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Estimating the New Automotive Value Chain

A Study Prepared for Accenture

November 2002

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Altarum Institute

CAR
CENTER FOR AUTOMOTIVE RESEARCH
ENERGY, ENVIRONMENT, & TRANSPORTATION DIVISION OF ALTARUM

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TABLE OF CONTENTS

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LIST OF FIGURES

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LIST OF TABLES

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STUDY INTRODUCTION

The automotive value chain is comprised of one of the largest sets of interconnected markets in the U.S. economy. We define the automotive value chain as the accumulated value produced by companies that sell components, materials and light vehicles to consumers, businesses and governments each year in the United States, and the services and after-sale products purchased each year by individuals and businesses to maintain and operate light vehicles in the United States. The sum value of the automotive value chain is much larger than the typical estimate of the annual net output produced by the U.S. automotive industry that is tracked by the Bureau of Economic Analysis (BEA) of the U.S. Department of Commerce.[1] In contrast to the BEA estimate, which is restricted to the measurement of the value of U.S. automotive production and new vehicle dealerships each year, our measurement of the automotive value chain includes the value of all of the light vehicle production sold each year in the United States, and the after-sale products and services connected to the operation of light vehicles in the country.

The year 2001 is an especially useful point in time for an examination and forecast of change in the automotive value chain. Recently, the non-U.S., international motor vehicle firms have once again expanded their U.S. share of the light vehicle market — a process that first began in the 1970s. The 1990s saw a historic shift in the share of North American automotive production from U.S. locations to Mexico and Canada, although U.S. vehicle production still reached a historic record in 1999 and 2000. The decade also saw an epochal shift of the production of parts and components from the internal, captive parts divisions of the traditional vehicle producers to the independent supplier sector (including the spin-off of the Visteon and Delphi parts divisions of Ford and General Motors respectively). Finally, motor vehicle users have increased their miles of travel per vehicle to record levels, and the life expectancy of the average vehicle has now reached a record number of years. These last two changes have resulted in a strong expansion of after-sale markets within the total automotive value chain.

In this study, we show a strong $900 billion total U.S. automotive value chain growing to an eventual size of $1.2 trillion in 2010. Yet this value chain, which constitutes over 10 percent of the U.S. economy, and much more of the private sector of the economy, appears to generate surprisingly little in the way of consistent net earnings for many of the companies involved. Why such a large and growing portion of the private sector economy produces such a small return for the value produced is a major question for the researchers involved in this study, and for many investors and managers in the industry today.

The major objectives of our study of the automotive value chain are to describe and estimate change in the automotive value chain in 1990–2000, and to forecast growth and change in the value chain in the 2000–2010 period. The purpose of our research is to provide the most essential strategic information regarding the automotive value chain to automotive executives and companies that are seeking to maximize the value of their business through adaptation to change in automotive markets.

Our study is divided into two parts. In the first part of the study, the Economics and Business Group of CAR presents an empirical overview of the scope and elements of the U.S. automotive value chain in the 1990–2000 period and a forecast of the size and elements of the value change through 2010. CAR's sources of economic information are data provided by various departments of the U.S. government, industry data from public sources, and data assembled from a special survey of motor vehicle assembly firms carried out by CAR's Forecast Group.

The Forecast Group of CAR carried out the majority of the second part of this study. The Forecast Group focuses on the component market chare of the automotive value chain. They forecast the relative growth of these component markets through 2010 through the use of a technology forecast and with the use of results from a special set of interviews of major supplier executives. This allows the Forecast Group and their Accenture colleagues to make a set of practical, strategic recommendations to major supplier companies on the positioning of automotive value of their firms for change in the first decade of the twenty-first century.

PART 1 — THE MACRO VALUE CHAIN

1.1 GROWTH IN THE VALUE OF THE U.S. LIGHT VEHICLE SALES MARKET

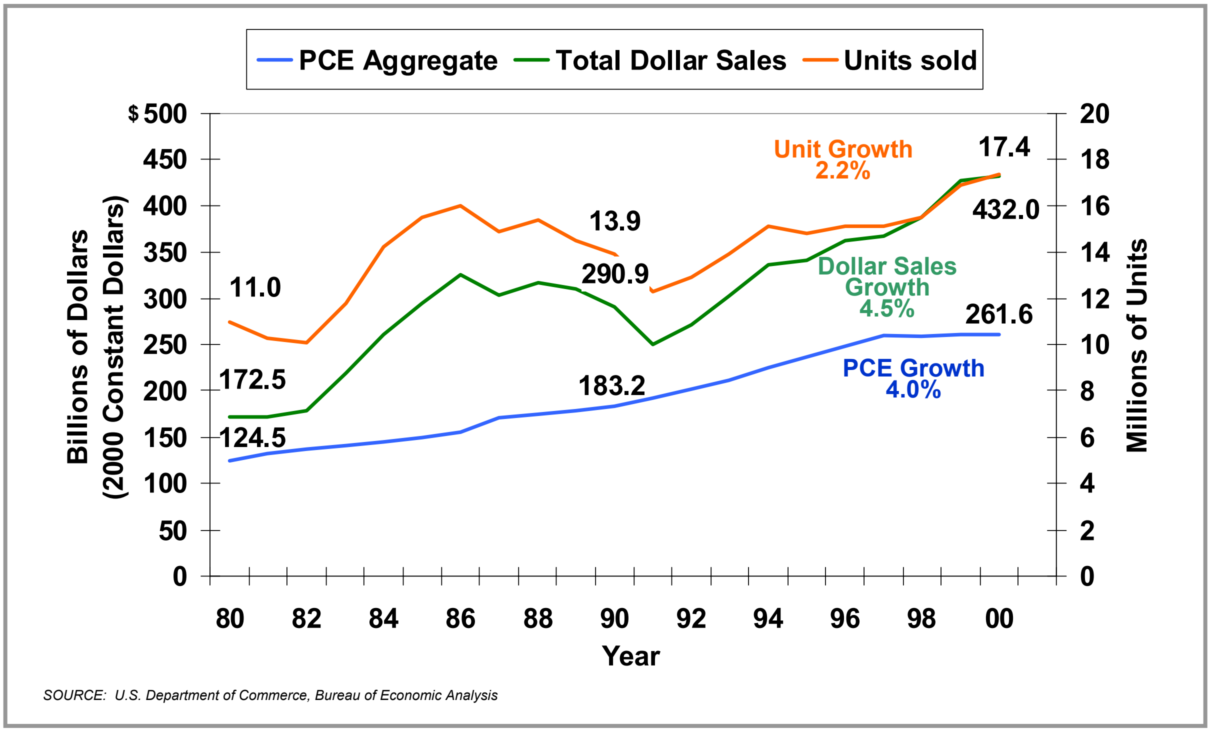
The U.S. automotive market is the largest automotive market in the world. As such, this market has been the subject of great attention in terms of estimating the intrinsic value of the U.S. and much of the world's automotive industry. However, for most of its one hundred year history, both business and government have tracked the U.S. automotive market and its related industries in terms of unit sales of vehicles. This focus on the sales cycle and growth of unit production or sales, unfortunately, has often overlooked changes in the value of sales as measured in current or constant U.S. dollars. In Figure 1.1, for example, we expand our discussion of the problem of valuation by showing three different versions of the growth of the U.S. market for light vehicles.

The growth of light vehicle sales in the United States during 1980–2000 has been impressive. As shown in Figure 1.1, the sales levels of 17.0 million and 17.4 million vehicle sales in 1999 and 2000, respectively, were record highs for the U.S. market, breaking the previous record of about 16.2 million set in 1986[2]. Unit sales of light vehicles grew at an average annual rate of 2.2 percent during 1980–2000, although this growth rate falls to about 0.6 percent per year if we use 1978 as the base year for the period.[3] The second type of growth in U.S. light vehicle sales shown in Figure 1.1 is constant dollar sales[4] of vehicles as reported by the National Automobile Dealers Association (NADA). These constant dollar sales include amounts received from individual consumers, businesses, and governments. The constant dollar value of vehicle sales grew by 150 percent during 1980–2000, or almost three times the total percentage growth for vehicle units. Constant dollar vehicle sales grew at an average annual rate of about 4.5 percent during 1980–2000, approximately twice the percentage growth rate of unit vehicle sales.

The third type of vehicle sales growth in Figure 1.1 is personal consumption expenditures (PCE) on light vehicles as measured by the BEA and the U.S. Bureau of the Census (BOC).[5] Three types of automotive vehicle PCE are identified for this study: purchases of vehicles by individual consumers, dollars of spending on vehicle leases (not including finance costs), and personal consumption spending on the rental of new vehicles. It is now a fact that consumer purchases of vehicles have fallen to about 50 percent of total NADA dollar sales.[6] The rest of NADA sales, of course, are to businesses that lease vehicles to consumers, corporate fleet buyers, rental car companies, and government buyers. Even so, the constant dollar value of total consumer spending on new light vehicles grew by 110 percent between 1980 and 2000, at an average annual growth rate of about 4.0 percent.[7]

Which measure of the value of U.S. light vehicle sales should be used to forecast the future growth of the automotive value chain? It is a strong assumption by CAR that the last measure of automotive value, constant dollars of aggregate PCE on new light vehicles, is the best predictor of future growth in the value change. This must be so since the major area of sales not included in PCE sales, the residual value of vehicle purchases by businesses for the purpose of leasing to consumers is actually driven by net PCE spending on leasing. In fact, it can be argued that much of the business purchases by rental car companies is also driven by PCE spending on such rentals. This 1980–2000 constant dollar growth rate of 4.0 percent for PCE spending on vehicles is applied to constant dollar NADA sales to drive our value chain forecast for 2010. Unit sales of light vehicles, however, will be largely ignored in our study. The old pattern of focusing on unit sales must be seen as increasingly irrelevant for value estimation in an era where vehicles are becoming increasingly multi-purpose and ever longer in life.

Figure 1.1
US New Light Vehicle Market: PCE[8], Total Dollar Sales, Annual Units Sold[9]



1.2 THE UPSTREAM VALUE CHAIN OF U.S. AUTOMOTIVE INDUSTRY AND MARKET: 1990–2000

Our measurement and forecast of the U.S. automotive value chain starts in mid-stream with the constant dollar value of NADA sales to consumers, business, and governments. We proceed upstream from this value through its major components of distribution costs and the value of vehicle shipments from vehicle firms located in the U.S., Canada, Mexico, Japan, Korea, and Western Europe. We then move further upstream to divide manufactured vehicle value into that produced by the assembly, administrative, and styling functions of the vehicle manufacturing firms, and value produced by the captive and independent component manufacturing sectors as well as other types of suppliers. Finally we append to NADA sales value the downstream value of after-sale services and products in a later section of this first part of our study.

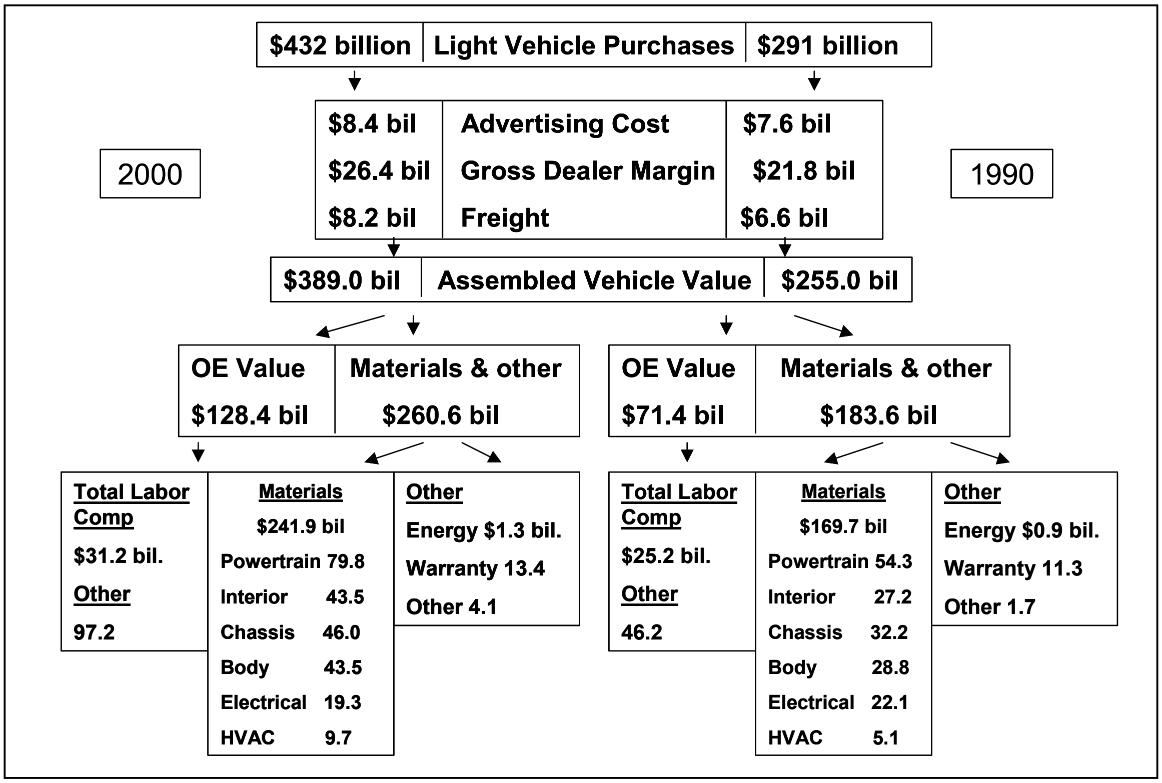
Our first measurement of the upstream components of the U.S. automotive value chain is an historical analysis of the elements of the chain in 1990 and 2000. This breakout is shown in Table 1.1. A brief set of definitions of the elements of this table is contained in the following description:

The Elements of Upstream Value: 1990–2000

1. Light Vehicle Purchases:	NADA estimates of the dollar value of sales in 2000 dollars (CPI-U, all items).
A. Distribution Costs:	
2. Advertising Cost:	Actual U.S. advertising costs for vehicle manufacturers (only) in *Advertising Age*.
3. Gross Dealer Margin:	Actual gross dealer margin reported by NADA annual report. Represents the monetary difference between what dealers pay to manufacturers for vehicles and what dealers receive from vehicle buyers at retail.
4. Freight Cost:	Freight cost estimate from CAR, based on unit sales.
B. Manufacturing and Administrative Costs:	
5. Assembled Vehicle Value:	The NADA light vehicle purchases value netted for the distribution costs listed in 2. through 4. above (sometimes called value of manufacturer's shipments).
6. Original Equipment (OE) Value:	The percentage of assembled vehicle value produced by vehicle firms in the areas of administration, final vehicle assembly, marketing, research and styling.
7. Materials & Other:	Value in assembled vehicle value produced by component, parts and other types of supplier firms.
8. Total Labor Compensation:	Wages, salaries and benefits paid to employees of vehicle firms in the areas of administration, final vehicle assembly, marketing, research and styling.
9. OE Net Value Added: "Other"	Net of labor compensation value added produced by vehicle firms in the areas of administration, final vehicle assembly, marketing, research and styling.
C. Purchased Cost of Goods Sold:	
10. Materials Purchases:	Manufacturers shipments of components and parts shipped by independent and captive suppliers to vehicle firm assembly plants.
11. Other Purchases:	Energy, warranty, and other costs of goods sold (such as business services) paid by vehicle firms.

Light vehicle purchases in constant dollars increased from $291 billion in 1990 to $432 billion in 2000.[10] These values are then netted for distribution costs in Table 1.1 to produce the value of vehicle shipments from vehicle assembly plants. Both the advertising and gross dealer margin figures are actual numbers.[11] Vehicle freight costs to dealerships for 1990 and 2000 are CAR estimates.[12] "Assembled vehicle value" then is $255 billion in 1990 and about $389 billion in 2000. These values are then split into OE (Original Equipment manufacturers — refers to the vehicle assembly firms, such as General Motors, Ford, Toyota, etc.) value added and "materials and other" categories on the basis of Bureau of the Census information from the 1990 Annual Survey of Manufacturers (ASM) and the 1997 Census of Manufacturers (COM).[13] CAR bases its estimate of the split in upstream value on the BOC information although the BOC surveys only cover U.S. manufacturing (including international production in the United States). CAR also projects the 1997 percentage split forward to 2000 since the BOC will not release information for that year until 2003.[14] The split is significantly different for the two years. About 28 percent of assembled value is assigned to OE value added in 1990, and 33 percent in 2000. This counter-intuitive result is the subject of a special discussion in the final section of this first part of the study.

Table 1.1
2000 and 1990 Value Chains



Original Equipment manufacturer value added in 1990 and 2000 are further split into separate values for total labor compensation paid by vehicle firms in those years and an all other category that will be explained in our final section below. Material and other purchases value are also split into two parts. Other purchases include the cost of energy (actual) for OE assembly plants and administrative offices, actual warranty charges as reported by NADA, and an all other purchases category.[15] The materials purchasing category is of special interest in our study since it includes the value of parts and components purchased by vehicle firms from both independent suppliers and captive component divisions. It should be pointed out that materials value includes the output of the powertrain (engine and transmission) and stamping plants owned by the vehicle producers themselves.

The value totals for six materials categories are the strong focus of the second part of our study. The 1990 figures were produced with the use of special research results produced by earlier CAR research in 1990. The 2000 results draw on BOC and COM information and special surveys conducted by CAR with two of the largest vehicle firms in the summer of 2001. Both sets of results are described fully in part two of our overall study and in Appendix C. It should be pointed out that the materials totals include the value of materials used in the manufacture of light vehicles sold in the United States, regardless of where the vehicles were assembled or materials were produced. In other words, material values for both 1990 and 2000 include the cost of components assembled in imported vehicles and imported components used in the manufacture of domestic vehicles that are sold in the United States.

Table 1.1 contains powerful historical evidence on the pattern of change in the upstream value chain during 1990–2000. Overall constant dollar sales of light vehicles increased by 48.5 percent during the period. Change in every other component of the upstream value change should be compared relatively to this overall change in automotive market value. For example, no area of distribution cost (advertising, deal margin, of freight cost) increased by more than half the change for overall downstream value. Thus, assembled vehicle value increased by 52.5 percent or more than overall automotive value. OE value increased by an impressive 79.8 percent, although OE labor compensation, a component of OE value, increased by only 23.8 percent. Materials increased by 42.5 percent in constant dollars, or far less than the change in OE value netted for labor compensation — which increased by 110.4 percent. Clearly, the vehicle firms as opposed to labor or other types of suppliers captured a large portion of the overall increase in automotive value during 1990–2000. A summary of the change percentages for each component of upstream value during 1990–2000 can be found in Appendix D.

1.3 THE UPSTREAM VALUE CHAIN OF U.S. AUTOMOTIVE INDUSTRY AND MARKET: 2000–2010

This study produces three forecasts of the upstream value chain in the U.S. automotive market of 2010. The first two forecasts both assume a forecast annual growth rate in constant dollars NADA light vehicle sales of 4 percent and identical distribution costs in 2010. The two forecasts then differ in the assumed split in assembled vehicle value between OE value added and all types of purchased materials and services. Scenario A calls for only 28 percent of assembled value accruing to OE value added, and Scenario B calls for a 33 percent share in assembled value for vehicle manufacturers. The difference in assumed OE share results in different values for the all of the elements of OE value added and materials and other purchases except for warranty cost. Our final forecast scenario is called the “unit constant model” since the number of unit sales is assumed to remain the same as in 2000 or 17.4 million units. Additional value added in this scenario arises solely because of content added to material components as estimated by the CAR Forecast Group. This additional value ripples up from the bottom of our value chain, changing other element values that depend on the final level of light vehicle purchases.

A number of assumptions are used to forecast the level in constant dollars of the 2010 value chain, regardless of the scenario employed. These forecast assumptions are reviewed in our second set of definitions below:

The Elements of Upstream Value: 2000–2010

1. Light Vehicle Purchases:	NADA sales in $ 2000 are forecast to grow at 4.0% during 2000–2010 except in the unit constant model.
A. Distribution Costs:	
2. Advertising Cost:	U.S. advertising costs for vehicle manufacturers are the same percentage of NADA sales as in 2000.
3. Gross Dealer Margin:	Gross dealer margin takes the same share of 2000 NADA sales as in 2000.
4. Freight:	Freight cost estimates from CAR.
B. Manufacturing and Administrative Costs:	
5. Assembled Vehicle Value:	The NADA light vehicle purchases value netted for the distribution costs listed in 2. through 4. above.
6. Original Equipment (OE) Value:	The percentage of assembled vehicle value is 28% of assembler value in scenario A and 33% of assembler value in scenario B.
7. Materials & Other:	Remaining value in assembled vehicle value produced by component, parts, and other types of supplier firms.
8. Total Labor Compensation:	Wages, salaries, and benefits paid to employees of vehicle firms are set at 24.3% of OE value added (the 2000 ratio).
9. OE Value Added:	Net of labor compensation value added produced by vehicle firms in the areas of administration, final vehicle assembly, marketing, research, and styling.
C. Purchased Cost of Goods Sold:	
10. Materials Purchases:	Manufacturers shipments of components and parts shipped by independent and captive suppliers to vehicle firm assembly plants. Estimated for 2010 as 92.7% of total materials and other purchasing (the 2000 ratio).
11. Other Purchases:	Energy costs are estimated as 1% of OE value added (the 2000 ratio). Warranty costs are estimated as 3.1% of light vehicle purchases (the 2000 ratio). Other costs of goods sold (such as business services) paid by vehicle firms are a residual sum.

Table 1.2 contains the 2010 forecast of the upstream automotive value chain with an assumption of 28 percent of assembled vehicle value accruing to vehicle assembly firms. The constant dollar value of U.S. light vehicle purchases rises from $432.0 billion in 2000 to a forecast value of $639.5 billion in 2010, or an increase of 48 percent. The value of assembled vehicles, netted for distribution costs, rises from $389 billion in 2000 to about $575 billion in 2010. OE value added rises from $128.4 billion in 2000 to $161.0 billion in 2010. About $8 billion of the increase in OE value takes the form of labor compensation and constitutes the overwhelming bulk of the change in "other value," which increases by about 25 percent. Materials purchasing in this scenario rises from a level of almost $242 billion in 2000 to $384 billion in 2010, or an increase overall of almost 59 percent. A rapidly increasing area of materials purchasing is in powertrain components, which increases by 81 percent between 2000 and 2010. However, the electrical and electronics group of components rises in total value from $19.3 billion in 2000 to an impressive $41.5 billion in 2010, or an increase of 115 percent. In the

28 percent scenario formulated by CAR, suppliers capture relatively and absolutely more upstream value during 1990 to 2000 than the vehicle firms.

Table 1.3 contains the 2010 forecast of the upstream automotive value chain with our assumption of 33 percent of assembled vehicle value accruing to vehicle assembly firms. In this scenario, OE value added rises from $128.4 billion in 2000 to $192 billion in 2010, or an increase of 49 percent. About $15 billion of the increase in OE value takes the form of labor compensation and constitutes the overwhelming bulk of the change in “other value,” which will be discussed below. Materials purchasing in this scenario rises from a level of almost $242 billion in 2000 to $356 billion in 2010, or an increase overall of about 47 percent. Rapidly increasing areas of materials purchasing still, of course, include powertrain components, a 67 percent increase, and the electrical and electronics group an increase of 99 percent. The most striking difference between the two “OE value share scenarios,” however, is in the share going to OE value added. Almost $30 billion in additional OE value added is produced under the 33 percent scenario compared to the 28 percent scenario. In the 33 percent scenario, materials suppliers and vehicle firms both see their level of automotive value rise by about the same percentage.

Table 1.4 contains our forecast values for the “unit constant” model of the upstream automotive value chain. In this scenario, we assume the exact same level of light vehicle sales as was achieved in the 2000 U.S. market. We also assume that value is added, compared to 2000, only through constant dollar increments to the various component values in materials purchasing. These assumptions allow a “bottom-up” approach to estimating the future level of the automotive value chain. Materials purchasing in this scenario rises from a level of almost $242 billion in 2000 to $275 billion in 2010, or an increase overall of almost 13.5 percent. A rapidly increasing area of materials purchasing is in powertrain components, which increases by 29 percent between 2000 and 2010. Once again, the electrical and electronics group of components impressively rises in total value from $19.3 billion in 2000 to $29.6 billion in 2010, or an increase of 53 percent. It should be remembered that these value increases for components are in constant dollars and do not depend on an increase in vehicle sales. In contrast, we estimate a fall in the value of the HVAC components market during 2000 to 2010.

Our unit constant model, of course, shows no change in OE value or its elements of labor compensation and “other value.” Other elements of the value change such as warranty cost, advertising cost and dealer profit do rise, but only because of an increase in light vehicle purchases.

Table 1.2
2010 and 2000 Value Chains: Scenario A, 28% OE Share

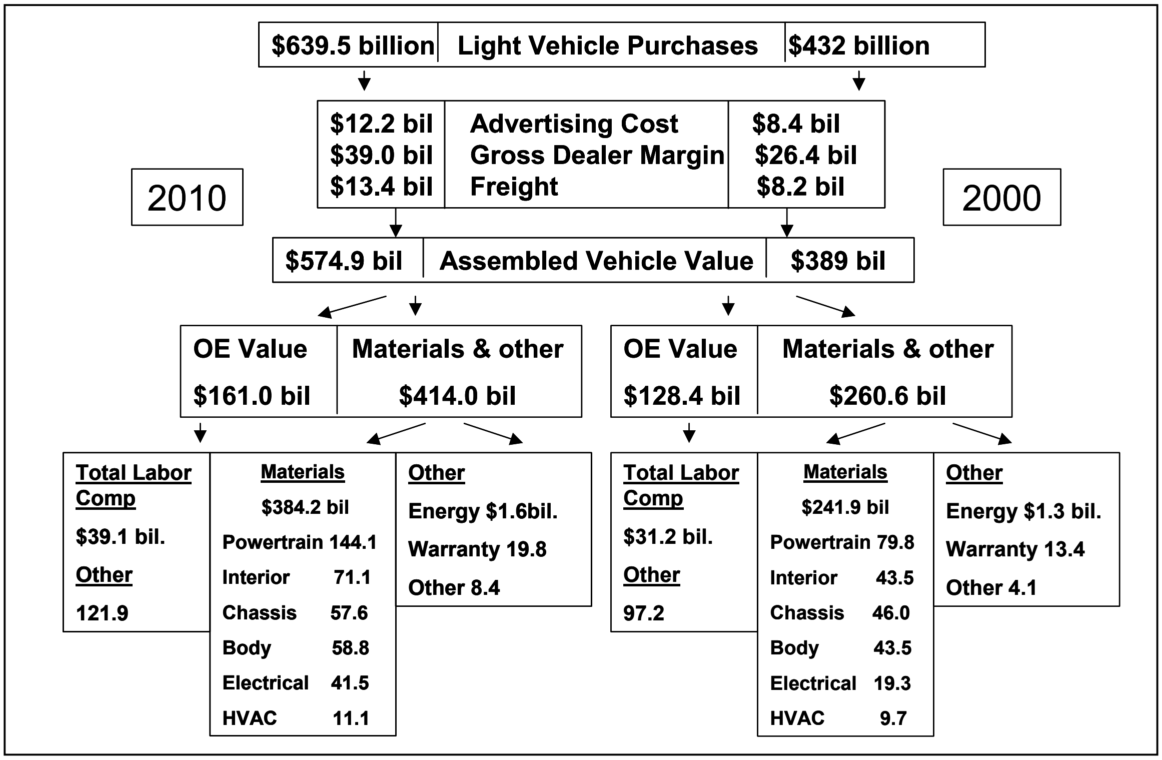


Table 1.3
2010 and 2000 Value Chains: Scenario B, 33% OE Share

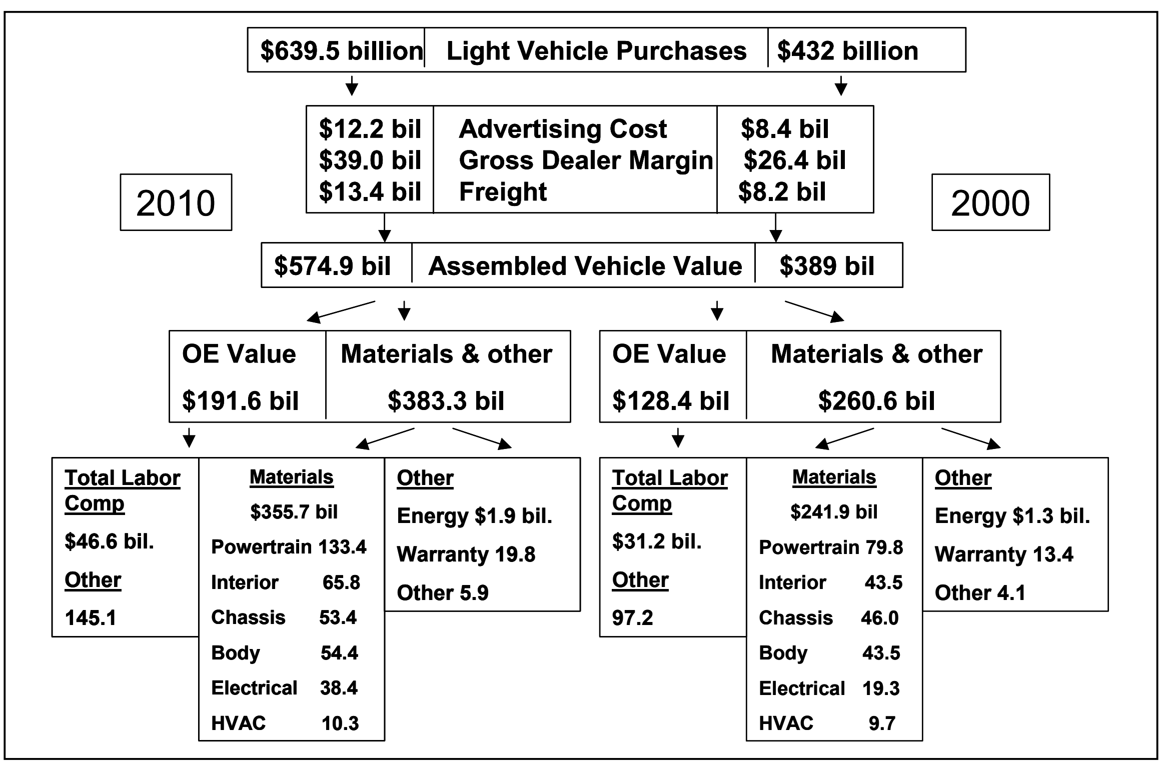
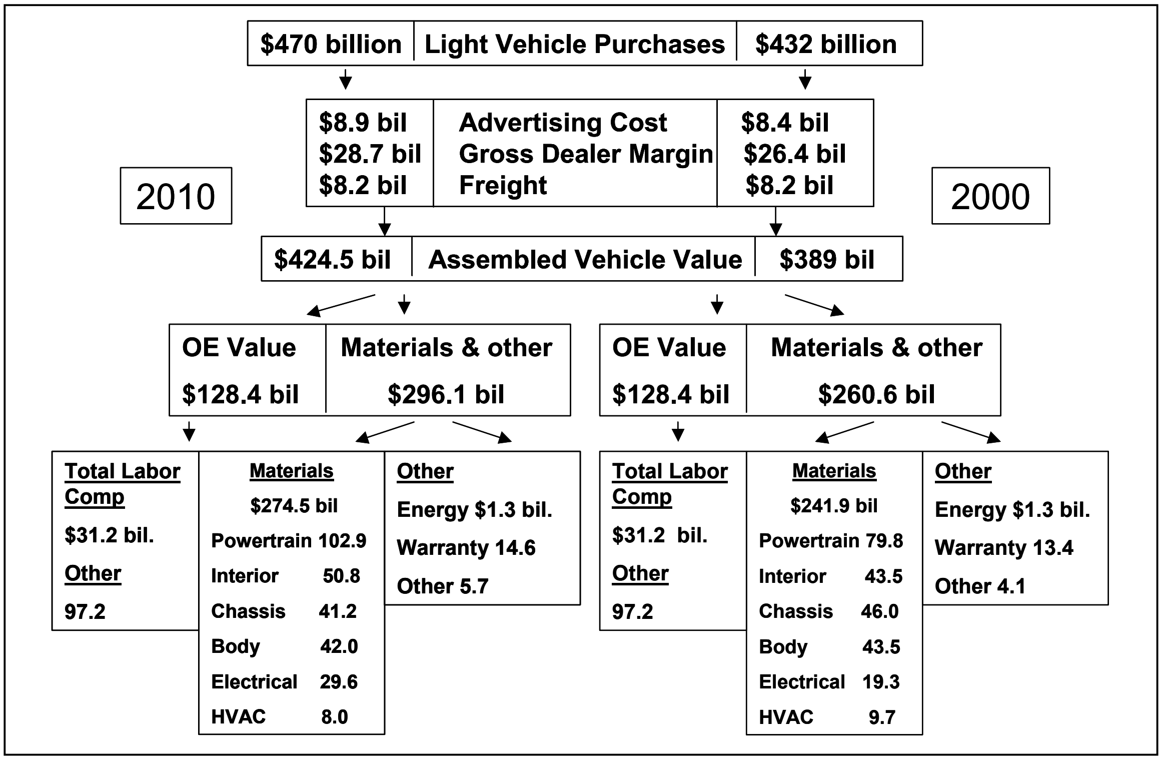


Table 1.4
2010 and 2000 Value Chains: Unit Constant Model



1.4 THE DOWNSTREAM VALUE CHAIN OF THE U.S. AUTOMOTIVE MARKET: 1990–2010

Historically, original equipment manufacturers and automotive suppliers have not considered the after-sale market as a reliable source of revenue. However, as the number of light vehicles on the road has increased to over 213 million in 2000, and the average age of a passenger car has increased to 9.0 years in 2000, up from 7.6 years in 1990,[16] the importance of the after-sale market has seen a corresponding increase. In addition, people are traveling further and more frequently: miles traveled are up 47 percent from 1990 to 1995 and the number of vehicle trips increased 45 percent during the same period.[17] Vehicles have taken on a multi-purpose role in the last decade — no longer are light vehicles used for personal transportation purposes only. In conjunction with their increased usage, light vehicles are being equipped with a wide range of after-market components such as towing hitches, cell phones, and a host of other telematic and outdoor activity components. This, together with the need for more tires, oil changes, repairs, and general maintenance needs, points to a growing after-sale market.

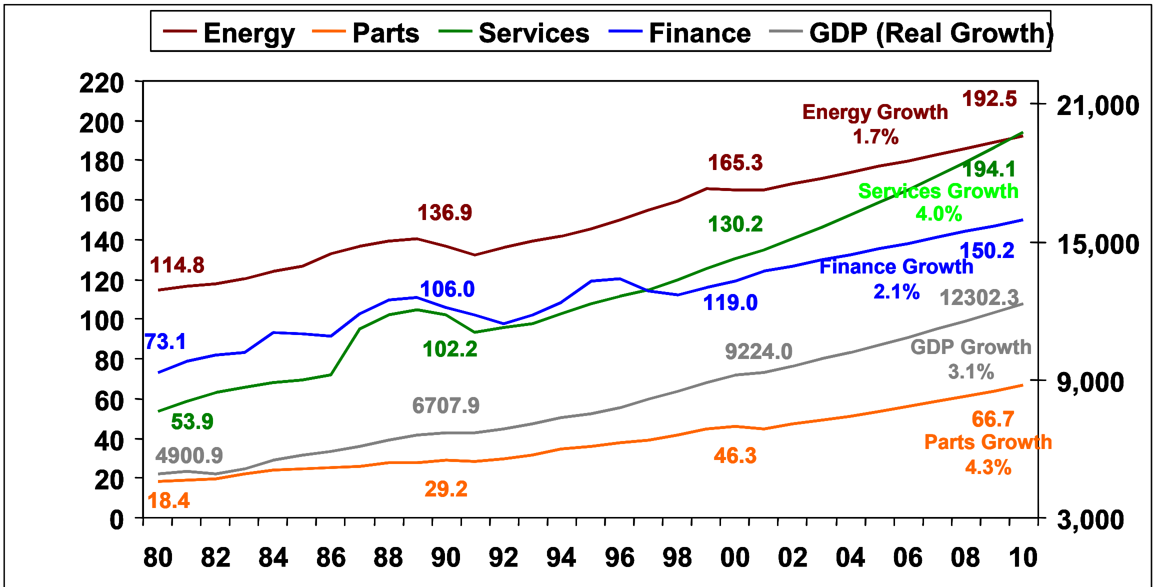
For this part of the study, we looked at the personal consumption expenditure after-sale value chain that begins immediately after the purchase of the automobile and ends when the vehicle is scrapped. We do not include expenditures by businesses or governments. The main reason for excluding these types of expenditures is the extreme difficulty in obtaining reliable data detailing these expenditures. We are confident that the exclusion of these groups has no adverse effect upon our analysis, as expenditures by business or governments are often negotiated at a lower quantity rate. Because of this, the business and government segment undoubtedly has a lower average expenditure rate per vehicle and, therefore, lower growth rates. The after-sale PCE value chain has been divided into four distinct segments: Financing, Service, Parts, and Energy.

Personal Consumption Expenditure Segments

1. Financing Segment:	Automotive loans, motor vehicle insurance and the value associated with the net purchase of used vehicles from a used-vehicle retail facility.
2. Service Segment:	Comprised of motor vehicle repair — and the requisite parts — conducted in dealer facilities and independent repair shops for consumers. This does not include warranty repair work. Service also includes the catch-all category of parking facilities, vehicle storage, washing, and greasing (oil change facilities).
3. Parts Segment:	Includes the replacement parts, tires, tubes, and add-on accessories purchased by consumers at retail parts facilities.
3. Energy Segment:	Consists of consumer purchases of gasoline and oil.

As detailed in Figures 1.2 through 1.6, for the period 1980 to 2000, two automotive segments show an increase in consumer spending of 4.0 percent or greater: automotive parts and automotive service. On the other hand, none of the expenditure increases in spending on gasoline and oil, insurance, or finance exceed 1.7 percent for the same growth period.

Figure 1.2
Personal Consumption Expenditures: Aggregates, 1980–2010[18]



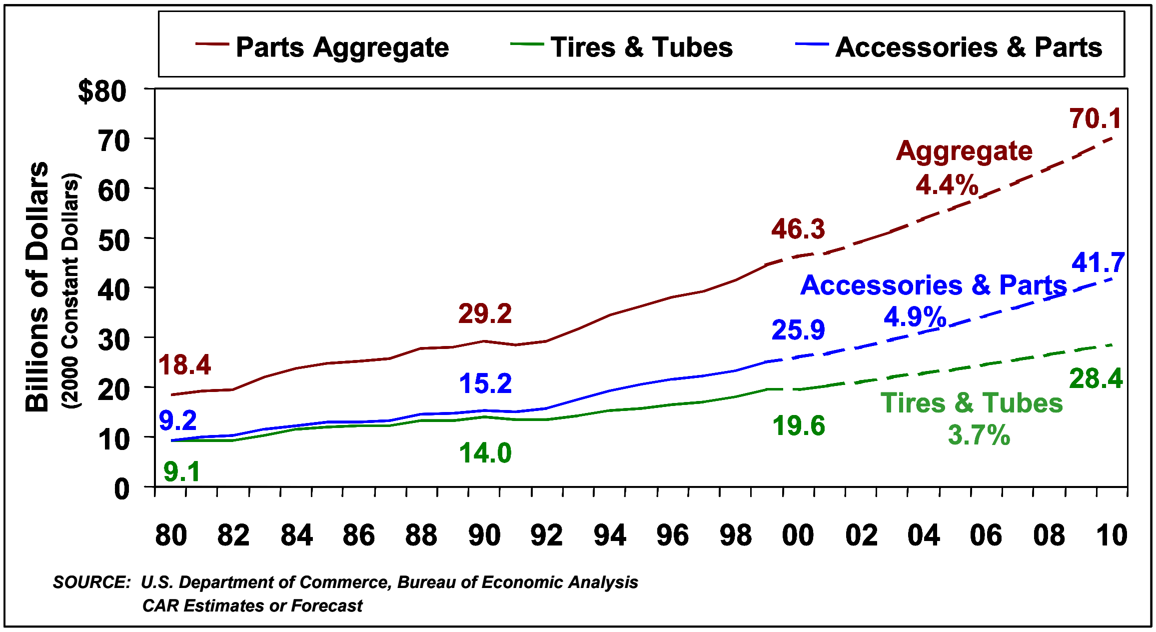
SOURCE: U.S. Department of Commerce, Bureau of Economic Analysis
Ward's Motor Vehicle Facts and Figures, 1993 and 2000
CAR Estimates or Forecast

The 1980 to 2000 trend data for the individual components of the automotive-related segments reveal areas of growth that surpass the growth of the overall economy (3.1 percent real growth from 1980–2000). For this period, aftermarket parts (4.3 percent growth) and automotive services (4.0 percent growth) grew at rates comparable to total dollar sales of new vehicles (4.5 percent growth). This strong expenditure growth occurred at a time when the unit growth of new vehicle sales increased a lethargic 2.2 percent.

When we disaggregate parts (Figure 1.3), the performance of the individual segments reveals that tires and tubes grew at 3.7 percent, while other accessories and parts grew at 4.9 percent.

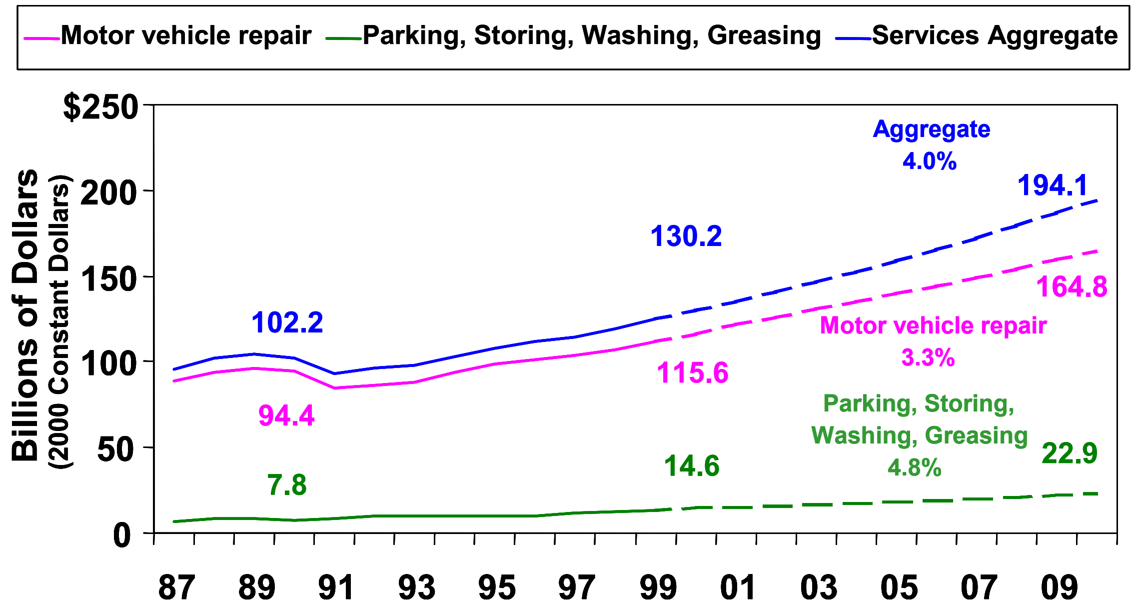
Clearly, as consumers keep their automobiles for longer periods of time, the need for aftermarket products becomes increasingly important.

Figure 1.3[19]
Personal Consumption Expenditures: Parts, 1980–2010[20]



Additionally, as shown in Figure 1.4, motor vehicle repair (3.3 percent growth) and parking, storing, washing, and greasing (4.8 percent growth) demonstrated strong growth as consumers strive to keep their vehicles running longer. These segments become even more important during weak economic conditions as consumers defer new vehicle purchases.

Figure 1.4
Personal Consumption Expenditures: Service, 1980–2010[21]

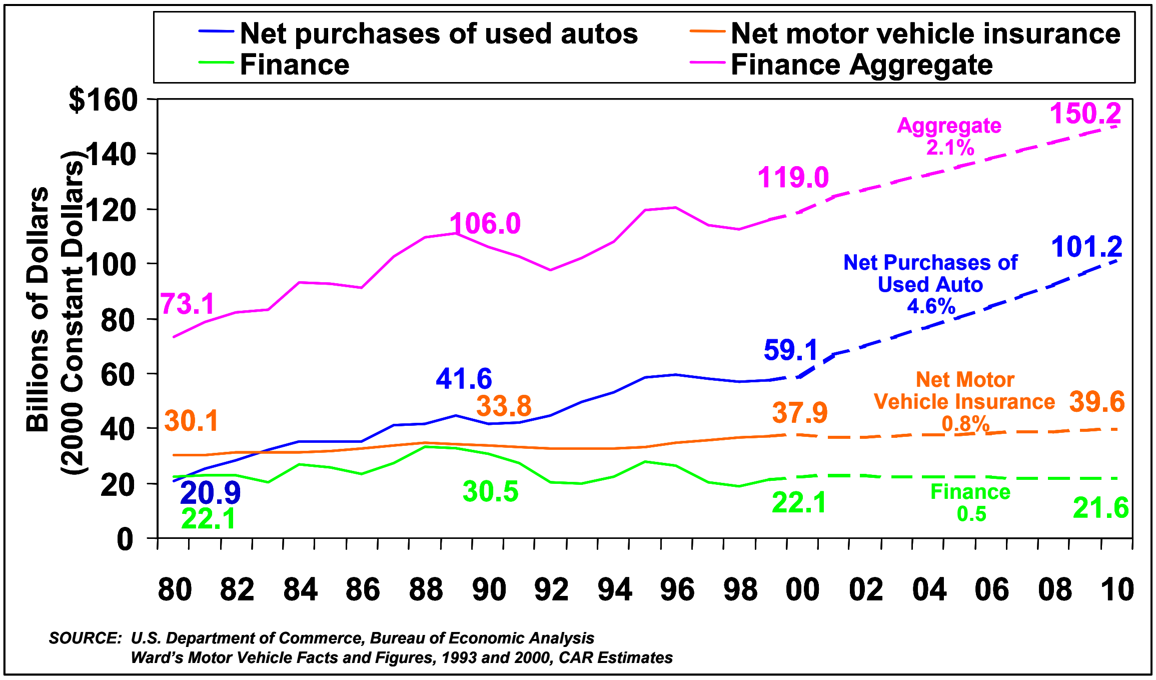


SOURCE: U.S. Department of Commerce, Bureau of Economic Analysis, CAR Forecasts

(Note: The growth rates for Services Aggregate and Repair were calculated using data from 1980-2000. However, the growth rate of Parking, Storage, etc., was calculated using data from 1987-2000. Only data points from 1987-2010 are shown in the chart below.)

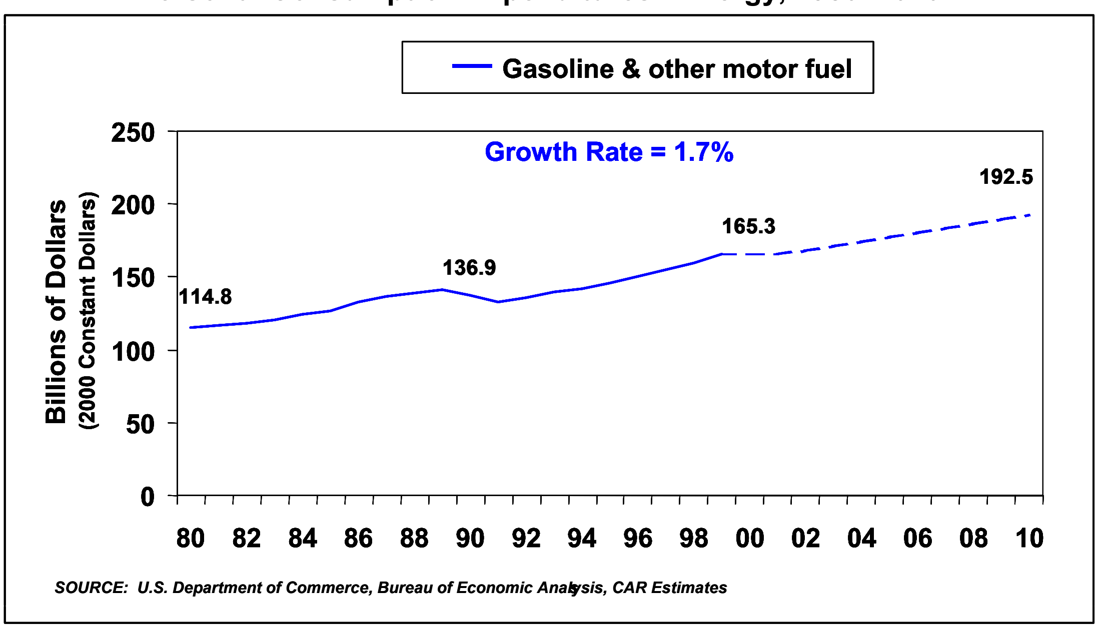
At the same time, the aggregate segments of automotive financing (Figure 1.5) and automotive-related energy use (Figure 1.6) grew at unimpressive rates of 2.1 percent and 1.7 percent, respectively. Examining the individual segments of financing, we see that used auto sales grew at a strong rate of 4.6 percent, but the aggregate segment was dragged down by the lack of strong performance in insurance (0.8 percent growth) and finance (-0.5 percent). This trend is bound to continue, as it appears that leases are not the money-maker the auto firms believed them to be and the recent incentive trend toward low or zero-percent loans is sure to affect the finance segment further. The domestic automakers, while they will eventually curtail the low or zero-percent loans, will have extreme difficulty distancing themselves completely from new vehicle financing incentives that will continue to adversely impact profits.

Figure 1.5
Personal Consumption Expenditures: Finance, 1980–2010[22]



The after-sale segment of energy has shown little growth (1.7 percent growth), and the prospects for the future are not good, as the investment required to produce and sell gasoline and oil cuts deeply into potential profits.

Figure 1.6
Personal Consumption Expenditures: Energy, 1980–2010[23]



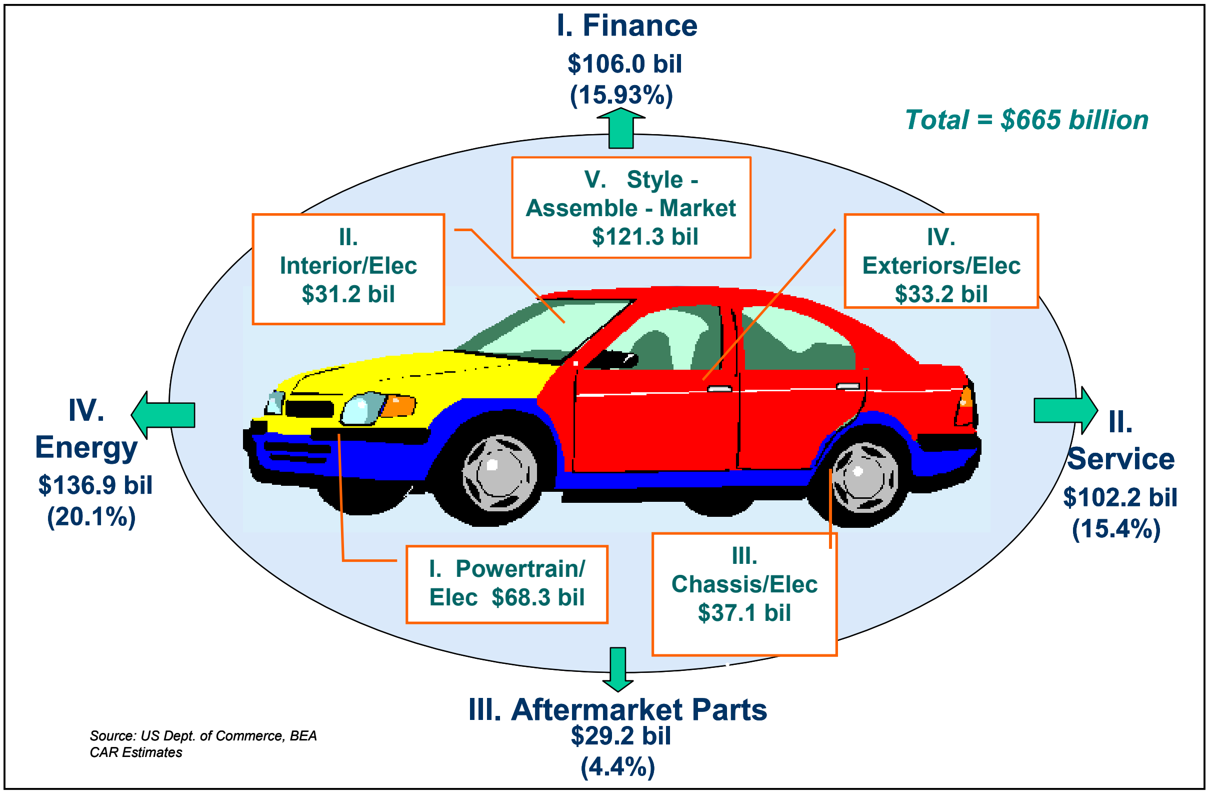
Clearly, there are areas of growth in the after-sale market where profits can be made, assuming adherence to a good business model. Unfortunately, there are also segments whose performance has been less than impressive, at best, over the last two decades. Using the overall economy's 3.1 percent real growth rate for the period of 1980 to 2000 as a comparison, the segments that have been growing at a slower rate should not be considered as candidates for investment — or entry by new competitors — whereas those segments performing better warrant a closer look. Based on past performance, the segments of motor vehicle insurance, finance, and gasoline and other motor fuel, do not offer much hope for strong growth in the years ahead and short of a revolutionary change in business strategy, profits in these segments should remain stagnant.

Areas of strong growth — and potentially high margins — include tires and tubes; parking, storing, washing, and greasing; repair; and accessories and parts. Of these segments, accessories and parts shows exceptional promise as an area where profits can be made well into the foreseeable future — especially at times of economic downturn. Due to the previously mentioned trends of longer vehicle ownership and increasing miles traveled per trip, there has been a concurrent growth in the parts segment that shows no signs of abating. Even though the barriers to entry in the parts segment are low, the presence of fewer national retail chains will make it difficult for new entrants to gain distribution economies of scale. The latest financial data from AutoZone, Inc., the largest U.S. auto parts retailer, demonstrates the vitality of this segment. AutoZone expects its profits to rise more than recent forecasts, and its same store sales have risen 7 to 8 percent in the present quarter.

1.5 The Value Chain of the U.S. Automotive Industry and Market: 1990–2010

Our descriptions and forecasts of both the upstream and downstream portions of the automotive value chain in the previous sections allow us to describe the total automotive chain in this section for the period 1990 to 2010. We start with a visual depiction of the total automotive value chain in 1990 as shown in Figure 1.7. Our visual chart places the entire upstream value of the chain within an oval that contains a car. For 1990, total downstream value amounts to $291 billion (constant dollars) in NADA U.S. sales for that year. The $291 billion dollars are separated into five essential areas of value. Four of the areas of value are component categories that sum to total materials purchasing in 1990 of $169.7 billion. We separate materials value into four, not five, component areas, as we did in our previous downstream analysis, because the electrical/electronic component market is distributed throughout the vehicle's systems and functions. The electrical materials value shown in our previous upstream tables is now re-distributed proportionally across the other four component value areas. Finally, the difference between the NADA U.S. sales value ($291 billion) and total materials purchasing ($69.7 billion) is $121.3 billion and is assigned to a fifth upstream value area titled "Style-Assemble-Market." This area measures the value produced by assembly firms' non-component activity, and all other non-manufacturing firms involved in the marketing, distribution, and sale of the vehicle (including dealerships).

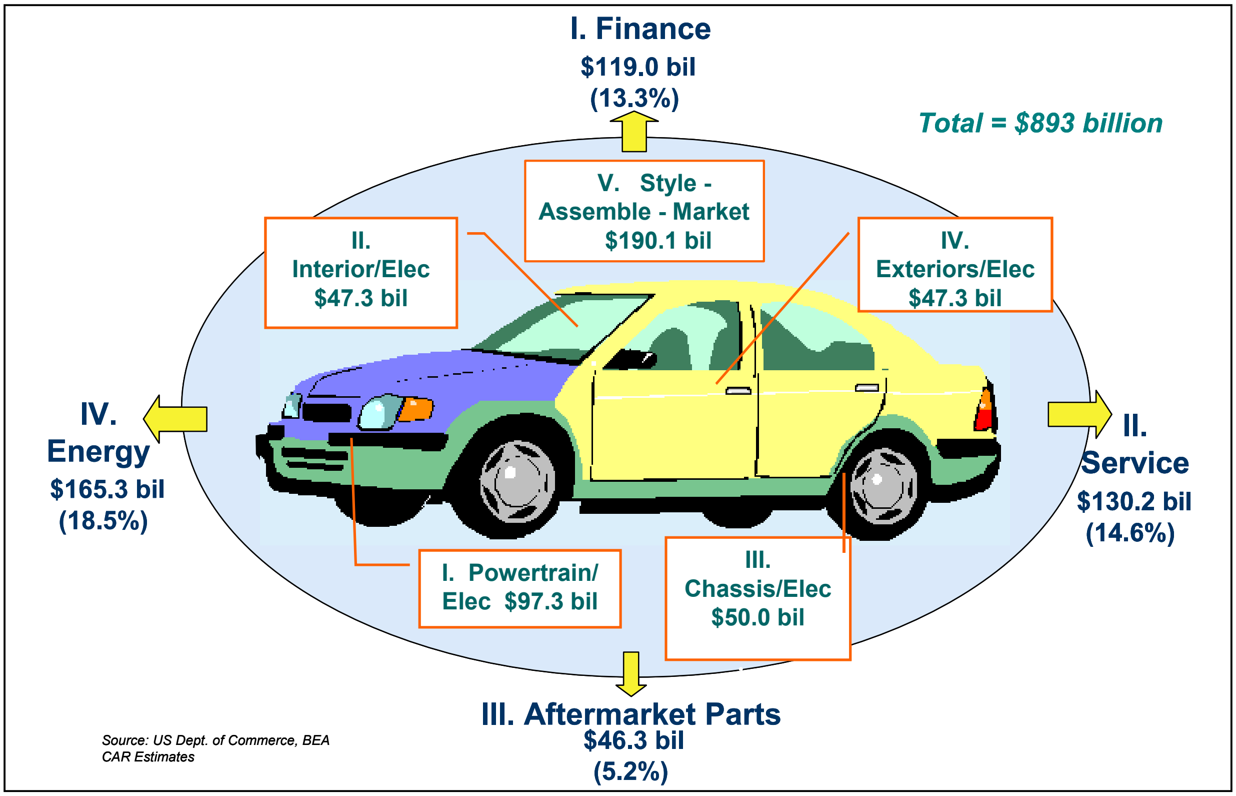
Figure 1.7
1990 Automotive Value Chain



The arrows spaced around our oval lead to aggregate values of the four large after-sale, or downstream, value areas: finance, energy, parts, and services. These four areas sum to $374 billion (constant dollars) in 1990 and together with the total of $291 billion in upstream value produce a total automotive value chain amount of $665 billion (constant dollars) in 1990. The share of the total automotive value chain's value taken by each after-sale market is supplied in a parentheses below their dollar value. For example, personal consumption expenditures on gasoline and oil used in vehicles was 20.6 percent of the value chain's total of $665 billion in 1990.

Our visual depiction of the total automotive value chain in 2000 is shown in Figure 1.8. In 2000, total downstream value amounts to $432 billion, a 47 percent increase over 1990. The style-assemble-market value balloons to $190.1 billion, a 57 percent increase over 1990. Powertrain value also grows impressively during the decade to a level of $97.3 billion or an increase of 42 percent from 1990.

Figure 1.8
2000 Automotive Value Chain



The after-sale values are given on the outside of the oval of Figure 1.8. Although all four categories of downstream consumer purchasing increased during 1990 to 2000, only aggregate parts (aftermarket) increases its share of the total automotive value chain in 2000 compared to 1990. The total value chain accumulates to $893 billion in 2000, a 34 percent increase in constant dollar value for the decade.

Our forecasts for the 2010 automotive value chain are brought together under varying assumptions in Figures 1.9 through 1.11. The first two charts forecast NADA constant dollar sales to increase by 4.0 percent per year during the period so that total vehicle sales amount to $639.5 billion (constant dollars). Our Scenario A — 28% OE value share forecast is shown in Figure 1.9 and the Scenario B — 33% OE value share forecast is shown in Figure 1.10. Both forecasts show a total automotive value chain of $1.2 trillion for 2010, with about $604 billion in downstream value located in the four after-sale markets. The major difference between the two scenarios, of course, lies in the allocation of assembled vehicle value between components and the style-assembly-market area of value. In scenario A, the style-assembly-market area of value receives about $29 billion less in value than in scenario B.

Figure 1.9
2010 Automotive Value Chain: Scenario A — 28% OE Share

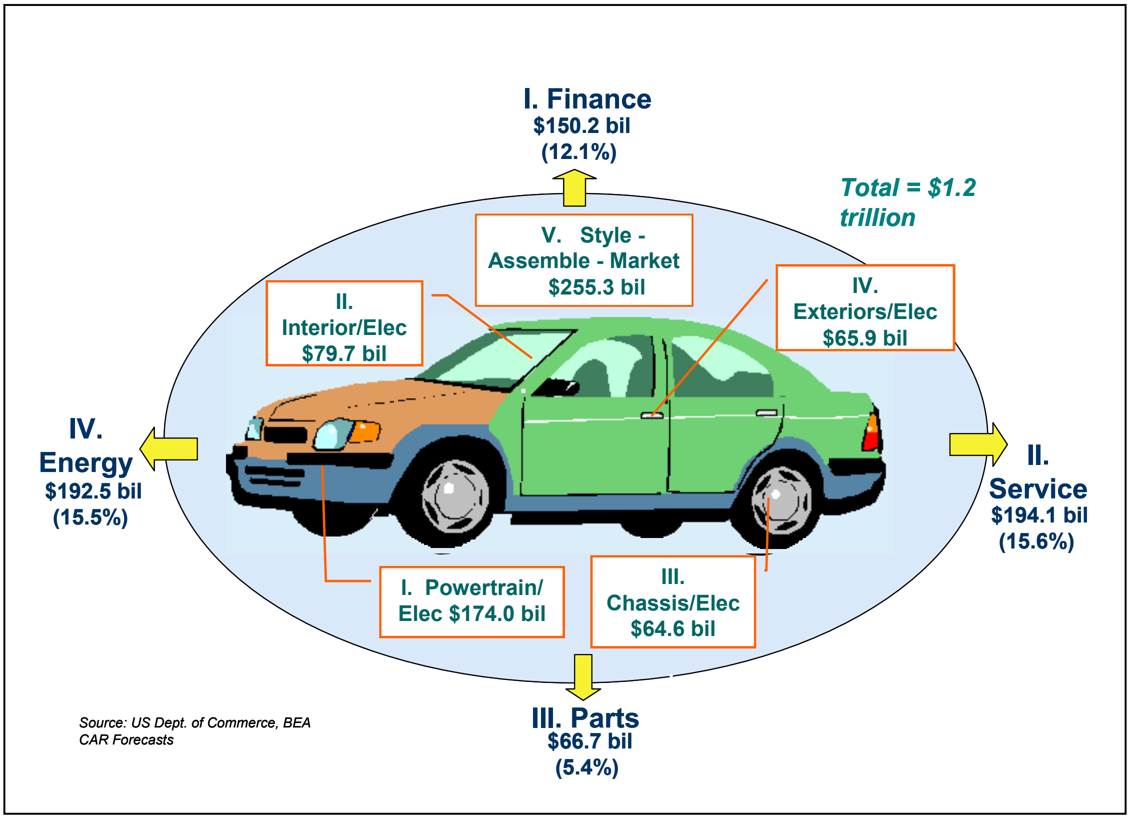
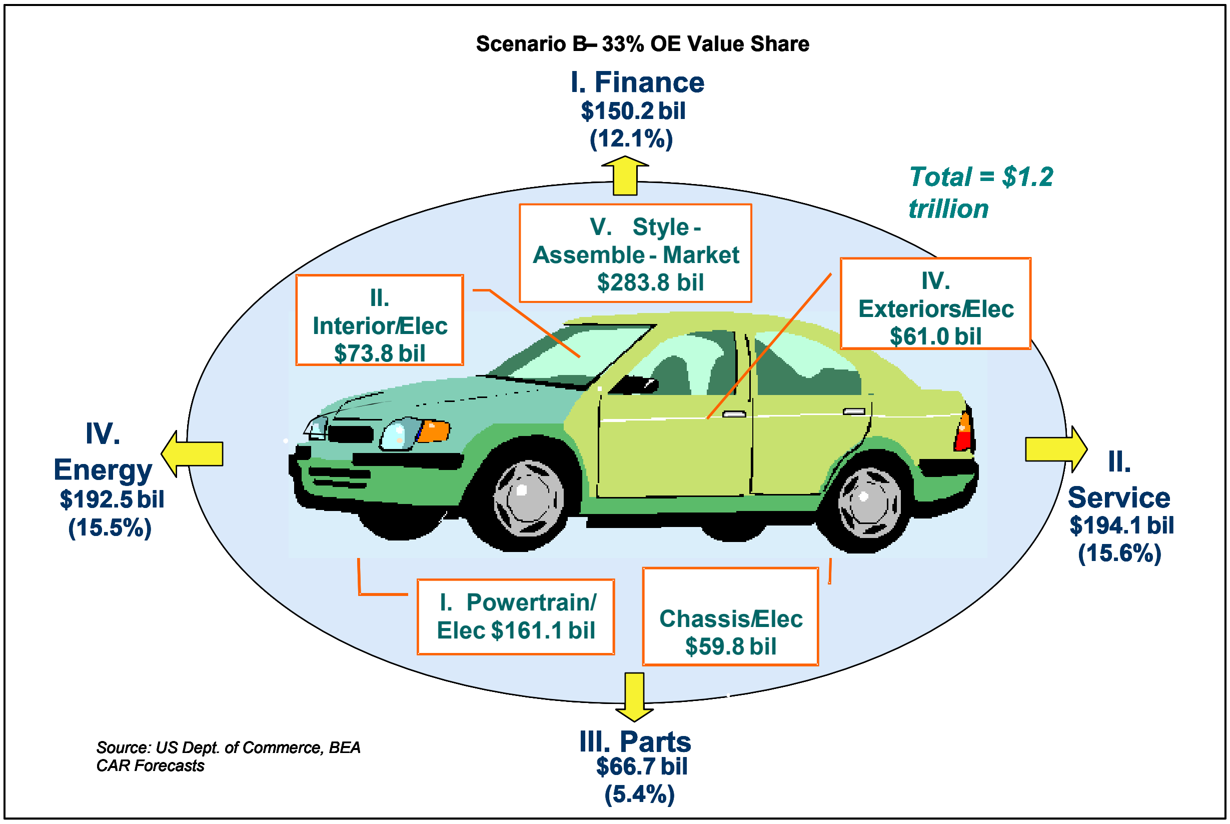
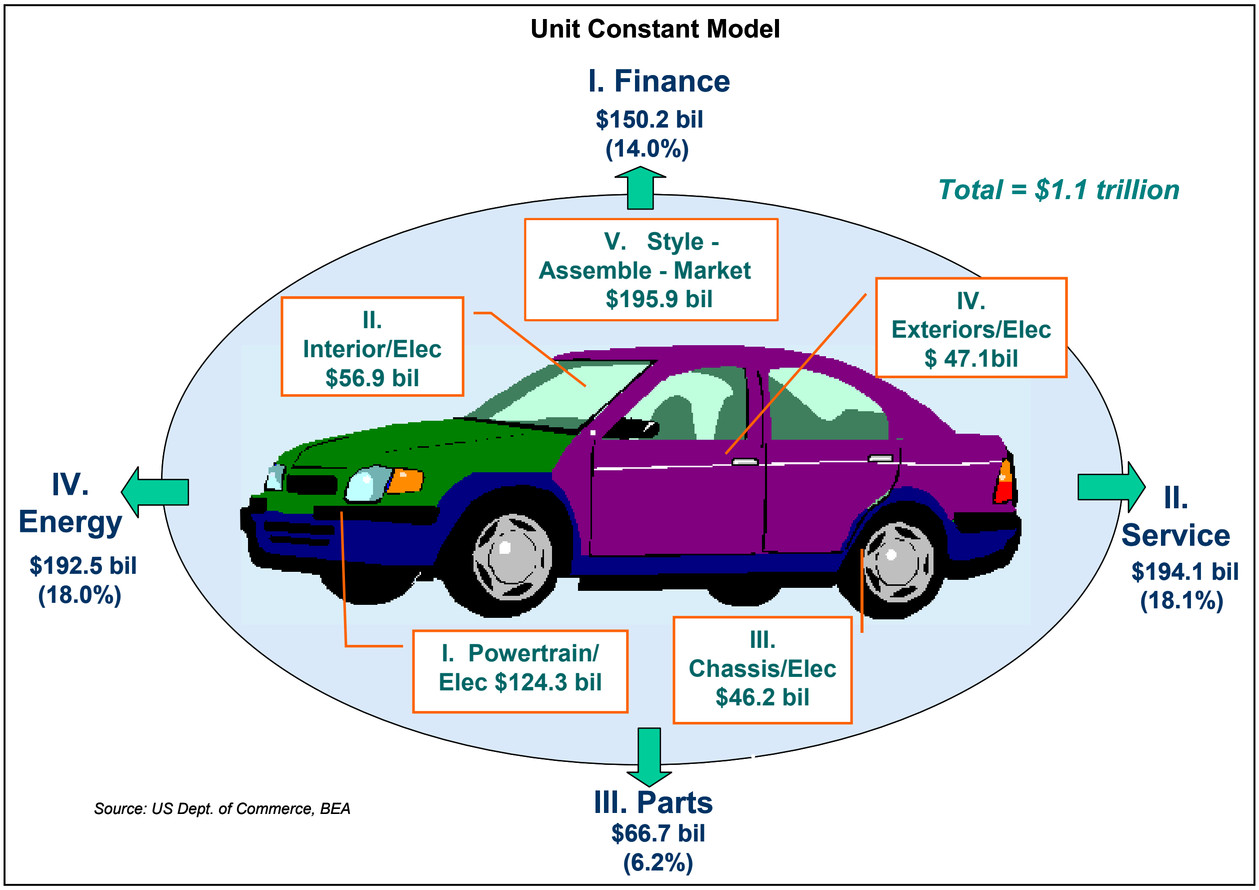


Figure 1.10
2010 Automotive Value Chain: Scenario B — 33% OE Share



Our final forecast is for the unit constant model, shown in Figure 1.11, where we assume the same level of unit vehicle sales and that upstream value can only increase in terms of higher component content. In this forecast it is interesting to note that the assemble-style-market value area still increases by about $6 billion — but all of this value is in marketing and warranty cost due to a somewhat higher level of vehicle purchase value.

Figure 1.11
2010 Automotive Value Chain: Unit Constant Model



It is also interesting that the total automotive value chain reaches $1.1 trillion for the unit constant model even though total unit vehicle sales remain at the same level as in 2000 (17.4 million units). Largely this is due to the $100 billion increase in downstream PCE spending (from $460 billion in 2000 to $560 billion in 2010). Since we restrict the growth of vehicle sales in this model, the after-sale categories take a far larger share of the dollar level of the total automotive value chain. Services and energy each comprise 18 percent of total chain value and parts reach a share of just over 6 percent. If higher levels of future vehicle sales fail to appear in the coming decade, both vehicle and component manufacturing firms would do well to reposition their business to the after-sale market.

1.6 An Examination of OE Value Added as a Share of Assembled Vehicle Value

We produce two alternative forecasts of the 2010 automotive value chain based on two separate assumptions of the split in the upstream value of assembled vehicles between OE value added and the value of materials and other purchases produced by suppliers. The two scenarios are based on the fact the U.S. BOC reports value added for the motor vehicle assembly industry as taking 28 percent of manufacturers shipments in 1990 and 33 percent of vehicle shipments value in 1997. These ratios are reproduced in the top portion of Table 1.5 under the heading U.S. BOC Vehicle Assembly.[24] The difference in the ratios seems counter intuitive because it is generally thought that vehicle firms reduced their share of shipments value during the 1990 to 1997 period. This subject is thought to be important because of the perilous business condition of the independent supplier sector in 1997 and certainly today. Is it possible that vehicle producers shifted much of the work of manufacturing the vehicle to the supplier sector in the 1990s but not the net value for performing this work? Did the OE firms somehow keep this value in the form of increased monopsony rents and higher labor (and perhaps executive) compensation?

We should first state that the OE value added in question refers to value created by the final assembly of the vehicle, executive administration and marketing activities, and vehicle research and product development activities. This is essentially the U.S. BOC's definition of the motor vehicle assembly industry's activities. In fact, the value of vehicle firm production in powertrain and body stamping manufacturing has already been assigned to the materials section of our automotive value chain. However, this fact should make the 41 percent increase in OE value added during the 1990 to 2000 period even more mysterious since there is so little actual manufacturing (just vehicle assembly) connected to it. Finally, it appears that labor compensation is not the source of higher OE value added. As shown in Table 1.5, total labor compensation measured in constant dollars, actually fell between 1990 and 1997. The U.S. Department of Commerce defines value added simply as the difference between the value of shipments and materials costs and other costs. Since internal total labor compensation (salaries, wages, and benefits) is clearly a component of value added, we can subtract labor compensation from value added to construct an amount called net value added (net of labor compensation). As can be seen in Table 1.5, the ratio of net value added to total shipments also increased between 1990 and 1997, by an even greater percentage than the share of value added to shipments.

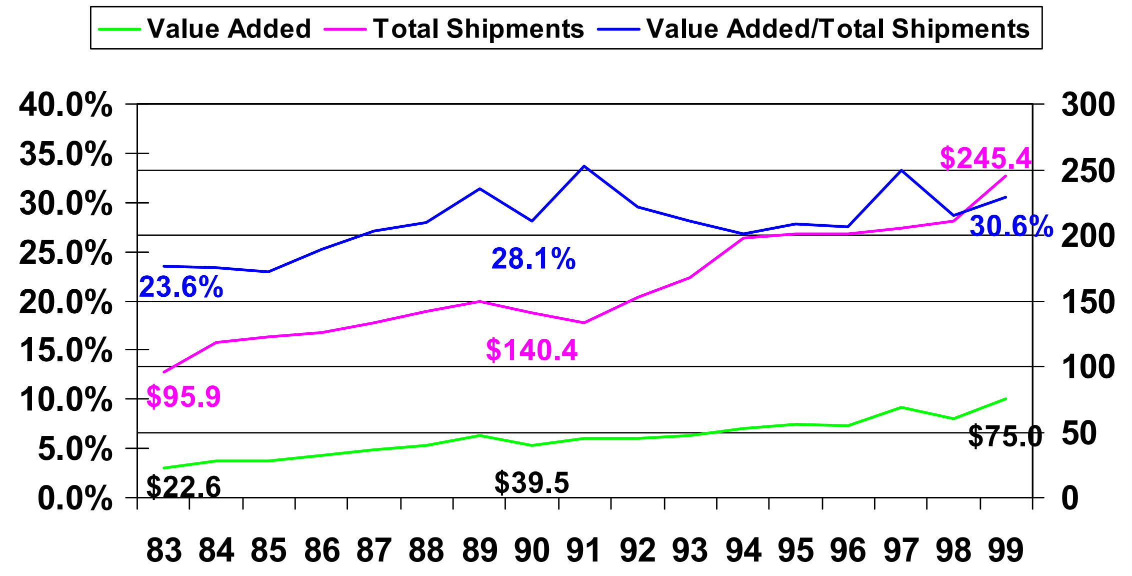
Table 1.5
Big 3 Elements of Value Added versus U.S. Bureau of Census Information on Motor Vehicle Assembly Industry: 1990 and 1997

	1990 ($2000)	1997 ($2000)	% Change 1990–97
U.S. BOC Vehicle Assembly:			
Total Compensation $2000	$18.5 bil.	$17.8 bil.	-3.8%
Value Added $2000	52.1 bil.	73.5 bil.	41.1
Net Value Added $2000	37.2 bil.	55.7 bil.	49.7
Total Shipments $2000	$185.1 bil.	$220.8 bil.	19.3%
Value Added/Total Shipments	28%	33%	18.0%
Net Value Added/Total Shipments	20%	25%	25.0%
GM/Ford/Chrysler:	**1990 ($2000)**	**2000**	**%Change 1990–2000**
Auto Research & Development	$12.9 bil.	$15.9 bil.	23.3%
Auto Depreciation and Amortization.	12.9 bil.	16.2 bil.	25.6
Auto. Interest	2.0 bil.	2.5bil.	25.0
Auto Operating Profit	-3.7 bil.	10.6 bil.	-
Total	24.1 bil.	44.7 bil.	85.5

Sources: Annual reports of companies and U.S. BOC of the U.S. DOC

Figure 1.12 contains a historical series for the OE value added share of total shipments value during 1983 to 1999, taken from the U.S. BOC's Annual Survey of Manufactures (ASM).[25] As can be seen, the ratio of value added to total shipments during this period averaged 28 percent. The 1983 to 1985 period saw the ratio hover in the 22 to 23 percent range. The ratio then rises to about 27 to 28 percent for most of 1986 to 1999 period except for two peak years, 1991 and 1997, when it reaches 33 percent. In 1991, this peak occurs because of relatively large drop in shipments value. In 1997, the ratio reaches 33 percent because of a spike in value added.

Figure 1.12
OE Value Share of Total Shipments



Source: U.S. Department of Commerce; Bureau of the Census

We must resort to company information in order to better understand the possible elements or variables that determine the OE share of shipment's value. We start by noting that economists generally agree that net value added includes such items as corporate profits, taxes paid, interest, rent, and capital depreciation. We have created a special set of financial results taken from the annual reports of the three largest assemblers in the United States in 1990 and 2000 in order to gain an understanding of the source of growth vehicle assembly industry value added during the 1990 to 2000 period. The set includes items that most economists would agree are components of value added as measured by the U.S. BOC in their survey publications. The results are shown in the bottom section of Table 1.5.[26] These results for the "Big Three" pertain to their automotive operations only, but do apply to global operations. It should also be remembered that Delphi and Visteon were still part of GM's and Ford's operations in 1990, but were spun off by 2000. Finally, powertrain and body stamping operations were part, of each of the companies' operations in those two years, as they still are today.

The first item, automotive R&D, we must admit, is largely made up of labor compensation directed to this activity and is generally thought to be a proxy for much of the product development activity carried out by vehicle assembly firms. As Table 1.5 shows, R&D for the three companies increased by an impressive 23 percent between 1990 and 2000. Automotive depreciation increased by a similar percentage, almost 26 percent, during the period. Automotive operating profit actually experienced a $14.3 billion turnaround between1990 and 2000, which goes a long way towards explaining how OE value added increased its share of assembled vehicle value during the 1990 to 1997 period. The 1990 to 2000 percentage change figures for R&D, capital depreciation, and automotive interest are almost identical to the increase shown in the upper portion of Table 1.5 in net value added during 1990 to1997. All in all, the sum of value added items for the Big Three, shown in Table 1.5, experienced an increase of almost 86 percent increase between 1990 and 2000. To put it bluntly: the Big Three were not profitable in 1990, but certainly were in 1997 and 2000.

Yet the results contained in Table 1.5 do not refute some general observations regarding the vehicle assembly firm share in value added during the 1990s. These observations can be summarized as follows:

1. The R&D spending totals for both 1990 and 2000 are massive and may average over $1,000 per vehicle by 2000 for the three companies combined. The departure of Delphi and Visteon reduced a 1997 $17.4 billion total for R&D by about $2 billion, but this reduction only marginally improves the severe effect that R&D (primarily product development) expense has on the vehicle manufacturers' bottom line performance. Indeed, much of this expense could represent redundant (shadow) engineering that is now largely performed in the component supplier sector. If so, the money would be better spent by the suppliers actually performing the product development work.
2. The capital depreciation totals in Table 1.5 are also immense and show little sign of improving (a 26 percent increase despite the spin-off of Delphi and Visteon). Currently, the typical Big Three assembly plant represents a $1.5 billion investment. Yet these plants produce far less actual value in operations today than was the case in the 1980s or 1970s. GM's new assembly and powertrain, modularity plants, at one-third the investment of previous plants, will go a long way towards recognizing the value shift in automotive operations to the supplier sector.
3. The enormous fixed costs of capital depreciation and R&D expense place a severe pressure on vehicle producers' margins. However, the typical reaction of vehicle firms to downward pressure on vehicle prices has been to demand further materials cost cuts from their independent suppliers. In other words, supplier fixed costs have been treated by their customers as variable, while vehicle firm fixed costs, which produce less and less, have been treated as almost permanent. Vehicle firms have sought to increase their margins at the expense of suppliers while failing to increase OE asset turnover performance in good or in bad sales years in the 1990s. A strong movement towards the transfer of vehicle firm R&D and capital expenses to the supplier sector and to operating OE earnings would both improve the vehicle companies' operating performance and the supplier sector's bottom line.

PART 2 — THE COMPONENT VALUE CHAIN

2.1 THE SUPPLIER CONTRIBUTION TO THE AUTOMOTIVE VALUE CHAIN

The portion of the value chain produced by suppliers (specifically materials) grew, in constant dollars, from $169.7 billion in 1990 to $241.9 billion in 2000 a 3.2 percent compound annual growth rate (CAGR). This compares to an average 2.9 percent real growth rate for the overall economy.[27] The push behind this growth comes from three critical factors. First, vehicle manufacturers outsourced value-added over the decade — including the eventual spin-off of Delphi Automotive Systems and Visteon Corporation from General Motors and Ford Motor Company, respectively. This reduced the OE levels of vertical integration in manufacturing the vehicle. Second, the value of the component parts per vehicle grew from approximately $11,940 in 1990 (in constant dollars) to approximately $13,600 in 2000. This equates to an approximately 1.2 percent CAGR. Third, unit growth in production moved from 12.6 million North American units in 1990 to 17.7 million units in 2000. The implied 1990 to 2000 materials growth rate, then, is a function of structural (component outsourcing), market (regulatory and consumer demanded content per vehicle) and cyclical (from the 1990 trough to the 2000 peak) factors.

Future growth in supplier top line revenue will be limited across the three factors discussed above. First, component or systems outsourcing opportunities for suppliers are narrowing. As we show below, the greatest incremental market potential for suppliers from outsourcing has already occurred. In the future, growth in total revenue will be limited to primarily the powertrain and interior sectors. Second, forecasting from the top of the current cycle, we estimate a continued increase in the material content per vehicle. However, our expectation is for a total increase of 15 percent in material content over the next 10 years — slightly higher than the 13.9 percent increase estimated between 1990 and 2000. The third source of increase, cyclical increases, are likely around a long-run trend growth rate influenced by the rates of household formation, vehicles per household, and vehicle scrappage. However, the cyclical boost in sales (and, in turn, production) at the end of the 1990s cycle — fueled by decreasing interest rates, increasing household net worth, and full employment — was generated under a unique set of circumstances that may rarely converge again.

It is evident that if supplier companies want to improve its financial performance that they must rapidly restructure. The decade of the 1990s offered a unique set of macro-market conditions for the suppliers to prosper under. Unfortunately, the suppliers, as a group, have not cut costs fast enough to maintain profitability over the period. For example, the largest global suppliers — again, as a group — for the period between 1994 and 2000 saw a 18 percent decline in Return On Assets (ROA).[28] If the supplier sector's financial performance was under-whelming in the 1990s, the market environment going forward will only be more challenging and will force even more radical supplier sector restructuring.

2.2 SUPPLIER STRATEGIC ISSUES

In the course of this research, we conducted interviews with two vehicle manufacturer financial executives, four supplier chief financial officers, and two suppliers in the strategy area to explore the challenges of improving their company's financial performance. From these interviews it is evident that a reshuffling of the assets is necessary to achieve improved supplier sector financial performance. From these interviews we learned:

- Suppliers are migrating their current product portfolio and asset base by clearing out under-performing (or non-core) assets acquired through mergers, eliminating current programs that are financial dogs, and capturing higher financial quality programs to better optimize total financial returns.

- Suppliers are focusing on component or system market share domination to improve ROA and moving away from acquisition strategies targeting purely revenue growth or content per vehicle.
- Suppliers playing a system integrator role are determining asset ownership requirements as a need to control critical manufacturing processes for product performance and cost control.
- Supplier long-term financial model sustainability is most significantly determined by design, engineering, manufacturing, and distribution capacity utilization.
- Components with market opportunities broader than auto or components not critical to automotive system performance or cost control are best produced by suppliers who are positioned to serve a number of industries and balance out supply and demand across a wide range of industries to fill capacity.
- Supplier and market rationalization is driving the majority of component markets to only three or four dominant suppliers.
- Niche suppliers will continue to operate taking advantage of outsourcing and engineering requirement variation among the vehicle manufacturers.
- Modular design, engineering, and procurement will be an attractive strategy for suppliers to increase financial performance but only when manufacturer shadow engineering, project management, and procurement are eliminated to allow suppliers to amortize The lack of true modularity and common architectures to allow module development costs to be spread across significant numbers of units remains a structural constraint for increased supplier financial returns.

2.3 System Value Migration 1990 to 2000

As we examine the historic makeup of the supplier sector (noted in the macro-section and throughout this section as the “materials” value shipped), we find that there has been a slight migration of value between 1990 and 2000 within the vehicle.[29] Table 2.1 presents a breakout of component costs for the years 1990 and 2000 on a per vehicle and total market basis — allowing a year-to-year comparison in constant dollars. The eleven breakout estimates were derived from vehicle manufacturer data for a “mid-market, mass market” vehicle selling at the average transaction price for the period.[30] While there will always be debates regarding the exact placement of components within these systems, Table 2.1 depicts a fairly accurate breakout of the market. Our analysis shows that the interior (which we also include in exterior trim because of similar production processes and suppliers) has received the greatest percentage shift of total change — 12.5 percent — with an increase of vehicle value share from 16 percent to 18 percent. This pushed the total estimated market for these components from $27.2 billion in 1990 to $43.5 billion in 2000, a 60 percent increase. The interior market benefited from the combination of OEM outsourcing (while most now assume that this wave is finished now), content shift (regulatory-requirements and consumer-driven appointments) as well as the market cycle (improved market conditions swing vehicle mix and option content towards higher vehicle transaction prices).

The most significant loss in total vehicle value share was that of the body structure — the result of steel prices hitting 30 year lows, the quantity of steel consumed being limited through increased use of advanced engineering techniques minimizing body-build complexity, and the increased use of competitive bidding for raw materials and commodity stampings. The result is a low 20 percent increase ($65 billion) in the annual total value created by the sector over the decade. Except for these major shifts, other sectors such as engines and drivetrains picked up 1 percent in vehicle value mix share and engine electrical lost 1 percent in total vehicle value mix share. Sector migration tends to move slowly as mass introduction of new technologies — large enough to show up in macro industry numbers — do not occur until the price of the new technology falls substantially within the range of the component being replaced.

While not directly correlated, the market growth differential between interiors and body structure plays out in the financial performance of the underlying companies making up these sectors. While the samples are not exhaustive, Figures 2.1 and 2.2 do show an interesting distribution of component financial performance (ROA and the ratio of earnings before interest, taxes, depreciation and amortization to sales) with the scatter graph mid-point of the interior components group above that for the body structure components. Figure 2.1 shows the financial returns of a sample of 16 interior and exterior components.[31] The financial data proves out the intuitive that commodity-type components, such as injection molded or other hard trim components, clearly under-perform the auto sector in general and most other financial market benchmarks. However, specialized components — such as electronics, noise/vibration/ harshness control materials, and even specialized stampings — components with higher manufacturing and engineering value added, and components that have moved through manufacturer rationalization, gravitate towards higher financial returns. Figure 2.2 shows a sample of financial performance of body components.[32] Clearly, the financial performance is more random in nature and well under any peer group comparison. This financial performance basically reflects the constrained market conditions of the body structure sector and intensive competitive pressures from excessive capacity.

Table 2.1
Value Breakout of Component Costs within a Vehicle — A Forecast[33]

	2000 Percent of Total Vehicle	2000 Billion U.S.$ Total Market	2000 per Vehicle Cost	1990 Percent of Total Vehicle	1990 Billion US$ Total Market	1990 per Vehicle Cost
Engine	16%	$38.7	$2,173	15%	$25.5	$1,788
Drivetrain	13%	$31.4	$1,770	12%	$20.4	$1,434
Body Structure	16%	$38.7	$2,173	19%	$32.2	$2,266
Interior & Exterior (trim)	18%	$43.5	$2,450	16%	$27.2	$1,912
Steering and Suspension	10%	$24.2	$1,360	10%	$17.0	$1,195
Fuel Delivery	5%	$12.1	$680	5%	$8.5	$602
Engine Electrical	4%	$9.7	$542	5%	$8.5	$602
Exhaust & Emission	3%	$7.3	$410	3%	$5.1	$354
Brakes. Wheels, & Tires	5%	$12.1	$680	5%	$8.5	$602
HVAC	3%	$7.3	$409	3%	$5.1	$354
Chassis Electrical	7%	$16.9	$9,51	7%	$11.9	$832
	100%	$241.9	$13,596	100%	$169.7	$11,942

Figure 2.1
Interior/Exterior Components Financial Performance Examples — 2000

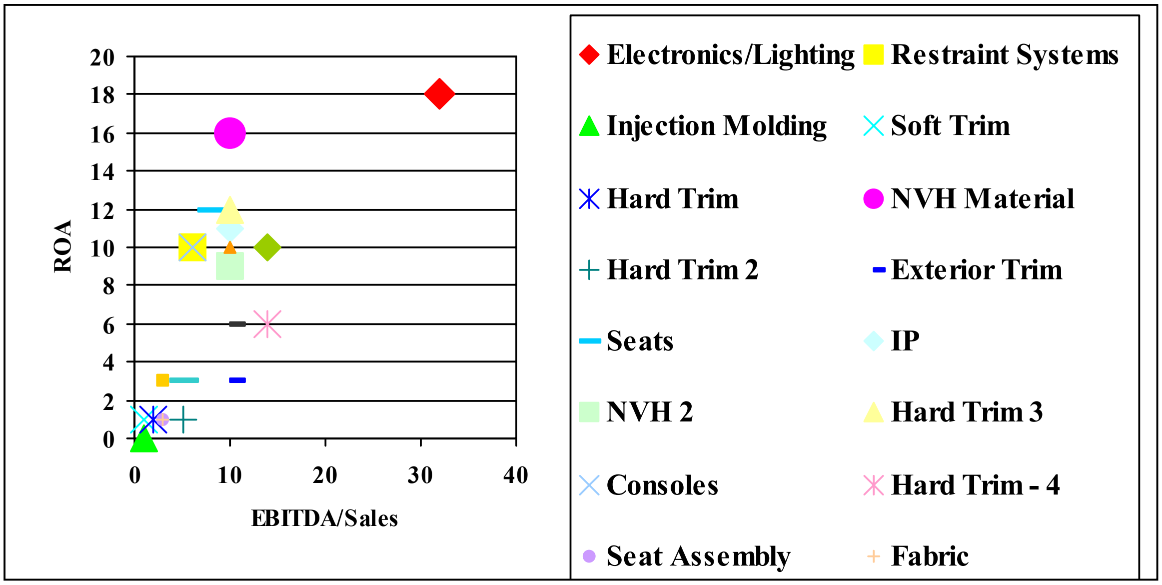
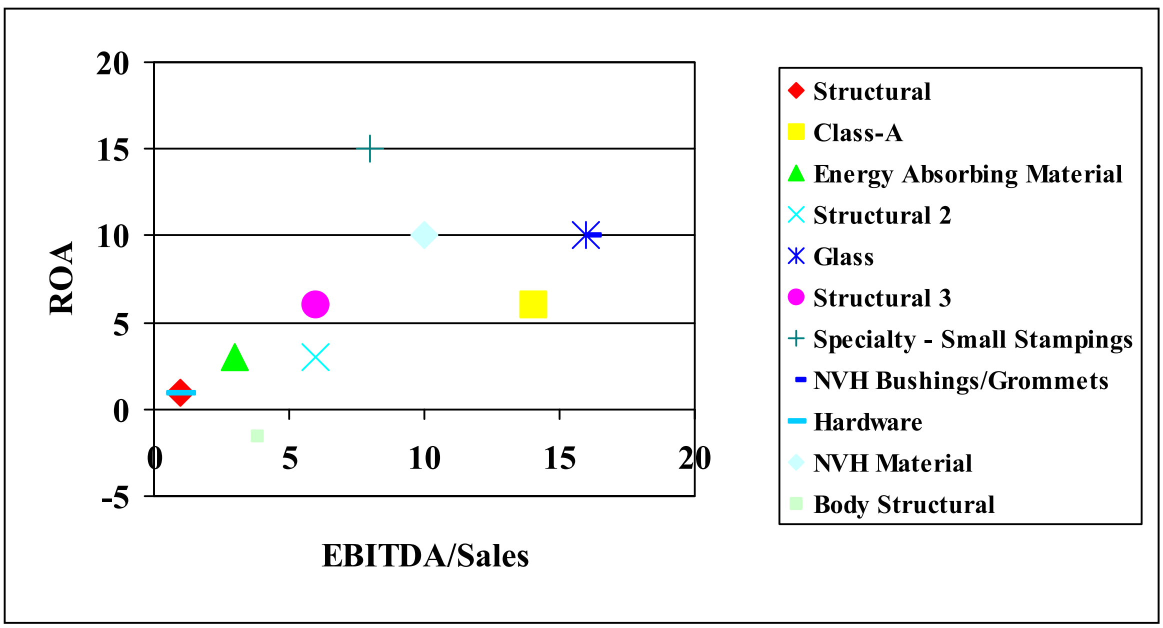


Figure 2.2
Body Components Financial Performance Examples — 2000



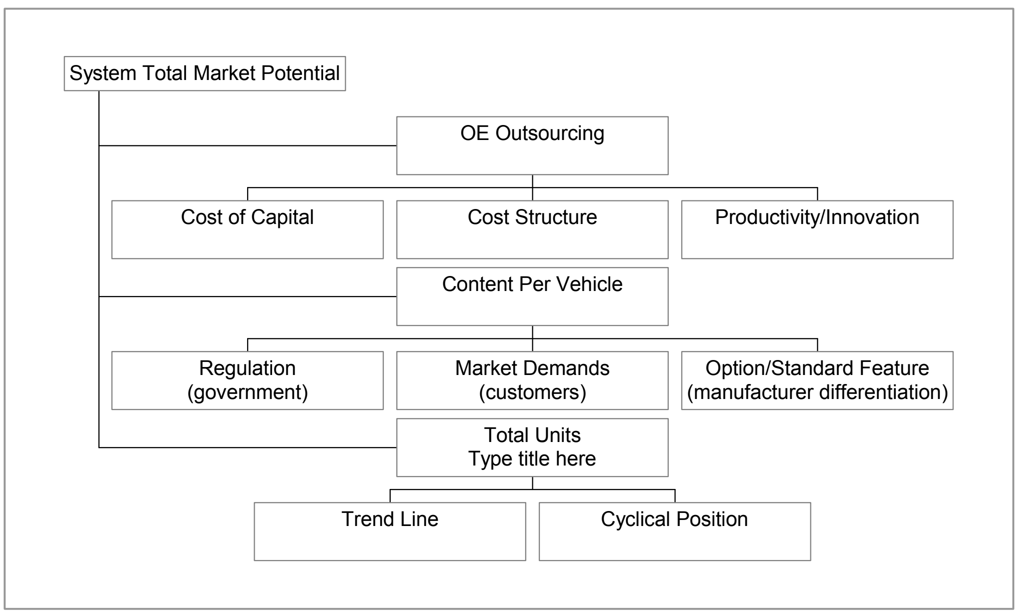
2.4 VEHICLE SYSTEM VALUE PROJECTIONS — 2010

The factors determining the level of material inputs supplied to the vehicle assemblers provide a solid underpinning to supplier revenue. As far as OE vertical integration, the potential outsourcing of transmissions and engines through 2010 could result in a 23 percent to 28 percent level of integration.[34] Everything else being equal, with an estimated 33 percent base level of OE vertical integration in 2000, a likely reduction to the long-run average of 28 percent shifts some $28.5 billion of material buys or 8 percent (off of a $355.7 billion base) out of the

OEMs and into the supply base. We performed a bottom-up, component-intensive forecast based on the introduction of new systems' technologies, consumer demands, and regulatory features to estimate vehicle content growth potential.[35] As a result, we calculated an increase in component costs to $15,640 in 2010 — a 1.3 percent CAGR or $2,040 per vehicle. This increase is distributed across the various vehicle systems.

Finally, the issue of the business cycle needs to be addressed. While the next peak is difficult to predict, incremental units over the 2000 base of 17.1 million North American unit production will be determined at a minimum by household growth, vehicles per household, and vehicle scrappage rates. These individual trends are all favorable in support of an underlying unit trend growth rate of approximately 1 percent per year. Figure 2.3 shows a basic schematic to evaluate the significant drivers of supplier revenue growth. Certainly, suppliers are attracted to growth markets — where vehicle manufacturing outsourcing opportunities may still occur, where content per vehicle is increasing, and where underlying unit trend growth is positive. After an evaluation to identify where total market opportunities are growing, the question becomes whether it is possible to capture these revenue streams in a financially attractive manner? And if not, what is a revised business model that can turn these revenues profitable?

Figure 2.3
Vehicle System Revenue Drivers



2.5 IMPROVING SUPPLIER FINANCIAL RETURNS

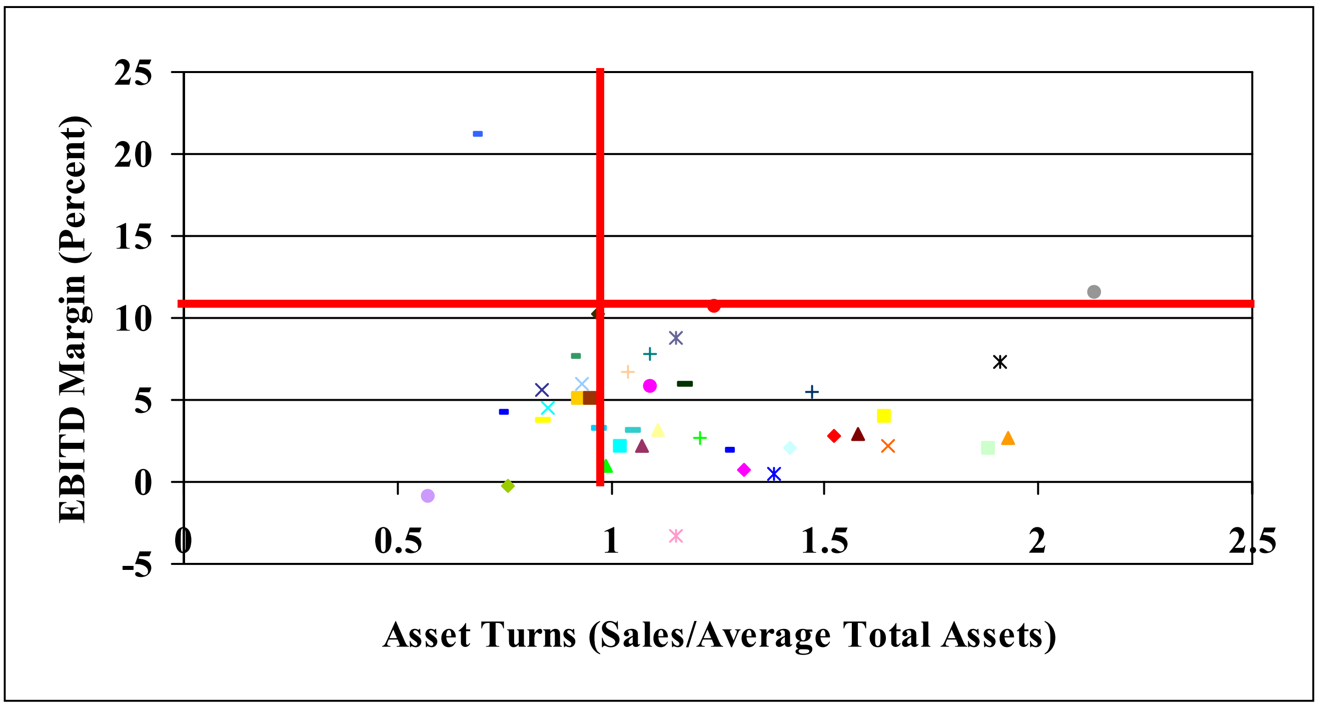
Figure 2.4 illustrates the recent financial performance of a sample of 39 publicly traded component suppliers.[36] This sample shows a general cluster of automotive financial returns around the S&P 500 average of 0.99 for asset turns (defined by revenues divided by average assets) with many suppliers outperforming this S&P 500 benchmark. Asset turns measure how efficient companies are in generating revenues against a given level of assets — the higher the ratio, the greater the comparative efficiency in creating a dollar of revenue on an asset dollar. However, only a few suppliers beat the S&P 500 average of 10.5 percent on EBITD margins. Through interviews and analysis of company reports, we find that companies operating with superior financial results typically exhibit the following characteristics:

- Proprietary technology,

- Company specifications that are defacto-industry standards, and
- Component (or system) sector-dominate market share.

The reasonably good showing on asset turns with poor earning margins indicates that suppliers' financial problems stem primarily from cost structure issues — including overhead, direct labor, and direct materials — that are not overcome by the three strategies listed above. It is through the execution of these three strategies — alone and in combination — that suppliers may begin to migrate their current product portfolios towards improved financial returns.

Figure 2.4
Automotive Supplier Asset Turns & EBITD Margins versus S&P 500 Average
Sample of 39 Automotive Supply Firms
12-Month Trailing Averages



Outside of the superior performers, current financial returns limit the supply base's strategic options — retained earnings are not substantial enough to invest in new technologies or make non-program related investments for increased productivity. For public companies, equity financing cannot be attracted forcing increased levels of debt to make acquisitions or other strategic investment. Private firms have limited access to new debt financing based on poor interest expense coverage ratio numbers. The result is an increased, non-productive level of tension between the suppliers and their customers (over pricing), suppliers and their financial partners (over access and terms of capital), and suppliers and their labor forces (over restructuring pressures).

To improve the operating performance of the supply base — to levels not just of the average automotive peer group, but to the levels of the S&P500 financial benchmark where the real benchmark for capital allocation is located — requires three critical responses:

- First, supply base in the 2nd and 3rd tiers will need to be radically restructured and consolidated to lower material costs (subassemblies and parts) and rationalize capacity (engineering, production, and distribution).

- Second, suppliers must migrate their product portfolios towards higher rates of returns through intelligent bidding on new programs and eliminating lower margin products.
- Third, suppliers must strategically align and partner their resources with customers (both vehicle manufacturers and other suppliers alike) that best define the relationship to allow a supplier to optimize its business model — most often a profitable balance between generic modules (lowest supplier cost/marginal OE differentiation) and customer-specific adaptations (higher supplier cost/significant OE differentiation which should relate to premium pricing for both supplier and OE).

While the supply base is not perfectly bipolar, there are many suppliers performing reasonable well and a core group basically looking to double their current return on assets. Step one in the restructuring process toward this goal will be the rationalization of production capacity. The body structure sector is likely to move quickly down the rationalization path. As we indicated above, the financial performance of this supplier sector is generally weak — except for those companies or programs sourcing specialized stampings. The substandard financials (under-performing their auto peer group in ROA and EBITDA measures) for the sector are in part a result of some 24 structural components competitors in this supplier sector with only 3 competitors each having over 20 percent market share (the 21 other competitors split 36 percent market share of North American production).[37] In contrast, many components within the interiors' sector, such as seats and instrument panels, have been consolidated through mergers and acquisitions. However, components in the interior/exterior trim sector — such as bumper fascias — face an extremely fragmented market of 22 competitors; the top 3 controlling 54.7 percent of the 2001 MY North American production.[38]

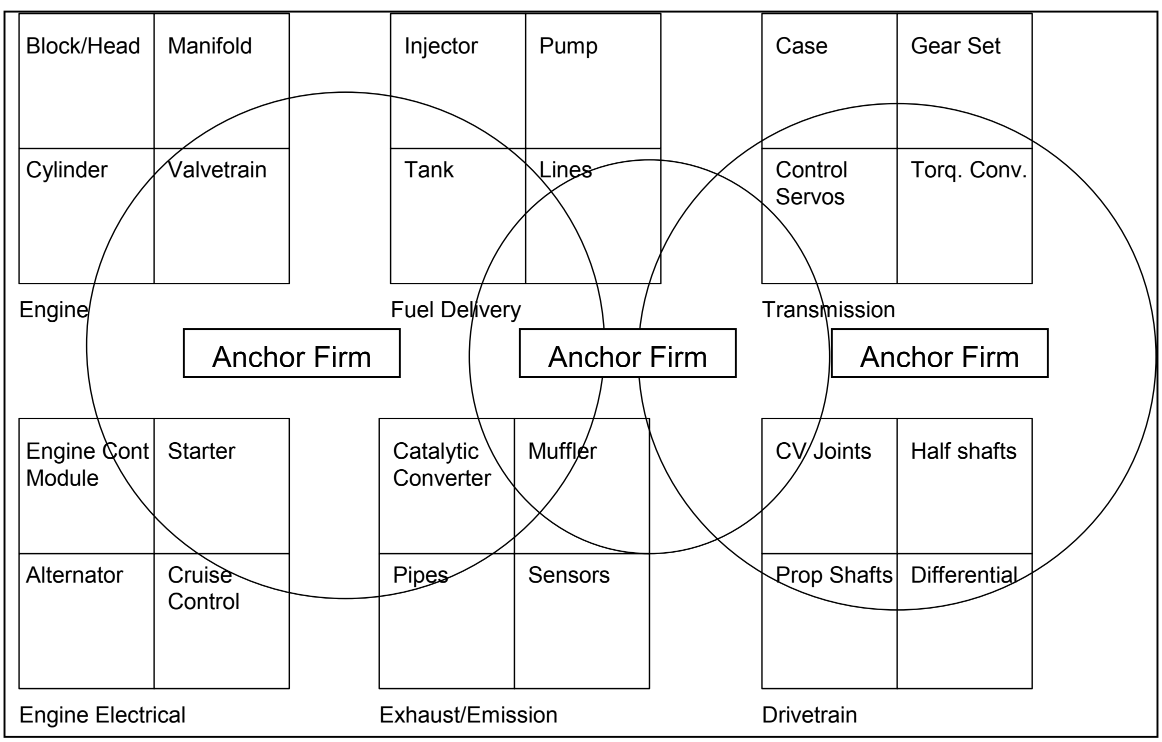
Many other components — from exhaust manifolds to control arms exhibit the same fractionalized market structure. Other sectors, such as suspension springs and brake assemblies have rationalized to 3 or 4 major players each with over 15 percent market share of a regional market — although a case could be made that additional consolidation is still required.[39] The basic premise of a 20 percent regional market share threshold is that at this level a supplier can influence designs and standards to the extent necessary to control their own cost structure. At this point, these markets are optimized with 3 or 4 dominant players (HVAC, diesel injectors, and brakes systems are examples typically identified) who have an opportunity to build a sustainable business as engineering and production scales are created. The business can truly be successful if flexibility is introduced in production to allow rebalancing production lines as product lines, regional markets, or individual customers exceed or fail to meet volume expectations. We see these markets being defined primarily on a regional basis for components and systems whose competition is just that, regional. However, where international capacity can be targeted on a region through imports, then a supplier's market space must be defined at an international level.

The second major strategy on the suppliers plate is to migrate their product portfolios toward higher returns by sweeping out low financial performing products and carefully choosing new programs to fill the pipeline of future business. There is nothing radically new about this business model — one of high engineering and production capacity utilization rates stemming from a dominate market share position through a focus on specific systems and components and disciplined manufacturing and business processes. While the model is not new, few firms achieve or practice the model fully. Certainly, a company like Gentex Corporation (which is the outlier firm in Figure 2.4) comes to mind as a company that is successfully playing out this strategy. Gentex has successfully maintained high levels of engineering capacity utilization by establishing a highly effective internal network to "barter" resources across product lines and functional departments. The company has also focused on improving production throughput on existing lines before allocating additional capital for new floor space. There is no reason that this discipline cannot be played out within individual divisions of large, billion dollar plus suppliers.

Without a doubt, purposeful supply base restructuring is a pathway to the more efficient business model. But it will not be the massive horizontal mergers that the industry produced in the 1990s. Those mergers were based on component diversification within defined systems and customer diversification within regional definitions. The dramatic asset portfolio migration we see facing the industry is a rapid consolidation around critical technology expertise (engineering scale of economies), production capabilities (manufacturing scale of economies), and capital access (financial scale of economies). The target of this restructuring is the 2nd and 3rd tier suppliers as pressures build on the 1st tier suppliers to improve their supply chains and related cost structures.

We have well defined the size of the markets for the total vehicle, the aftermarket and energy markets, and the individual subsystems. For the original equipment suppliers we have estimated the future migration of system value within the vehicle. Certainly, total vehicle production demand and systems' value share create the top line opportunity for any supplier. Delivering on the financial returns though will require a restructuring effort focused around recombining the engineering, manufacturing, and distribution assets to produce the value required by these markets in the most efficient manner.

Figure 2.5
A Stylized Illustration of a Supplier Systems Integrator



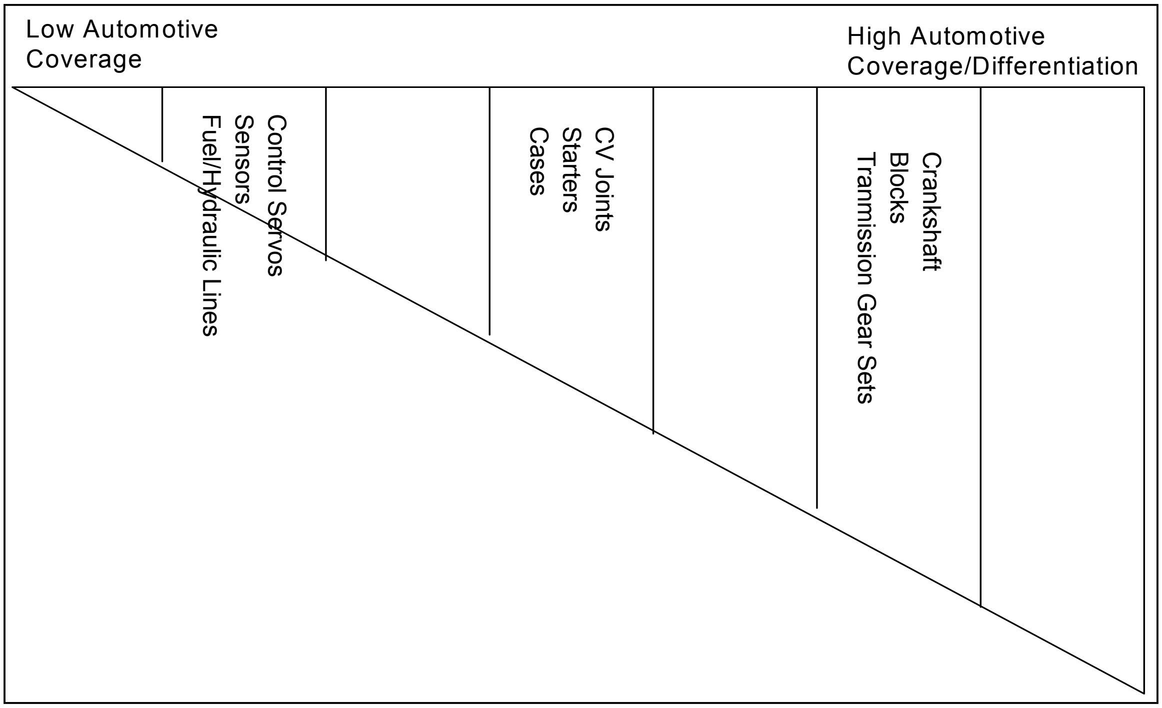
We see this restructuring occurring in the following manner. First, we do not believe that the industry will collapse into a handful of super suppliers — $10 billion plus entities that engineer, manufacture, and support complete super-systems. By this we mean 5 or 6 "buckets" including powertrain, body-in-white, chassis/suspension, etc. Instead, what we do see is a number of suppliers that play an integrating roll across key component systems and subsystems. An example is provided in Figure 2.5. The individual blocks of 4 components illustrate an example of components grouped by like production processes, product technologies, or critical functionality. This is where the asset swapping becomes an opportunity to pull together the assets that must come together under one set of management control. The circles represent stylized grouping of where the supplier integrators could play. There may be companies that pull together transmission and drivetrain and others that pull together the engine components, fuel delivery, engine electrical, and exhaust and emission control. The anchor companies or systems integrators represented by these circles may or may not own the underlying manufacturing assets — but they must insure that they can effectively and efficiently integrate these components into a highly functional and valuable system. We see these system integrators playing an important "patch" between what any individual vehicle manufacturer may require (in the form of engineering support, purchasing criteria, or manufacturing requirements) and the most efficient engineering and manufacturing structure from the suppliers' perspective. We have already seen some examples of this strategy, including the recent swap between DESC, S.A. de C.V. and TRW to pull piston production together under DESC and engine valves under TRW. In the future, particularly if automotive equity valuations remain weak, we expect more of this asset swapping to continue so that suppliers concentrate on a narrower set of components and systems.

What ever the case on vertical integration, suppliers will not make the intended returns on these modules until they have complete control over their cost structure — that includes product engineering, purchasing, and project management. It may be that some manufacturers will quickly provide this level of flexibility and allow suppliers to amortize the significant levels of engineering and R&D costs over a large number of units. Other customers may be reluctant to let go of this control. Because of this potential delay in the complete control of their cost structures, suppliers should concentrate on improving their engineering, manufacturing, and distribution cost models to support a break-even point at the lowest possible production levels. This will create a sense of discipline that can only make the large runs more profitable.

Figure 2.6 (powertrain is used as an example) shows a framework supplier integrators can use to determine vertical integration within their activity within each of the major subsystem and component areas. Components having little external auto market opportunities — because of the physical size of the component (such as instrument panels in the case of interiors), required volumes (engine blocks), or significant product performance competitive advantage (such as crankshafts and gear set machining) can have a case made for controlling the production — by necessity or by choice. However, as components become less automotive specific, and increased outside market opportunities become available, it appears that suppliers of these components will need to move to consolidate production and sell to a wide range of customers. This is exactly the strategy taken by several of the companies outperforming the S&P 500 as shown in Figure 2.6. This transition is also shown in the recent decision by Dura Automotive to sell off its plastic molding operation to a supplier specializing in plastic molding.

Each individual supplier integrator will need to determine what specific technologies and manufacturing capabilities that they will need to control and own on the inside and which resources they can control and but rent on the outside. We do not envision systems integrators that are only engineering or design firms without being supported in some manner by internal manufacturing operations in at least one or two critical component areas.

Figure 2.6
Likely Vertical Integration — Powertrain Example



In the future, we expect a slightly accelerated growth rate for the materials sector at 1.3 percent CAGR. We have assumed that changes between 1990 and 2000 such as the increased sophistication of engine valvetrains and transmissions, increased electronic content throughout the interior, and the like, have built in a rate of growth that will cover expected required increases in regulatory content and consumer-driven content increases. Over the full course of the 10-year forecast, we show little change in breakout of the value of a total vehicle. We do show directional changes where we continue to believe value will migrate in or out. Three factors typically tend to stabilize the vehicle value mix. First, new technology is often introduced by convincing an OE that the product differentiation and the value equation are such that consumers will pay for the feature (costs passed through) or the manufacturer will offset the cost with a feature delete in another area. This tends to keep initial feature penetration low. On a short-term basis, this will slightly swing the value breakout towards a single system. However, to move the feature into high volumes — and truly affect industry averages — price reductions are often required by the OEMs. This is the second disciplining factor that keeps the systems' breakout in check. Finally, target pricing from the complete vehicle through individual systems and components tends to slow radical changes in the overall mix.

We estimate that over the next 10 years vehicle material costs will increase approximately $2,000 per vehicle.[40] The result is Table 2.2 — shown at a constant unit model. That is, there are no additional production units calculated into this model. In addition, in this model we hold vertical integration constant at 33 percent. Vehicle value migration through 2010 was estimated through a process of reviewing each component sector individually, estimating technology introductions and consumer demand preferences[41], incorporating pricing information from vehicle manufacturers and component supplier interviews, and applying additional sources of resident knowledge. From a bottom up approach with as detailed component information as possible, a weighted average of new technology costs were offset by assumed productivity improvements and continued customer price-down efforts. We assume that there will be a better future pricing environment than the 5 percent to 10 percent that supplier are giving back to win or defend business. However, we do assume that prices will be kept in check until individual market sectors are rationalized.

We forecast engine and drivetrain value share to continue to increase based on the introduction of new technologies to improve fuel economy and emission controls. There is an assumption that powertrain offerings will become more diverse with hybrids and continuously variable transmissions gaining market share, but we do not foresee significant fuel cell applications that would move the industry-level averages. Interior value mix continues to increase, however at a slower rate. We assume moderate, but consistent growth in telematic equipment — but not a wholesale movement of standard equipment. And as telematic installations do increase, we assume the typical electronic cost curves that would drive down unit costs through our 10 year forecast (in addition, it is the service revenue side that is the real attractive growth market for telematics — which is outside of the component revenue stream and at risk for the vehicle manufacturers or the current supply base to capture).

Within the body structure sector, we do foresee a greater mix of materials — including plastics and aluminum — as well as a rebound in price for steel. However, continued reduction in weight, through better designs and product mix will limit total system value shift. In addition, there will also likely be a redistribution of value as engines are shipped into assembly plants on a built up cradle and rear suspensions capture some of this same value from body structure. For suppliers, the content and components are still present, but the customer and ship points will evolve. Our secondary sources as well as primary input from CAR analysts show significant changes within the chassis system with the increasing applications of electric steering and electric braking. Here there will be significant pressure to keep net cost changes at a minimum as these new technologies are introduced. As these systems are typically lighter than the systems they replace they allow secondary trade off benefits such as reduced body structure weight (and material usage) allowing early introduction of these new technologies while keeping a vehicle's total cost targets under control.

Within the electrical system, we do forecast an increase in 42-volt system applications. This will add cost to the electrical system. However, we foresee the integration of electrical wiring harnesses and other content into the interior system that will offset increased costs of 42-volt systems in the electrical system area by shifting costs into the interior system. Multiplexing and fiber optics — technologies awaiting breakthrough applications — will remain just that, application-by-application increases but only where specific costs and weight reductions can be justified by other cost reduction incentives. It does not appear that these technologies are as "enabling" as 42-volt systems to justify any increased costs into the electrical system. Finally, for HVAC, we assume that the most significant technology change will be the introduction of electric compressors (enabled by the greater electrical supply of the 42-volt systems). We do not assume that this technology will have a net increase in cost over current engine-driven compressors.

Table 2.2
Value Breakout of Component Value within a Vehicle
Unit Constant Model[42]

	2010 Percent of Total Vehicle	**2010** Billion US $ Total Market	**2010** per Vehicle Cost	**2000** Percent of Total Vehicle	**2000** Billion US$ Total Market	**2000** per Vehicle Cost
Engine	16.4%	$45	$2,564	16%	$38.7	$2,173
Drivetrain	13.4%	$37	$2,095	13%	$31.4	$1,770
Body Structure	15.3%	$42	$2,392	16%	$38.7	$2,173
Interior & Exterior (trim)	18.5%	$51	$2,893	18%	$43.5	$2,450
Steering and Suspension	10%	$27	$1,564	10%	$24.2	$1,360
Fuel Delivery	4.8%	$13	$750	5%	$12.1	$680
Engine Electrical	3.8%	$10	$594	4%	$9.7	$542
Exhaust & Emission	2.9%	$8	$453	3%	$7.3	$410
Brakes. Wheels, & Tires	5%	$14	$782	5%	$12.1	$680
HVAC	2.9%	$8	$453	3%	$7.3	$409
Chassis Electrical	7%	$19	$1,094	7%	$16.9	$9,51
	100%	$274.5	$15,635	100%	$241.9	$13,596

At the beginning of this section, we stated that the decade of the 1990s offered a unique set of macro-market conditions for the suppliers to prosper, yet the suppliers as a group, had not cut costs fast enough to maintain profitability over the period. It appears that that the decade of 2000 to 2010 will offer many of the same macro-opportunities: additional content within the vehicle, additional outsourcing potential from the vehicle manufacturers, and additional units of vehicle production. It also appears that automotive component pricing in the next decade will be similar to the previous decade and not allow supplier profitability without the most efficient cost structure in place. This includes variable cost structures in the form of the most efficient subtier supply chains as well as fixed cost structures with the most efficient utilization of engineering, manufacturing, and distribution assets.

APPENDIX A

A.1 PERSONAL CONSUMPTION EXPENDITURE

Personal consumption expenditure data was aggregated from the Bureau of Economic Analysis. Current dollar and chain-weighted dollar figures were obtained for each category. The analysis and the forecasting of data were carried out in chain-weighted 1996 dollars. These figures were then converted into constant dollars.

A.2 METHODOLOGY

Analysis

All analysis was completed on chain-weighted 1996 dollars. The data contained in the personal consumption expenditure accounts is based on an identity equation. Extracted from the tables of data were the following categorical figures:

1. Greasing, Parking, Storing, Washing
2. Repair
3. Rental
4. Leasing
5. Energy (Gasoline & Oil)
6. Tires & Tube
7. Accessories & Parts
8. Net Motor Vehicle Insurance

THE DATA WAS COLLECTED FOR THE PERIOD 1980 THROUGH 2000, IN EVERY CASE EXCEPT RENTAL, LEASING, AND GREASING, PARKING, STORING, WASHING. THESE CATEGORIES WERE REPORTED IN AGGREGATE UNTIL 1987. THIS ANOMALY AFFECTED THE VEHICLE, RENTAL, LEASING AND THE SERVICES CALCULATIONS. THE AGGREGATE FOR EACH SECTOR WAS OBTAINED BY ADDING THE APPROPRIATE CATEGORIES (I.E. TIRES & TUBE PLUS ACCESSORIES & PARTS EQUALS THE AGGREGATE PARTS FIGURE).

Due to lag time in the publication of the financial statistics, only data from 1980 through 1997 was obtained. The limited number of observations may be problematic for the statistical analysis and forecasting of the consumer finance data. Additionally the aggregate finance analysis and forecasting numbers were affected by this occurrence.

Analysis consisted of running single and multiple variable linear regressions. Based on the results of the f-test, it was determined to utilize a single variable regression line. Time was the independent variable; the natural log of each data point was the dependent variable. The growth rate was the coefficient of x.

For complete categorical definitions please see www.bea.doc.gov.[43]

A.3 FORECASTING

The regression lines obtained in analyzing the data were deemed representative of the data. Forecasting was completed through extrapolating the said lines for ten consecutive years.

A.4 YEAR 2000 DOLLARS

As stated previously, all analysis was completed in 1996 chain-weighted dollars to obtain real growth rates. There is no statistically sound way to predict the rate of inflation until 2010, therefore data points are presented in year 2000 dollars. To transform the chain-weighted dollars into current dollars the ratio of year 2000 dollars to year 1996 dollars for each specific category was multiplied by the chain-weighted figure.

For the finance figure the Consumer Price Index, all Urban Consumers (CPI-U) was used as the deflator.

APPENDIX B

B.1 TWO METHODS FOR ESTIMATING CONSUMER VALUE IN PASSENGER CARS

During the course of this report, it has become obvious that automakers are not being adequately compensated for the additional content they have added to their products. In this appendix, we have attempted to illuminate and quantify the shortfall in the automakers' value. Table B.1, illustrates two methods to establish this assumption.

The first method, detailed in the upper portion of Table B.1, compares the level of the consumer price index (CPI)[44] for the general economy with the CPI for new light vehicles. With this method, we can see that the CPI for Light Vehicles (LV), Trucks, and Autos has not risen as quickly as the overall CPI since the late 1980s. This suggests that the cost for a new light vehicle has not risen as fast as overall inflation, thus offering new vehicle consumers relatively good value for their dollar, compared with other goods. Figures B.1–B.3 graphically represent these changes in automotive and overall CPI.

Careful examination of the Figures B.1–B.3 reveals three distinct periods of relationship between the various CPI indexes. During the period of 1970–1983, the LV-CPI was actually higher than the All items-CPI, indicating that light vehicle prices were rising faster than prices for other goods, and suggesting that manufacturers were receiving greater value for light vehicles than were consumers. In the period from 1983–1988, the values of both indexes were similar, as new vehicle prices tracked consistently with the general economy CPI. However, beginning around 1988 through the present, the rate of increase of the All items-CPI has actually outpaced the new vehicle CPI indexes. In fact, the automotive-related consumer price indexes leveled off, and actually decreased slightly, after 1997, while the All items-CPI continued to increase steadily — a troubling trend for automobile manufacturers as they struggle to be compensated for added content, which is having a dire effect on their profit margins. The compressed level of the new vehicle CPI indexes indicate that value has shifted from the manufacturers to consumers beginning in the late 1980s, with the rate of the value shift appearing to have escalated in the last few years.

Referring back to the lower portion of Table B.1, our second method for estimating consumer value attempts to quantify the increase in consumer value over the last two decades. A comparison of the change in average new car prices during the period from 1980–90 and again from 1990–2000, suggests that consumers are realizing greater value during the 1990s than they did during the 1980s — and conversely, manufacturers have been experiencing decreasing value for their products.

The unit of comparison for this methodology is a new passenger car built in 1967 and its comparable purchase price in 1980, 1990, and 2000. The average cost of a new car more than doubled from 1980 ($7,591) to 1990 ($16,157), while increasing less than 25 percent by 2000 ($20,355). Taking the difference in average price from 1980 to 1990 and from 1990 to 2000, we subtracted out the price change due to inflation and additional mandated safety and emissions equipment (in order to compare the same car from decade to decade). This analysis reveals that there is additional content recognized and paid for in the amount of $2,465 in 1990, while the additional content is valued at only $652 in 2000. This comparison suggests that consumers are paying less for additional content in 1990–2000 than they were in 1980–1990. This occurs in a decade (1990–2000) that saw widespread applications in vehicles of such innovations as anti-lock brake systems (ABS), overhead cam engines, and compact disc changers. For instance, in 1990, the installation rate of ABS was approximately 8 percent, while by 2000, ABS was being installed in over 65 percent of all passenger cars[45]. The cost to manufacturers of adding these three items alone is in the range of $1500 to $1800[46] — much more than the $652 added content cost paid by consumers. This is a dire trend for manufacturers, as it appears they are having a difficult time passing the costs of additional content on to consumers, which in turn, is eating into their per vehicle profit margin.

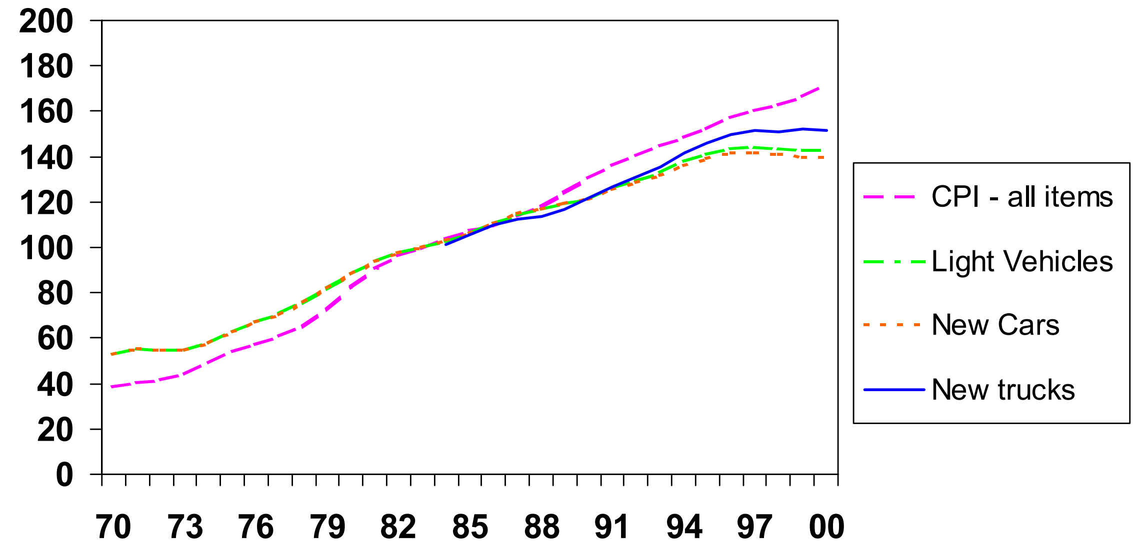
Table B.1
Two Methods for Estimating Consumer Value[47]

TWO METHODS FOR ESTIMATING CONSUMER

	1980	1990	2000
CPI-U LIGHT VEHICLES	88.5	121.4	142.8
CPI-U NEW CARS	88.4	121	139.6
CPI-U NEW TRUCKS		121.6	151.7
CPI-U ALL ITEMS	82.4	130.7	172.2
Average expenditure per new car	$7,591	$16,157	$20,355
(Weeks of income)	(18.7)	(24.7)	(19.6)
1967 comparable with added safety and emissions equipment	$6,962	$10,851	$13,178
(Weeks of income)	(17.2)	(16.2)	(12.7)
1967 comparable without added safety and emissions equipment	$5,726	$7,938	$9,157
(Weeks of income)	(14.2)	(12.2)	(8.8)

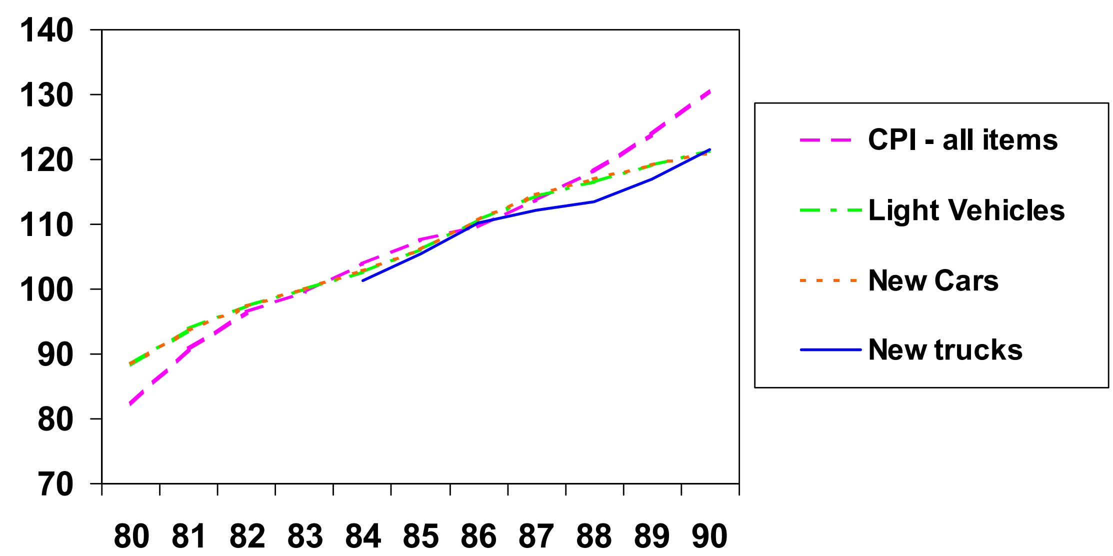
	1980-90	1990-00
Difference in average price	$8,566	$4,198
Minus safety and emissions	-$3,889	-$2,327
Minus inflation	-$2,212	-$1,219
Value Added	**$2,465**	**$652**

Figure B.2[48]
CPI: 1970–2000 (not seasonally adjusted)
Automotive-CPI Not Rising as Fast as All item-CPI



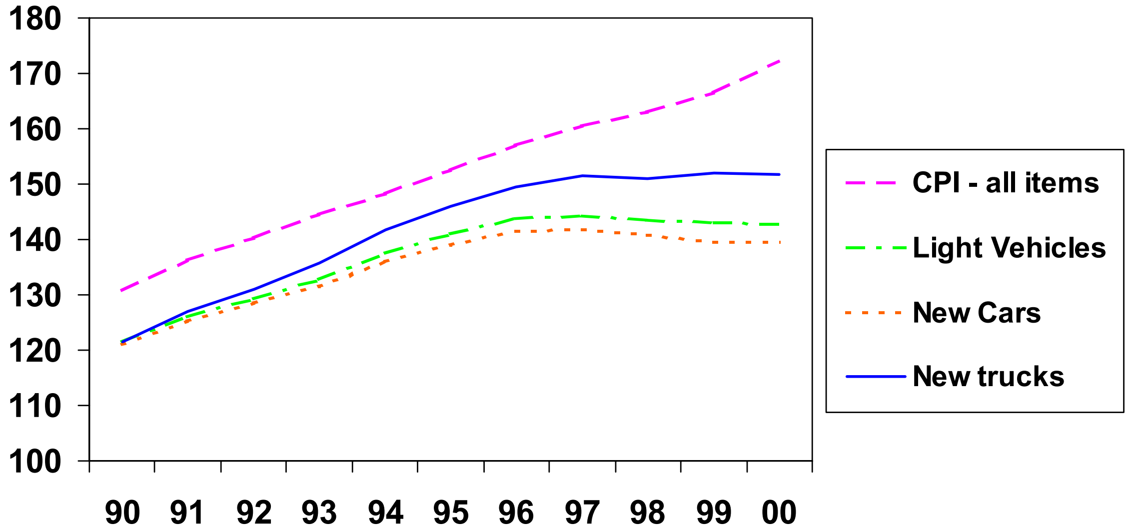
Source: Bureau of Labor Statistics (BLS), August 27, 2001

Figure B.3[49]
CPI: 1980–1990 (not seasonally adjusted)
All Item-CPI and Automotive-CPI Track Together



Source: Bureau of Labor Statistics (BLS), August 27, 2001

Figure B.4[50]
CPI: 1990–2000 (not seasonally adjusted)
All item-CPI Outpaces Automotive-CPI



Source: Bureau of Labor Statistics (BLS), August 27, 2001

APPENDIX C

C.1 CROSSWALK TABLES FOR COMPONENT VALUE

Vehicle system descriptions in Part 1 — The Macro Value Chain are divided into six main vehicle system groups: powertrain, interior, chassis, body, electrical, and heating, ventilation, and air conditioning (HVAC).

Vehicle system descriptions in Part 2 — The Component Value Chain are divided into 11 vehicle system groups: engine, drivetrain, body structure, interior and exterior, steering and suspension, fuel delivery, engine electrical, exhaust and emission, HVAC, chassis electrical, and brakes, wheels, and tires.

The adjustment was made to facilitate more detailed component analysis in Part Two. Because this section of the report focuses more heavily on vehicle system analysis, more specific system classifications are provided than those used in the macro analysis found in Part 1.

Table C.1
Crosswalk Table for Component Value 1990
($ Billions)

1990

11 System Vehicle		
System	**Share**	**Value**
Engine	15%	25.5
Drivetrain	12%	20.4
Body Structure	19%	32.2
Interior & Exterior (trim)	16%	27.2
Steering and Suspension	10%	17.0
Fuel Delivery	5%	8.5
Engine Electrical	5%	8.5
Exhaust & Emission	3%	5.1
Brakes. Wheels, & Tires	5%	8.5
HVAC	3%	5.1
Chassis Electrical	7%	11.9
	100%	169.7

6 System Vehicle		
System	**Share**	**Value**
Powertrain	32%	$54.304
	Engine 15%	25.455
	Drivetrain 10%	16.97
	Fuel Delivery 5%	8.485
	Exhaust & Emission 3%	5.091
Interior	16%	27.152
	Interior & Exterior Trim 16%	27.152
Chassis	19%	32.243
	Steering & Suspension 10%	16.97
	Brakes, Wheels & Tires 5%	8.485
	Drivetrain 2%	3.394
	Body Strucutre 2%	3.394
Body	17%	28.849
	Body Structure 17%	28.849
Electrical	13%	22.061
	Chassis Electrical 7%	11.879
	Engine Electrical 5%	8.485
HVAC	3%	5.091
	HVAC 3%	5.091

Some percentages may not sum to 100% due to rounding.

Table C.2
Crosswalk Table for Component Value 2000
($ Billions)

2000

11 System Vehicle

System	Share	Value
Engine	16%	$38.7
Drivetrain	13%	31.4
Body Structure	16%	38.7
Interior & Exterior (trim)	18%	43.5
Steering and Suspension	10%	24.2
Fuel Delivery	5%	12.1
Engine Electrical	4%	9.7
Exhaust & Emission	3%	7.3
Brakes, Wheels, & Tires	5%	12.1
HVAC	3%	7.3
Chassis Electrical	7%	16.9
	100%	$241.

6 System Vehicle

System	Share	Value
Powertrain	33%	$79.8
	Engine 16%	38.7
	Drivetrain 10%	24.2
	Fuel Delivery 5%	12.1
	Exhaust & Emissions 3%	7.3
Interior	18%	43.5
	Interior & Exterior (Trim) 16%	38.7
	Chassis Electrical 2%	4.8
Chassis	19%	46.0
	Steering & Suspension 10%	24.2
	Brakes, Wheels & Tires 5%	12.1
	Drivetrain 2%	4.8
	Body Structure 2%	4.8
Body	18%	43.5
	Body Structure 15%	36.3
	Interior & Exterior Trim 2%	4.8
Electrical	8%	19.4
	Chassis Electrical 5%	12.1
	Engine Electrical 4%	9.7
HVAC	4%	9.7
	HVAC 4%	9.7

Some percentages may not sum to 100% due to rounding.

Table C.3
Crosswalk Table for Component Value 2010
($ Billions)

2010

11 System Vehicle

System	Share	Value
Engine	16%	$45.0
Drivetrain	13%	36.8
Body Structure	15%	42.0
Interior & Exterior (trim)	19%	50.8
Steering and Suspension	10%	27.5
Fuel Delivery	5%	13.2
Engine Electrical	4%	10.4
Exhaust & Emission	3%	8.0
Brakes. Wheels, & Tires	5%	13.7
HVAC	3%	8.0
Chassis Electrical	7%	19.2
	100%	$274.5

6 System Vehicle

System	Share	Value
Powertrain	38%	$104.3
	Engine 16%	43.9
	Drivetrain 13%	35.7
	Fuel Delivery 5%	13.7
	Exhaust & Emissions 3%	8.2
Interior	19%	52.2
	Interior & Exterior (Trim) 19%	52.2
Chassis	15%	41.2
	Steering & Suspension 10%	27.5
	Brakes, Wheels & Tires 5%	13.7
Body	15%	41.2
	Body Structure 15%	41.2
Electrical	11%	30.2
	Chassis Electrical 7%	19.2
	Engine Electrical 4%	11.0
HVAC	3%	8.2
	HVAC 3%	8.2

Some percentages may not sum to 100% due to rounding.

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APPENDIX D

D.1 VALUE CHANGE AND SHARE COMPARISONS

Table D.1
Value Change Comparison
(Percentage Change)

	1990-2000	2000-2010/28%	2000-2010/33%	2000-2010/CONS
Light Vehicle Purchases	48.4%	48.0%	48.0%	8.9%
Advertising Cost	10.5%	44.6%	44.6%	6.4%
Gross Dealer Margin	20.7%	48.0%	48.0%	8.9%
Freight Costs	24.9%	62.6%	62.6%	0.0%
Assembled Vehicle Value	52.6%	47.8%	47.8%	9.1%
OE Value	79.8%	25.4%	49.3%	0.0%
Materials and Other	42.0%	58.8%	47.1%	13.6%
Total labor compensation	23.7%	25.4%	49.3%	0.1%
Other OE Value Added	110.4%	25.4%	49.3%	0.0%
Materials Purchases	42.5%	58.8%	47.1%	13.5%
Powertrain	47.0%	80.5%	67.1%	29.0%
Interior	60.4%	63.2%	51.1%	16.6%
Chassis	42.5%	25.4%	16.1%	-10.4%
Body	50.9%	35.0%	25.0%	-3.5%
Electrical	-12.3%	114.4%	98.5%	53.2%
HVAC	90.0%	15.1%	6.6%	-17.7%
Average	45.9%	48.7%	47.3%	8.0%

Table D.2
Value Share Comparison
(Share of Light Vehicle Purchases)

	1990	2000	2010 - 28%	2010 - 33%	2010 - CONS
Advertising Cost	2.6%	1.9%	1.9%	1.9%	1.9%
Gross Dealer Margin	7.5%	6.1%	6.1%	6.1%	6.1%
Freight Costs	2.3%	1.9%	2.1%	2.1%	1.8%
Total labor compensation	8.7%	7.2%	6.1%	7.3%	6.6%
Other OE Value Added	15.9%	22.5%	19.1%	22.7%	20.7%
Powertrain	18.7%	18.5%	22.5%	20.9%	21.9%
Interior	9.3%	10.1%	11.1%	10.3%	10.8%
Chassis	11.1%	10.6%	9.0%	8.3%	8.8%
Body	9.9%	10.1%	9.2%	8.5%	8.9%
Electrical	7.6%	4.5%	6.5%	6.0%	6.3%
HVAC	1.7%	2.2%	1.7%	1.6%	1.7%
Energy Costs	0.3%	0.3%	0.3%	0.3%	0.3%
Warranty Costs	3.9%	3.1%	3.1%	3.1%	3.1%
Other Purchases	0.6%	0.9%	1.3%	0.9%	1.2%
Total	100.0%	100.0%	100.0%	100.0%	100.0%

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APPENDIX E

ENDNOTES

[1] For example, the BEA estimated the value of U.S. automotive output to be $348 billion in 1999. Our estimate of the level of the U.S. automotive chain is more than twice this value in 2000 at $893 billion. The major difference between the two approaches lies in the fact that we include the value contained in total U.S. light vehicle sales no matter where it is produced, and we also include the value of after-sale products and services sold to U.S. consumers and business to maintain and operate the total U.S. fleet of light vehicles. To further understand the BEA approach and the economic impact on the U.S. economy of this definition of auto output see: Fulton, George A. and McAlinden, Sean P., *Contribution of the Automotive Industry to the U.S. Economy in 1998: The Nation and its Fifty States*, A Study prepared for the Alliance of Automobile Manufacturers, Institute of Labor and Industrial Relations, The University of Michigan, and the Center for Automotive Research, Environmental Research Institute of Michigan, Ann Arbor, Winter 2001.

[2] National Automobile Dealers Association, sales data 1978–2000 — sent via e-mail correspondence with Jason Altman, and NADA Market Data Book, 2001.

[3] Ibid.

[4] Unless otherwise noted, all references to constant dollars in this report are in 2000 dollars, converted using the CPI-U all items index.

[5] Personal Consumption Expenditure (PCE) data was obtained from the U.S. Bureau of Economic Analysis website at: http://www.bea.doc.gov/bea/dn1.htm. The following files contain the data utilized:

206U: Personal Consumption Expenditures

207U: Real Personal Consumption Expenditures

705U: Chain-Type Price Indexes for Personal Consumption Expenditures

808U: Motor Vehicle Output

809U: Real Motor Vehicle Output

718U: Chain-Type Price Indexes for Personal Consumption Expenditures

[6] National Automobile Dealers Association, sales data 1978–2000 — sent via e-mail correspondence with Jason Altman, and NADA Market Data Book, 2001.

[7] During the course of this report, it became obvious that the value the automakers receive from this increased consumer spending has been shrinking. For a comparison of consumer spending and the shortfall in the automakers' value, please see Appendix B.

[8] Personal Consumption Expenditure (PCE) data was obtained from the U.S. Bureau of Economic Analysis website at: http://www.bea.doc.gov/bea/dn1.htm. The following files contain the data utilized:

206U: Personal Consumption Expenditures

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[9] National Automobile Dealers Association, sales data 1978–2000 sent via e-mail correspondence with Jason Altman, and NADA Market Data Book, 2001

[10] NADA, 2001

[11] Ibid.

[12] Set at $475 (constant 2000 dollars) per vehicle, imported or domestic.

[13] U.S. Department of Commerce, Bureau of the Census, *Annual Survey of Manufacturers. Statistics for Industry Groups and Industries,* (AS-1). 1983–1999 volumes, Washington D.C., U.S. Government Printing Office; and U.S. Department of Commerce, Bureau of the Census, *1997 Census of Manufacturers*, Industry Series, "All Other Motor Vehicle Parts Manufacturing," EC97M-3363K, U.S. Government Printing Office, Washington D.C., October, 1999.

[14] U.S BOC Census of Manufacturing is performed every five years. U.S. BOC Annual Survey of Manufacturers released at two-year lag.

[15] U.S. Department of Commerce, Bureau of the Census, *Annual Survey of Manufacturers. Statistics for Industry Groups and Industries,* (AS-1). 1983-1999 volumes, Washington D.C., U.S. Government Printing Office; and U.S. Department of Commerce, Bureau of the Census, *1997 Census of Manufacturers*, Industry Series, "All Other Motor Vehicle Parts Manufacturing," EC97M-3363K, U.S. Government Printing Office, Washington D.C., October, 1999.

[16] Ward's Motor Vehicle Facts & Figures 2001, Ward's Communication, Southfield, MI

[17] U.S. Census Bureau, National Personal Transportation Survey 1969–1995 (most recent data)

[18] Personal Consumption Expenditure (PCE) data was obtained from the U.S. Bureau of Economic Analysis website at: http://www.bea.doc.gov/bea/dn1.htm. The following files contain the data utilized:

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718U: Chain-Type Price Indexes for Personal Consumption Expenditures

Data for the period 2001–2010 is based on CAR projections

[19] For Figures 1–3, 1–4, and 1–5, each of the disaggregated components was converted to 2000 constant dollars according to a slightly different deflator — calculated from each component's specific trend data — rather than using the deflator calculated for the aggregate only. Therefore, the individual components may not add to the exact aggregate figure for any particular year.

[20] Personal Consumption Expenditure (PCE) data was obtained from the U.S. Bureau of Economic Analysis website at: http://www.bea.doc.gov/bea/dn1.htm. The following files contain the data utilized:

206U: Personal Consumption Expenditures

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Data for the period 2001–2010 is based on CAR projections

[21] Ibid.

[22] Ibid.

[23] Ibid.

[24] U.S. Department of Commerce, Bureau of the Census, *Annual Survey of Manufacturers. Statistics for Industry Groups and Industries,* (AS-1). 1983–1999 volumes, Washington D.C., U.S. Government Printing Office; and U.S. Department of Commerce, Bureau of the Census, *1997 Census of Manufacturers*, Industry Series, "All Other Motor Vehicle Parts Manufacturing," EC97M-3363K, U.S. Government Printing Office, Washington D.C., October, 1999.

[25] U.S. Department of Commerce, Bureau of the Census, *1997 Census of Manufacturers*, Industry Series, "All Other Motor Vehicle Parts Manufacturing," EC97M-3363K, U.S. Government Printing Office, Washington D.C., October, 1999.

[26] General Motors Corporation, *Annual Reports,* 1990 and 2000; Ford Motor Company, *Annual Reports,* 1990 and 2000; Daimler Chrysler AG, *Annual Report,* 2000; Chrysler Corporation, *Annual Report,* 1990; and Daimler Chrysler, *SEC Filing, Form 20-F,* 2000.

[27] U.S Department of Commerce, Bureau of Economic Analysis. Data obtained for the growth calculation from the following website: http://www.bea.doc.gov/bea/dn/gdplev.xls

[28] Based on the S&P Automotive Supplier Index

[29] The 1990 base estimate numbers are sourced from Dan Luria, et al, Industrial Technology Institute for the Auto-in-Michigan Project. Aggregating primary data from two full-line manufacturers and secondary data from an investment bank derived the 2000 estimates.

[30] See Appendix C for a description of how the eleven areas of component costs were combined into the six material cost categories show in Part 1.

[31] Data sources for these scatter graphs are from CAR survey data on the financial health of the supply base (work completed in 2001 for the Michigan Economic Development Corporation), personal interviews, and company public filings. Attempts were made in all cases to get company or divisional data relating to a specific component line.

[32] Ibid.

[33] Dan Luria, *Calculating Big Three Vertical Integration*, Industrial Technology Institute, August 1990, Vehicle manufacturers, US Governmental Sources, CAR Estimates.

[34] CAR estimates.

[35] Sources for this analysis include the University of Michigan Office for the Study of Automotive Transportation Delphi X Forecast and Analysis of the North American Automotive Industry (Technology and Materials volumes), personal interviews, and CAR estimate

[36] The sample base is primarily made up of public companies with a significant share of total revenue from the automotive sector. Data was obtained from public filings and Morningstar.com

[37] CSM Worldwide Northville, Michigan. Share based on 2001 model year North American production in dollars.

[38] Ibid.

[39] Source: CSM Worldwide, Northville, Michigan

[40] This estimate is from the supply side. It is interesting to note that J. D. Powers and Associates has performed consumer-based research indicating that the consumer may pay up to $4,000 (which would be at the manufacturers suggested retail price level) more over the next 10 years for additional content. This ratio of 2 to 1 for material cost to retail price is consistent with the current ratio of component costs to retail prices.

[41] Sourced primarily from the University of Michigan Office for the Study of Automotive Transportation Delphi X Forecast and Analysis of the North American Automotive Industry Technology Volume

[42] Dan Luria, *Calculating Big Three Vertical Integration*, Industrial Technology Institute, August 1990, Vehicle manufacturers, US Governmental Sources, CAR Estimates

[43] Personal Consumption Expenditure (PCE) data was obtained from the U.S. Bureau of Economic Analysis website at: http://www.bea.doc.gov/bea/dn1.htm. The following files contain the data utilized:

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Data for the period 2001-2010 is based on CAR projections

[44] CPI index numbers were obtained from The Bureau of Labor Statistics (BLS) and were accessed at http://stats.bls.gov/cpi/home.htm on August 27, 2001

[45] Automotive News Market Data Books, 1991 and 2001

[46] CAR estimate, 2001

47 Consumer Price Index (CPI) numbers are from The Bureau of Labor Statistics (BLS) and were accessed at http://stats.bls.gov/cpi/home.htm on August 27, 2001. Purchase price comparison information was obtained from Automotive News Market Data Books, 1991 and 2001

[48] CPI index numbers were obtained from The Bureau of Labor Statistics (BLS) and were accessed at http://stats.bls.gov/cpi/home.htm on August 27, 2001

[49] Ibid.

[50] Ibid.

REFERENCES

Automotive News Market Data Books, 1991 and 2001

Center for Automotive Research estimate, 2001

Chrysler Corporation, *Annual Report,* 1990

Cole, David E, and Londal Gerald F., Delphi X, Forecast and Analysis for the North American Automotive Industry. Tenth in a Series. (Ann Arbor: University of Michigan Transportation Research Institute, Office for the Study of Automotive Transportation, 2000

CPI index numbers were obtained from The Bureau of Labor Statistics (BLS) and were accessed at http://stats.bls.gov/cpi/home.htm on August 27, 2001

CSM Worldwide. Share based on 2001 model year North American production in dollars

Daimler Chrysler AG, *Annual Report,* 2000

Daimler Chrysler, SEC Filing, Form 20-F, 2000

Ford Motor Company, *Annual Reports,* 1990 and 2000

General Motors Corporation, *Annual Reports,* 1990 and 2000

Fulton, George A. and McAlinden, Sean P., *Contribution of the Automotive Industry to the U.S. Economy in 1998: The Nation and its Fifty States,* A Study prepared for the Alliance of Automobile Manufacturers, Institute of Labor and Industrial Relations, The University of Michigan, and the Center for Automotive Research, Environmental Research Institute of Michigan, Ann Arbor, Winter 2001

Luria, Dan, *Calculating Big Three Vertical Integration*, Industrial Technology Institute, August 1990, Vehicle manufacturers, US Governmental Sources, CAR Estimates

National Automobile Dealers Association, sales data 1978–2000 — sent via e-mail correspondence with Jason Altman, and NADA Market Data Book, 2001

Personal Consumption Expenditure (PCE) data was obtained from the U.S. Bureau of Economic Analysis website at: http://www.bea.doc.gov/bea/dn1.htm. The following files contain the data utilized:

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718U: Chain-Type Price Indexes for Personal Consumption Expenditures

U.S BOC Census of Manufacturing, *Annual Survey of Manufacturers*, 1999

U.S. Census Bureau, National Personal Transportation Survey 1969–1995

U.S. Department of Commerce, Bureau of the Census, *Annual Survey of Manufacturers. Statistics for Industry Groups and Industries,* (AS-1). 1983–1999 volumes, Washington D.C., U.S. Government Printing Office.

U.S. Department of Commerce, Bureau of the Census, *1997 Census of Manufacturers*, Industry Series, "All Other Motor Vehicle Parts Manufacturing," EC97M-3363K, U.S. Government Printing Office, Washington D.C., October, 1999

U.S Department of Commerce, Bureau of Economic Analysis. Data obtained for the growth calculation from the following website: http://www.bea.doc.gov/bea/dn/gdplev.xls

Ward's Motor Vehicle Facts & Figures 2001, Ward's Communication, Southfield, MI