Sweden (9 countries in total), each £20,000 cost per variant.

Cost = 5 cars x £50,000 per car.
+ ferry + 2 people + subsistence + 1 trip for 5 cars = £5,000 total.

4. IMPACT OF COMPLEXITY

If you calculate £15 million for Development, add £5 million for US legislation.

This figure excludes engine and gearbox development.

Add on 5% to meet EEC specifications.

Add on 5% to meet other European specifications (S, CH, A, SF, N etc).

In a True Europe situation they would still export to USA and would still require 2 variants for Europe, hence development costs cannot be saved, but a clearer brief results.

Fewer variants, i.e. instead of LHD/RHD or 2 European specifications, they could save 10 - 20% on develpment and engineering costs overall.

5. RHD ISSUE IN UK

The cost of RHD/LHD is built in: The actual number of components affected are not large and do not add a large cost. The costing is anyway not critical as the incremental cost is averaged out over the production run and 'disappears' in the total cost.

They would always need to have LHD (USA) and RHD (Japan, UK etc) variants, even if UK were to change to LHD, there are other important RHD markets.

Having said that, extra cost = bulkhead, steering gear, dashboard. A large part is bought in: volumes bought in are e.g. 50% RHD, 50% LHD. If it were only LHD, saving on these component overall may only reach 10% for higher volume. They would still source from e.g. 2 suppliers, so volumes could not be increased much.

6. MARKET DATA

The 4 staff who are involved in documentation and writing specifications for each market, would have less to do in True Europe -- maybe 50% saving in this area too.

France requires Technical Translation; Canada requires French ones - but ignored.

7. PERSONNEL ACCOMODATION

They have staff who do car testing (tyre approval) in USA. These people would need to travel regardless of European situation. No savings envisaged in this area.

8. DIFFERING ENGINEERING STANDARDS

Main cost is type approval.

9. JUST IN TIME SOURCING

Just in time sourcing is not important. The speed of sourcing is less important than the quality. Of course if a UK supplier is slow, they may prefer sourcing from abroad, which means building up their inventory. At present they source mainly from UK and have an uninterrupted flow of parts for OEM -- whether their site warehouse is half full or quarter full is irrelevant.

What is more important is the reduction in the inventory of parts held by LOTUS and the whole dealer network, in terms of reducing the total number of piece parts.

LOTUS try to get 'off the shelf' parts from component suppliers, hence they have less 'cost' than other producers in this area, but they could save more, by reducing variations -- maybe 10-20% savings could result in total inventory cost, but this is only a small part overall of total vehicle cost.

10. COMPANY CUSTOMS STAFFING

They spend £50,000 per annum on agents fees for Europe at present. This would either disappear, or reduce substantially.

OTHER COMMENTS

Savings which could result from a True Europe situation are:

	Material Cost	
Savings on / model	5%	(less than £500)
Savings on / inventory	1%	
Savings on / assembly	3%	
Savings on / wiring looms	0.5%	

5% savings achievable on a £10,000 car.

They outsource a large proportion of their production, so they have big savings.
They only do body and assembly.

LOTUS produce 200 cars in 4 months.

Largest savings are in buying in.

Larger producers have lower proportion of in house labour) save 5% on labour

Larger producers have higher tooling costs) cost 5% on tooling per car

Larger producers have higher material costs) add 5% on material cost

LOTUS tooling cost is low due to outsourcing -- cost is built in to final price.

LOTUS is in a position where they can price cars to absorb all costs.

FINAL PRICING

LOTUS distributor margin	--	10%
LOTUS dealer margin	--	20%
LOTUS distribution costs	--	£150 per car for Sweden -- £100
LOTUS transport cost	--	£300 fixed price (part of final price)

LOTUS 150 cars sold into Europe -- £100,000 marketing budget for shows, brochure and media advertising i.e. £100,000 divided by 150 or £666 per car. This is unavoidable.

They have a problem in Belgium in terms of margin price fixing by government -- but this only applies to firms who publish price lists. So LOTUS do not publish a price list and are exempt.

Cost of exporting to Sweden -- £80,000.
Cost of exporting to Italy -- £50,000. Just type approved cars are priced in sterling.
For Europe, ex factory cost + £300 added.
W Germany is the exception -- invoicing is in DM -- any gains on exchange rate are put straight back into business, e.g. bank interest on dealer stock is subsidised by LOTUS (or 3 months + dealer advertising costs subsidised).

LOTUS get around distribution cost element by piggy backing on existing dealer network. It takes 2 years before dealer ship pays off. So dealer needs to be well established.

Mercedes and Porche have standard 'world car' specification, i.e. although they have many engine and trim variants, the emissions/type approval specification is the same worldwide. This reduces the overall cost -- but this is irrelevant at the prices/profits these producers make.

RECEIVED 2 2 OCT 1987

ROVER GROUP

19th October 1987

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Telephone: 0895 51177
Telex: 263654

Mr D Cohen
Project Co-ordinator
Ludvigsen Associates Limited
105/106 New Bond Street
London W1Y 9LG

Dear Mr Cohen,

I am very sorry that circumstances made it impossible for us to respond to your questionnaire within your deadline. I am also very conscious that your own target date for completion of the study has probably passed.

However, since we are now able to make an albeit limited response, I thought you should have the benefit of it, even if its use is now limited to helping you verify the conclusions which you may have already made.

I have to say that we had considerable difficulty with the questions seeking information on the specific numbers of people in the various functional areas and we have not provided quantified answers to these questions. I trust the reasons will be evident from our comments.

That aside, the following are our comments on the points raised in the questionnaire.

1. SPECIFIC EQUIPMENT COSTS

For the most part, the "cost to the consumer" of any specific item of equipment, unless it is an option offered to the customer at a specific price, is absorbed within the overall price of the product. This certainly applies to components which have to be fitted in response to legislative requirements. However, the price of the product does not necessarily move in response to component (and other) cost pressures alone, but reacts also to competitive pricing in the market. This may mean that the manufacturer has to absorb at least some of the cost involved.

Given this, we would estimate that the price effect on the consumer of the items you specify to be as follows:

A. Dim-Dip Lighting in the UK

The price effect averages approximately £10.00 per vehicle.

B. Side Repeater Flashers in the UK and Italy (also Denmark)

The company now standardises the fitment of side-repeater flashers in all its cars, whatever the destination.

The customer price effect of fitting this item averages approximately £10.00 per vehicle.

C. Third Central Rear Brake Light

The price effect for the United States market is approximately £15.00 per vehicle. (This does not take into account revisions to the rear parcel shelf should this be necessary). We would expect this price effect to be reduced if UK volume were added to the more limited (in our case) US sales. The price could reduce further, if it became an EC requirement. In this case, of course, the effect of harmonisation would be to increase the price for all car buyers, since we would be fitting an item of equipment not otherwise provided.

D. Yellow Headlamps for France

This requires the fitment of bulbs with yellow glass, the incremental price effect of which is marginal.

E. Special Windscreens for Italy

In addition to Italy, we note that Eire, Denmark and France also require the fitment of laminated screens.

Austin Rover has now standardised the fitment of laminated windscreens in all its models, since it is considered that this is a marketable feature. Many, but not all manufacturers have done the same.

We estimate the incremental price effect of a laminated over a toughened glass screen to be about £25.00.

F. <u>Other Items</u>

Other unique national requirements within the EEC include:

- labelling or stamping the engine block with the engine manufacturer's name (Italy);
- a minimum ground clearance requirement (Italy);
- separate headlamps fusing (Italy);
- separate tail-lamp fusing (Germany);
- head restraint fitment (Denmark)

If Austin Rover's reaction to certain of these requirements is typical, where the volume is high and/or the requirement a marketable or technically desirable feature, there is a tendency to standardise its fitment. However, there are other unique national requirements (such as dim-dip in the UK and the Italian requirements regarding engine- block marking and ground clearance) which are not likely to fall into this category and represent an additional development and cost burden which ultimately falls on the consumers in those markets.

2. EMISSIONS WORKLOAD STAFFING

Question B makes the premise that implementation of the Luxembourg compromise will reduce the emissions workload on manufacturers. Our view is that it has <u>increased</u> the workload:

- the compromise envisages the application of three technological solutions to exhaust emission control, depending in engine capacity;
- it is not certain that all EC countries will adopt it (given the Danish and Greek positions);
- it is not certain that those EC countries that do adopt it will do so at the same time. Indeed, the strong possibility is that they will not. For example, Germany, and the Netherlands are considered certain to adopt the Luxembourg package at the earliest possible date, while the UK Government maintains its opposition to the adoption of standards requiring three-way catalysts, which apply to over 2 litre cars;

- where the Directive is not adopted, ECE 15.04 will continue to apply, but engines will still have to comply with the Directive on unleaded fuel;

- incentives have already been applied by Germany and Netherlands to promote the adoption of cars meeting more stringent standards in advance of directive dates;

- the second stage small car standards are likely to affect the technology which is satisfactory for meeting first stage standards etc.

As a result, demands an emissions development facilities will increase, not reduce.

Question A presumes it is possible to separate headcount employed for EC emissions from those employed on EFTA emissions work. It is our experience that emissions development work is a function of engine family rather than market. However, work relevant to the US market obviously carries over to other territories having similar standards. We do not feel able to give a quantified answer as to the headcount involved in the various functions.

3. TYPE APPROVAL WORKLOAD STAFFING

In general, it is not feasible to separate the engineering of legislative requirements into a vehicle from the basic engineering design of a vehicle, and not normally realistic to separate this by market. The need for the end product to comply with legislative requirements will be an inherent part of the engineering task rather than a separate exercise. For instance, if it is known that a car will be sold in markets where an exhaust catalyst is required, then the floor pan of that model will be so designed as to accommodate a catalyst. We would not design and manufacture two floor pans, particularly since, in this example, very expensive body tooling is involved.

However, this is not intended to imply that Whole Vehicle Type Approval is not desirable and would not reduce costs and workload. Instead of having to present cars for type approval to varying national authorities, with varying standards and requirements, a consistent set of standards and one type approval evaluation would represent a significant saving of time and money. We might, for instance, require only five examples of a car for type approval purposes whereas the need to proceed in parallel with individual national authorities might require six times that number at present. Since these would all be early production cars, they could cost considerably more than normal (- perhaps double). Similarly, there would be a comparable reduction in contacts with national authorities, but this would not have significant headcount implications.

However, while we are very supportive of EEC Whole Vehicle Type Approval, we do not want to see the option of seeking national approvals abandoned. Gaining EEC wide approval is an expensive business involving, for instance, crash testing of cars. For low volume models not intended for EEC-wide sale this could be a prohibitive cost.

Therefore, some form of easier national route is needed (which should not be an opportunity for Member States to reimpose unique national standards), otherwise EEC Whole Vehicle Type Approval will produce an economic barrier to trade.

4. IMPACT OF COMPLEXITY

A. There is no typical threshold volume, as it all depends on circumstances. Whether it is worthwhile, for example, offering an automatic derivative in a certain market where we have previously supplied only manual versions of the particular model, depends on incremental costs, volumes achieveable, margins etc., all of which vary between markets and models. In some cases small volumes (perhaps only tens per annum) can be justified yet in others, hundreds or thousands will be required.

B. We do occasionally get an overstock problem in markets that have a unique derivative of a particular model, but it is usually possible to sell it somewhere else relatively quickly. This does impose a cost, but it is almost impossible to quantify with any precision since the answer is dependent on the specific circumstances of each case.

It is, perhaps, worth noting that the varying national application of the Luxembourg standards has the potential to make this problem greater than it now is.

5. RIGHT HAND DRIVE IN THE UK

A. About 70%.

B. In our case, it is LHD vehicle which are not the norm. Incremental cost is marginal.

C. We do not advocate the UK changing from RHD to LHD. Cost benefits to both industry and car buyers will be negligible, while the cost and disruptive effects on the UK economy would be enormous.

6. EUROPEAN MARKET DATA

Our staff are employed primarily on analysis of data and the same number would be required irrespective of data inconsistencies.

7. PERSONNEL ACCOMMODATION

This is not a significant issue for Austin Rover but would, we suspect, be more relevant for multi-national companies with major production and staff operations in more than one Member State.

8. DIFFERING ENGINEERING STANDARDS

Again, we believe this is more relevant to multi-national companies; otherwise, our comments in sections 1, 2 and 3 apply.

9. JUST IN TIME SOURCING

Rover Group sources the bulk of its production materials from UK sources, so that internal EC barriers referred to do not affect the business to any significant degree. To the extent that we do procure components from other EC countries the geographic separate of UK by the Channel is likely to have a greater impact.

With respect to Odette, the standardisation of messages and the ability to transmit these electronically will certainly help with JIT sourcing within UK and with our suppliers in other Member States. However, Odette's contribution, while valuable, will remain secondary in JIT sourcing to the physical task of inventory control.

10. COMPANY CUSTOMS STAFFING

Normally, dealing with intra EEC movement would either be handled as part of an individuals role in a sales company, or agents would be employed. Any estimate of the net numbers involved would be fairly subjective.

Once again, our apologies for the delayed response and the difficulty we have had in addressing some of the questions in the manner required. I hope nevertheless that this belated reply will still be of some value in your studies.

Yours sincerely,

D. Lindley

D C LINDLEY

General Motors Europe
Passenger Cars

RECEIVED - 9 NOV 1987

November 6, 1987

Mr. K.E. Ludvigsen MSAE
Managing Director
Ludvigsen Associates Limited
105/106 New Bond Street
London W1Y 9LG
England

Dear Mr. Ludvigsen,

Attached you will find GM Europe's response to your questionnaire dealing with the economic benefit to the automobile industry of a true European internal market.

We apologize for the delay but we were not able to start our collecting of information before mid-August. We hope that you will find our response helpful for your study for which we wish you the best success. Certainly, we would be highly interested in receiving the results of your work as soon as it will be finalized.

Sincerely yours,

Rudolf Beger

cc. Mr. H.W. Gäb

ATTACHMENT

QUESTIONNAIRE

Q.1. **Specific Equipment Costs**

The currently-experienced add-on costs of specific equipment items can provide a useful guide to the benefits that will result when regulations are conformed throughout the EC. Please provide the cost to the consumer of the following items:

Q.1.A. The dim/dip lighting provision in the UK:

A.1.A. £ 8.00

Q.1.B. Side repeater flashers in the UK and Italy:

A.1.B. £ 3.00

Q.1.C. Third central rear brake light as required in the US and as being discussed for the UK:

A.1.C. Not discussed for the UK

Q.1.D. Yellow headlamps for France:

A.1.D. --

Q.1.E. Special windscreens for Italy:

A.1.E. --

Q.1.F. Other or others judged to be of interest:

A.1.F. --

Q.2. **Emissions Workload Staffing**

The establishment of uniform EC emissions rules, on the basis of the "Luxembourg Compromise", will clarify the position as far as the EC is concerned. Separate emissions rules are in effect now, and may still remain in effect, for EFTA countries. Guidance is requested on the relevant personnel and facility requirements.

Q.2.A. Please provide information on the numbers of people who are currently working specifically on the meeting of emission standards, according to the following table. Please include all personnel so involved, including those in national sales companies and/or national distributors:

A.2.A.

	For the EC market alone	In addition for EFTA
Design/engineering	3,5	3,5
Engine/car testing	25,0	12,0
Homologation	8,0	2,0
Legal affairs	1,0	1,0
Purchasing		
Manufacturing		
Government liaison	2,0	1,0
Sales/marketing		
Other		
TOTAL	39,5	19,5

Q.2.B. Please indicate the percentage reduction in personnel that you foresee as being possible and/or likely when the "Luxembourg Compromise" rules take effect for the EC. Show either in overall terms or against each of the personnel categories shown above.

A.2.B. No reduction expected.

Q.2.C. Certain of the activities required to implement emissions rules have substantial facilities requirements. Please list below the three activities that have the largest such requirments in your company and show the percentage reduction in their size that will be possible with the implementation of the "Luxembourg Compromise".

A.2.C.

Activity	Percentage reduction
1. Exhaust emission	1.
2. Engine	2.
3. Proving ground facilities	3. no reduction possible
4. CO + RPM adjustment	4.
5. Check of electronical components or assembly line diagnostic link check-out equipment	5.
6. Duration of role test	6.

The UK (Vauxhall) indicated an extra £ 1.0 million cost for all plants if regulation would be introduced.

Q.3. <u>Type Approval Workload Staffing</u>

The establishment of Whole Vehicle Type Approval for the EC will lead to the simplification of the activities needed to gain homologation to safety and equipment standards. Separate technical and equipment requirements are in effect now, and may still remain in effect, for EFTA countries. Guidance is requested on the relevant personnel and facility requirements.

Q.3.A. Please provide information on the numbers of people who are currently working specifically on the meeting of safety and equipment standards, according to the following table. Please include all personnel so involved, including those in national sales companies and/or national distributors:

A.3.A.

	For the EC market alone:	In addition for EFTA:	
Design/engineering			
Validation/testing	20,5	2,0	(Opel only)
Homologation	28,5	2,0	(Opel only)
Legal affairs	3,0	3,0	(Opel only)
Purchasing			
Manufacturing	2,0		
Government liaison	2,2	1,0	(Opel only)
Sales/marketing			
Other (mix of above)	28,0		
TOTAL	84,2	6,0	

Q.3.B. Please indicate the percentage reduction in personnel that you foresee as being possible and/or likely when Whole Vehicle Type Approval to a single consistent set of standards takes effect in the EC. Show either in overall terms or against each of the personnel categories shown above.

A.3.B. 15% reduction expected.

Q.3.C. Certain of the activities required to implement safety and equipment standards have substantial facilities requirements. Please list below the three activities that have the largest such requirements in your company and show the percentage reduction in their size that will be possible with the implementation of Whole Vehicle Type Approval.

A.3.C.

Activity	Percentage reduction
1. Emission testing	1. No reduction expected/
2. Safety testing	2. or change would have
3. Proving grounds	3. no quantifiable effect

Q.4. <u>Impact of Complexity</u>

Q.4.A. Though it may be desirable to offer a power train variant in a national market, your firm may have a rule of thumb for the annual level of volume below which it is not economically feasible to offer such a variant in a given single market. Please indicate the typical threshold volume or range of volume:

A.4.A. There is no general "rule of thumb" for the annual volume. The situation in the respective markets is different: There may be a market, in which no minimum volume exists because of specific reasons, whereas in another market in which a certain minimum volume is required.

Besides the profit potential in the market, the level of volume is determined by the cost to

- modify an existing power train variant to specific market requirements, e.g. exhaust emission standards, taxable engine output
- derive a new displacement size not available in other markets.

In the European market the first category is prevailing, but cost for modification may vary significantly. Thus no rule of thumb really exists.

The second category is of little or no importance, however, here again the cost of modification determines the volume level.

In addition to the profit potential and cost of modification the availability of engineering resources may limit engine offers for a specific national market, thus only a limited number of variants is offered.

Q.4.B. Conflicting technical requirements within the EC will limit your marketing flexibility by preventing you from filling a demand in one country with cars that were initially shipped to another country. This situation will cease in True-Europe. Please indicate the degree to which this problem now exists and provide a guideline to the cost penalty that it currently causes:

A.4.B. All Opel AG (question not applicable to Vauxhall) vehicle allocations to EC and non-EC member states are based on individual monthly sales forecasts/inventory status reports. Thus, GM was successful avoiding unnecessary transfers of units. Newly developed electronic sales systems (which are expected to be operational within the next 3-5 years will even more facilitate precise product movement and minimize the problem. Consequence: No cost reduction effect seen, as far as Opel AG is concerned. A substantial (but unspecified) cost advantage is seen, however, in the area of Product Engineering and materials supply.

Depending on the individual legal situation in the respective EC Member State, special options may be required on cars sold, which do not belong to the standard equipment. The extra cost penalty for such special equipment may be about DM 100.-- per vehicle.

. Vehicles originally ordered for countries where only "clean" engines are permitted, will not find clients in Belgium as long as no price or tax advantages are given or existing emission regulations remain unchanged.

Q.5. <u>The Right-Hand-Drive Issue in the UK</u>

Q.5.A. Please state the percentage share of the vehicles you produce for EC sale that have right-hand drive:

		1986
A.5.A.	Opel AG (Federal Republic of Germany)	23,8 %
	Vauxhall (UK)	98 %
	Belgium	5,7 %
	France	5,0 %

Q.5.B. If you judge that the design and production of RHD model incurs an incremental cost, please state the percentage of the average per-vehicle cost increment that you experience:

A.5.B. Opel AG (Federal Republic of Germany): 0,3 %
(reflecting the increment of RHD versus LHD cost as an average for all model lines weighted on a basis of the total of LHD and RHD vehicles).

Vauxhall (UK) not applicable

Belgium 4,3 %
(for assembly)

France 3,0 %

Q.5.C. In the view of your company, should the UK change over to left-hand steering and driving on the right?

What would be the principal cost benefit to the industry and to the car buyer of such a changeover, in your view?

A.5.C. At present UK manufacturer has an advantage over imports whereas the cost penalties in the FRG, Belgium and France seem to indicate an incentive for a UK change to left-hand steering and right-hand driving.

Deproliferation of models, improved production efficiency, reduced total costs, rationalization of after market and stocks.

Q.6. European Market Data

Inconsistencies of reporting from one EC country to another require companies to have their own staffs for the timely gathering and interpretation of Community sales and production data.

Please state the size of the staff that your company maintains in order to carry out the gathering and interpretation of European market data:

A.6. Statistics of automobile production, sales and registrations are produced and distributed differently and inconsistently in the individual EC countries.

This hampers our job of analyzing the international automotive business in three ways:

1) The degree of details is different. Some countries e.g. provide detailed engine information, whereas others only show the displacement (no horsepower). In this case we have to prepare estimates, which usually are rather rough, to get a European-wide pricture.

2) The coding systems and distribution media are inconsistent. Some countries e.g. provide printed reports, others magnetic tapes. The various coding systems have to be converted individually into a uniform internal one, which fits best in our analyses needs.

3) Not-unified legal requirements and tax structure cause different reactions of the buying public and require specific analyses by country.

In GM's European Sales Analysis Department we spend in total about 2000 hours a year to harmonize the different European statistics and to analyse repercussions of the individual legal regulations.

This means we employ practically two specialists (plus one in Spain) due to the not-unfied European market.

Q.7. <u>Personnel Accommodation</u>

Differing residence requirements and national paperwork needs within the EC continue to make it difficult for EC residents to move from one Community country to another to work in the same company. Motor companies provide special staffs to deal with these problems.

Please state the size of the staff at your company that is engaged in dealing with the problems of EC residents (both white- and blue collar workers) moving from country to country:

A.7. + 5 employees

Q.8. <u>Differing Engineering Standards</u>

Vehicle design and engineering are made more costly in the EC by differences between member countries in the technical standards of design and research methods themselves: incompatibility of computer systems, differing test standards, communications problems, etc.

Please indicate the three types of differences in this respect that your company judges to be the most cost-incurring. Please also state the percentage by which you estimate that each type of difference increases your cost of research, design and/or engineering.

A.8.

Type of difference	Percentage increase
1. Emissions	1. } not quantifiable
2. Weight/dimensions	2. }
3. Right-hand drive	3. 15 - 20 %

For France: (Special case because of important component manufacturing share in this country)

1. Extrapolate LHD product designs for RHD	20 %
2. Duplicate certain prototype and production tools/test equipments	30 %
3. Validate RHD models	15 %

Q.9. Just-In-Time (JIT) Sourcing

Auto makers in the EC have lowered cost through the reduction of inventories and the speeding of parts deliveries from suppliers. Nevertheless the remaining internal barriers in the EC pose obstacles to the successful achievement of JIT sourcing on a pan-European basis.

Please state the three types of ECC internal barriers that you find most obstructive to successful JIT sourcing. Please also state the percentage impact you estimate that each such barrier imposes negatively on your JIT sourcing efforts.

A.9.

Type of barrier	Percentage impact
1. Customs clearance	1. 40 %
2. Electronic data exchange	2. 30 %
3. International trucking licences	3. 30 %
4. Distance from User Operations	4. 60 %
5. Local freight regulations	5. 15 %
6. Development of documents (Ideal JIT situation would exclude document production/ transmission of information on pre-determined timing basis and C.T.C. ("Computer to Computer)	6. 10 %
7. Differnt regulation/standards in the EC means proliferation of parts. Restrictions for road transport during weekends and holidays are different in EC member states.	7. 7 %

Q.9 cont'd. Will the ODETTE programme provide assistance in JIT sourcing? When will it take full effect and what will the nature of its impact be?

A.9. cont'd. ODETTE will provide assistance in JIT sourcing. GM expects its full positive effects by 1988 (reduced paperwork, mailing, data entry into terminals and more balanced inventory, standardized C.T.C. on line exchange of data, speeding up supplies - reduced leadtimes - and more reliable scheduling.

Q.10. Company Customs Staffing

Like others that have transborder sourcing activities in the EC, your company has a staff of personnel engaged in facilitating customs and VAT inspections at borders or at receiving sites, linked with the associated road, rail, water or air transport systems.

Please advise the number of people throughout your company who are engaged in carrying out this activity.

A.10. For transborder sourcing activities in the EC in total 57.5 employees are engaged in related import/export activities.

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