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ECN 145 Lecture 6



**Transportation Economics:  
A Look at the U.S. and Global  
Auto Industry**

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Early history of automobile manufacturing

- **It did not start in Detroit**
    - First auto manufacturing company, Duryea Motor Wagon Company of Springfield, MA, in 1895
  - **Early industry fragmented, characterized by massive industry, small-scale production**
    - As many as 3,000 firms organized to produce autos
    - More than half of these clustered in Northeast
    - Most never entered into commercial production
    - Like the Internet boom of the 1990s?
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## Early history of automobile manufacturing

- **Early industry characterized by frequent mergers, divestitures, entry and exit**
- **As early as 1903, three leading auto producers located in Michigan**
  - Olds (4,000 cars)
  - Ford (1,700 cars)
  - Cadillac (1,700 cars)
- **1904 Census revealed Michigan to be center of production for 42% of all cars, up to 51% 5 years later**

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## Early history of automobile manufacturing

- **Why Michigan?**
  - Southeastern Michigan was already a center for machine shops specializing in gasoline engines (which quickly became dominant engine)
    - In 1900, 40% of autos powered by steam, 38% by electricity, only 22% by gasoline – but this soon changed as gas engines improved
    - Auto pioneers Ransom Olds and Henry Ford were gas engine machinists
  - Southeastern Michigan also a center for carriage makers with experience building chassis
    - The founder of General Motors, William Durant, was the head of the nation's largest carriage producer. He began by taking over the struggling Buick Motor Company in 1904, then made several successful acquisitions

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## Early history of automobile manufacturing

- **Why Michigan?**

- Southeastern Michigan was well endowed with wealthy entrepreneurs looking to invest fortunes made in the copper, iron, and lumber industries
- Henry Ford's first two automotive ventures collapsed, but he was still able to obtain financing for his third venture
- Ford's failed second venture was renamed Cadillac, went on to become an important component of General Motors

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## Early history of automobile manufacturing

- **Ford's early dominance**

- Ford's (3<sup>rd</sup>) company, founded in 1903, took national sales leadership in 1906 with 8,700 cars (twice as many as second-place Cadillac)
- Unlike competitors, who focused on small-scale production of "high-end" cars, Ford focused narrowly on maximizing sales of low-priced cars through productivity improvements, lowering prices as production-improvements and economies of scale lowered costs
- Ford plowed large percentage of profits into innovative technology rather than higher dividends
- Ford dominated auto sales until 1920s, was the principal contributor to Detroit's dominance

## Early history of automobile manufacturing

- **Ford's early dominance**

- Introduced the moving assembly line and Model T in 1908-1909
- Cost of Model T declined from 7 months of a Ford assembly line worker's wages in 1908 to less than 3 months in 1916
- This brought millions of middle-class families into the market for autos
- By 1920, *half the cars in the world* were Model T Fords!
- Product diversity, options strictly limited by Ford to maximize standardization, production efficiency. (“You can have any color car you want, so long as it's black.”)

## Early history of automobile manufacturing

- **Auto models**

Producer	Assembly plant location	Sales in 1913	Market share
<i>Luxury (over \$2,500)</i>			
Packard	Detroit, Michigan	18,500	4.79
Pierce-Arrow	Buffalo, New York	2,300	0.60
White	Cleveland, Ohio	2,000	0.52
Franklin	Syracuse, New York	1,500	0.39
Winton	Cleveland, Ohio	1,400	0.36
Locomobile	Bridgesport, Connecticut	1,300	0.34
Oldsmobile	Lansing, Michigan	1,100	0.28
Others	—	1,000	0.26
<i>Medium (\$1,500-\$2,500)</i>			
Cadillac	Detroit, Michigan	7,900	2.05
Chalmers	Detroit, Michigan	62,500	16.19
Hudson	Detroit, Michigan	15,000	3.89
Mitchell	Detroit, Michigan	8,000	2.07
Cole	Pontiac, Michigan	5,000	1.30
Rambler	Pontiac, Michigan	4,000	1.04
Others	Racine, Wisconsin	3,000	0.78
<i>Moderate (\$600-\$1,499)</i>			
Willys-Overland	Indianapolis, Indiana	3,000	0.78
Buick	Kenosha, Wisconsin	3,000	0.78
Studebaker	—	21,500	5.57
Hupmobile	—	120,000	31.09
Reo	Toledo, Ohio	35,000	9.07
Maxwell	Flint, Michigan	26,000	6.74
Paige-Detroit	South Bend, Indiana	25,000	6.48
Others	Detroit, Michigan	12,000	3.11
<i>Inexpensive (under \$600)</i>			
Ford	Lansing, Michigan	9,000	2.33
Others	Tarrytown, New York	4,000	1.04
<i>Total</i>			
Ford	Detroit, Michigan	3,000	0.78
Others	—	6,000	1.55
<i>Total</i>			
Ford	Detroit, Michigan	185,000	47.93
Others	—	178,000	46.11
<i>Total</i>			
		7,000	1.81

Source: Parlin and Youker 1914: 419

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## Early history of automobile manufacturing

### Ford and GM in the early 20<sup>th</sup> Century

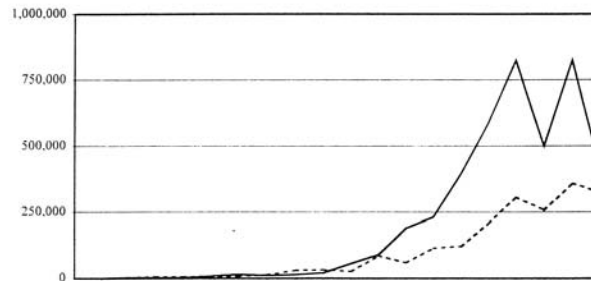


FIGURE 1 Passenger car sales by Ford and General Motors from 1901 through 1920.

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## Early history of automobile manufacturing

### • GM's marketing counter-revolution

- General Motors founded in by William Durant in 1908, acquired several other auto companies and the marketing genius of Alfred Sloan
  - Formed GMAC in 1919 to help new car buyers finance purchases
  - Created a differentiated product line of comfortable, stylish, easily operated cars; introduced annual model changes
    - Self-starter
    - Other significant technological improvements
  - Facilitated a more active used car market to encourage buyers to “trade up” for newer models
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## Early history of automobile manufacturing

- **GM's marketing counter-revolution**

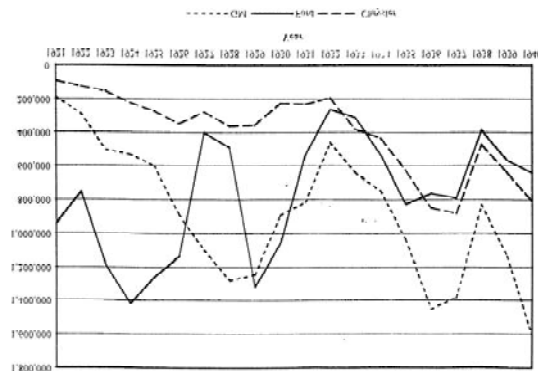
- Ford had continued too long with an increasingly “stale” technology
- Ford was forced to shut down production, drastically re-tool as GM grabbed market share during the “roaring 20s”
- Fueled by booming economy, consumer credit, stock market wealth, demand for autos soared – U.S. had 1 car for 5 people, a ratio not exceeded until the 1950s
- Ford caught up with GM in market share just as the stock market crashed

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## Early history of automobile manufacturing

- **Ford, GM, Chrysler sales, 1920s-30s**

FIGURE 5.3 Sales from 1921 through 1930



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## Early history of automobile manufacturing

- **The Great Depression**

- Sales of automobiles collapsed 1930-32, rebounded slowly
- GM recovered, exceeded late 1920s sales levels by end of the 1930s
- Ford continued to languish under the increasingly erratic leadership of Henry Ford, who was quite unhinged by the end of the decade
- Ford would have gone bankrupt without WWII

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## Early history of automobile manufacturing

- **World War II**

- Military procurement contracts increased demand
- Most of the auto industry in Europe, Japan effectively bombed out of existence
- Technological improvements made during the war were applied to postwar auto production
  - Better automatic transmissions
  - Functional power steering and brakes
  - V-8 engines
  - Air conditioning

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## The U.S. Auto Industry after WWII

- **The Fat Years, 1950-1967**

- Smaller producers went bankrupt or exited auto production (Kaiser, Studebaker, Packard, Nash, Hudson) leaving three large domestic manufacturers
  - Imports were less than 10 percent of sales (U.S. gas prices, driving conditions quite different from those in Europe or Japan)
  - Despite rapidly rising wage costs, industry profitability remained substantially above the profit rate for all U.S. manufacturing
  - Evidence of monopoly profits: the 1955 Price War
  - U.S. companies established strong presence in Europe, Latin America
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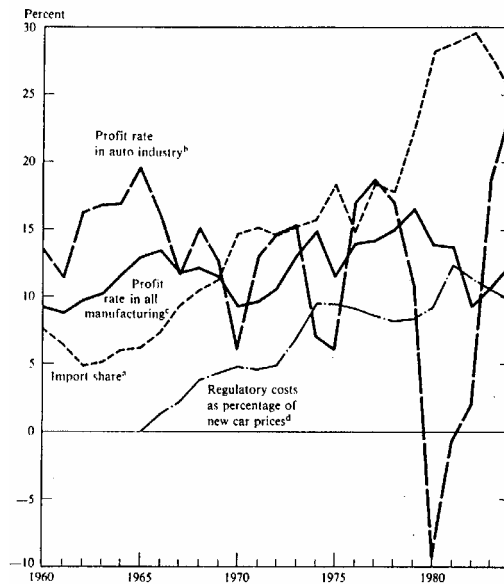
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## The U.S. Auto Industry after WWII

- **Rumblings of discontent, 1966-1975**

- Reaction against the “What’s good for General Motors is good for the U.S.A.” view
  - Consumers, government reacted to safety concerns by mandating installation of safety equipment
  - Concerns over air pollution generated technology mandates for emissions reductions
  - Oil crisis generated technology mandates for increased fuel efficiency
  - Government intervention in the energy market complicated product planning
  - Oil crisis induced U.S. consumers to shift demand to smaller, more fuel efficient imports
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Figure 2-2. Regulatory Costs, Import Share, and Profit Rates in the U.S. Automobile Industry, 1960-84



Sources: *Automotive News*; *Market Data Book*, various years; U.S. Bureau of the Census, *Quarterly Financial Report*, various issues; data provided by the Bureau of Economic Analysis and authors' calculations based on table 3-5.  
 a. Imports as a percentage of U.S. new passenger car registrations.  
 b. After tax return on equity for SIC 371, motor vehicles and equipment.  
 c. After tax return on equity for all manufacturing.  
 d. Cost of equipment only, with 5 percent learning curve (see table 3-5), as a percentage of the average retail price of a new domestic automobile.

## Rise of Japanese Imports

- **The Japanese invasion**
  - German imports of 1950s, 1960s never accounted for much of the market
  - Imports of Japanese cars soared after the second oil shock
  - Japanese firms had quality, price advantages which devastated U.S. industry profits, sales
  - Big 3 forced to retool, rush new, smaller models into production
  - Chrysler slid into bankruptcy, Ford and UAW petitioned government for import relief

**Table 2-1. Import Penetration of U.S. Automobile Market, 1960-84**  
 Hundreds of thousands unless otherwise indicated

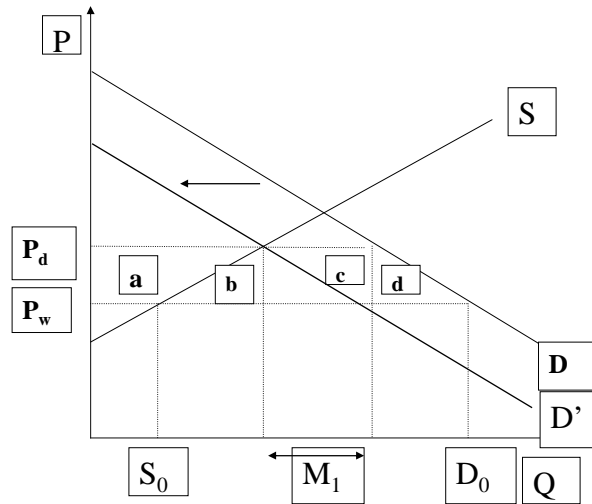
<i>Year</i>	<i>Total new car registrations</i>	<i>Imports</i>	<i>Import share (percent)</i>
1960	6.58	0.50	7.60
1961	5.85	0.38	6.50
1962	6.94	0.34	4.90
1963	7.56	0.39	5.16
1964	8.07	0.48	5.95
1965	9.31	0.57	6.12
1966	9.01	0.66	7.33
1967	8.36	0.78	9.33
1968	9.40	0.99	10.53
1969	9.45	1.06	11.22
1970	8.39	1.23	14.66
1971	9.83	1.29	13.12
1972	10.49	1.53	14.59
1973	11.35	1.72	15.15
1974	8.70	1.37	15.75
1975	8.26	1.50	18.16
1976	9.75	1.45	14.87
1977	10.93	1.98	18.28
1978	10.95	1.95	17.81
1979	10.36	2.35	22.68
1980	8.76	2.47	28.20
1981	8.44	2.43	28.79
1982	7.75	2.27	29.29
1983	8.92	2.46	27.58
1984	10.12	2.52	24.90

Source: *Automotive News, Market Data Book, 1985, p. 26*

## U.S. Government Response

- **Uncle Sam to the rescue**
  - Government granted emergency loans to Chrysler to prevent the firm (a major defense contractor) from going bankrupt
  - President Reagan negotiated “voluntary quotas” on Japanese exports from 1981-85
  - Real profits per vehicle were 50% higher in 1983 than in 1975 (a year of similar vehicle sales), thanks to the VERs
  - U.S. auto industry recovered with protectionist shield, domestic economic recovery

## Effect of Import Quota of $M_1$



## Quota of $M_1$

- $P_w$  - Free trade Prices
- Home country applies quota of  $M_1$
- Demand shifts left by this amount to  $D'$
- $P_d$  - price in importing country
- $P_w$  - worldprice foreign firms receive
- *The difference between  $P_w$  and  $P_d$  is referred to as the "quota rent"*

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## Quota of $M_1$ , Small Country

- *Welfare Impact*
- $\Rightarrow CS \downarrow a + b + c + d$
- $PS \uparrow a$
- Quota rents of  $(P_d - P_w)M_1 = c$
- *Who gets these quota rents?*

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## Quota of $M_1$ , Small Country

- *Three possibilities:*
- 1) Importing gov't auctions quota,  
• e.g. New Zealand, gov't earns  $c$  (so net loss is  $b+d$ )
- 2) Importing firms are given quota,  
• e.g. U.S. dairy, home firms earn  $c$  (so loss is  $b+d$ )
- 3) Exporting gov't/firms are given quota  
• e.g. U.S. trade restriction on Japanese autos, given to MITI, foreign firms earn  $c$  (so net loss is  $b+c+d$ )
- this is called a "Voluntary Export Restraint"

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## Background to U.S. trade restrictions

- October 1979:
- Paul Volcker takes over at U.S. Federal Reserve Bank
- - raised interest rates  $\Rightarrow$  Recession  
Auto Demand  $\downarrow \Rightarrow$  Unemployment  $\uparrow$
- Auto industry wanted import protection

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## GATT/WTO rules

- Article XXIX of GATT/ WTO
- - Allows temporary tariff when an import competing industry has unemployment, low profits,
- Mirrored in Section 201 of U.S. Trade Act of 1974:
- - ITC ( International Trade Commission) will recommend protection when imports  $\uparrow$  is a *substantial cause of serious injury, or threat thereof*
- **substantial cause**: important and not less than any other cause
- **serious injury**: excess capacity, unemployment, and low profit
- **threat thereof**: for example, rising inventory

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## Section 201 protection

- 1980, Ford and UAW filed **section 201** Petition ( for cars and trucks)
- ITC **rejected** section 201 petition since the U.S. recession was ruled to be a more important cause of injury than rising imports
- Look at the data:

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## Auto Sales and Imports in U.S.

**Table 1: New Passenger Autos – Sales (1,000) and Prices (\$)**

Year:	1979	1980	1981	1982	1983	1984	1985
U.S. demand	10,644	8,903	8,566	7,598	9,322	10,567	11,900
(% change)		-16.3					
Jpn. Imports	1,617	1,992	1,912	1,801	1,871	1,949	2,528
Jpn. Share (%)	15.2	22.4	22.3	23.7	20.1	18.4	21.2
(change)		7.2					

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## Protection for Cars

- Industry went to Congress:
- Sen. Danforth, Michigan:
- Proposed bill limiting imports from Japan
- When this was due to be “marked up”, Reagan negotiated “VER”, Voluntary export restraint, with Japan - limiting auto sales in U.S. to about 1.83 million cars/year beginning April 1981, rising slightly over time

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## Japanese Auto Prices in U.S.

**Table 2: Japanese Imports, Prices (\$)**

Year:	1979	1980	1981	1982	1983	1984	1985
Jpn. Price, \$	4,946	5,175	6,211	6,834	7,069	7,518	8,038
(% change)		4.6	20	10	3.4	6.4	6.9
Quality Upgrading		0	387	772	1133	1364	1585
Adjusted Price		5,175	5,824	6,062	5,936	6,154	6,453
Free Trade Prices		5,175	5,395	5,345	4,870	5,055	
Effect of Quota		-	429	717	1,066	1,099	
Quota Rents (\$mill)		-	820	1,291	1,994	2,142	

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## Quality Upgrading

- **Estimated with a “hedonic regression” for data on base version of Japanese cars:**
- $\log(\text{Price}_{it}) = (\text{year effect})_t + 0.35*\text{Width}(\text{feet}) +$
- $0.69*\text{HP}(100) + 0.14*\text{Transmission} +$
- $0.058*\text{Power Steering} + 0.15*\text{AC}$
- $\log(\text{Quality}) = 0.35*\text{Width}(\text{feet}) +$
- $0.69*\text{HP}(100) + 0.14*\text{Transmission} +$
- $0.058*\text{Power Steering} + 0.15*\text{AC}$
- First used in the 1930s by economist at GM!

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## Effects of VER in Autos

- Japanese prices some \$1,000 higher by 1984, with imports of 2 million, leads to quota rents of about c=\$2 billion earned by Japanese firms!
- The stock market valuation of the large Jpn auto firms went up when the VER was announced!
- From the mid-1980s, the Japanese began to move more production facilities into the U.S., so by the late 1980s, the VER was not binding (i.e. imports became less than the allowed amount)

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## Later in the 1980s

- **The auto industry in the 1980s**

- Expansion of Japanese production overseas
- Luxury sedan market increasingly dominated by European, Japanese brands
- U.S. industry pioneered, dominated increasingly popular “light truck” market segment
  - Minivans
  - Sport Utility Vehicles
  - Vans
  - Trucks

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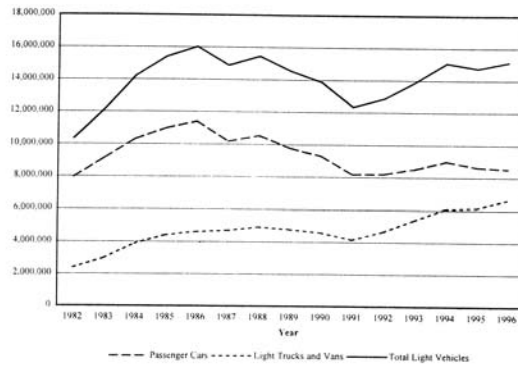
## The Global Auto Industry

- **The auto industry in the 1990s**

- Japanese industry crippled by a long domestic recession; at the end of the decade Nissan is partially acquired by Renault and Ford consolidates its effective control of Mazda
- U.S. industry achieves record profits due to booming U.S. economy, dominance of increasingly profitable “light truck” market segment
- Increasing role of Mexico in NA vehicle production
- Wave of global consolidation hits both autos, auto parts at the end of the decade
- Will Ford overtake GM as the largest producer?

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## • The auto industry in the 1990s

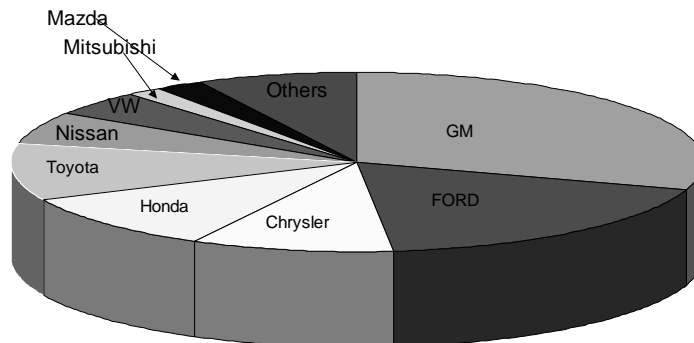


Sales of light trucks approaching those of cars

FIGURE 3 Passenger car, light truck, and van sales since 1970.

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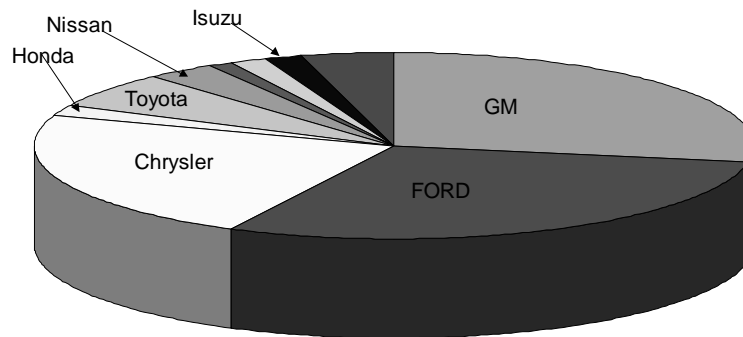
## The North American Auto Market in 1998



Market share of the Big 3: 57.6% and shrinking...

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## The North American Truck Market in 1998

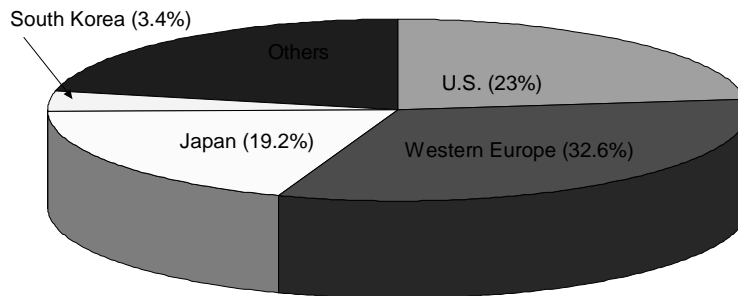


Market share of the Big 3: 80.3%

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## The Global Auto Industry in 1998

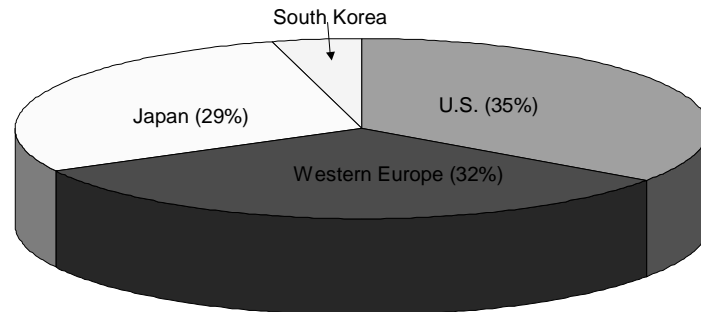
Measured by location of production



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## The Global Auto Industry in 1998

Measured by nationality of producing firms



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## The Global Auto Industry in 2000

- **Mergers and Consolidations, 1999-2000**

- \$38 billion merger of Daimler-Benz, Chrysler
- VW acquires Rolls Royce plants, products; BMW acquires Rolls Royce name
- Renault partially acquires Nissan
- Ford acquires Volvo
- Ford consolidates hold on Mazda
- GM, Ford bid for Daewoo Motors
- Follows up on other prominent mergers of 1990s (Ford-Jaguar, BMW-Land Rover, GM-Saab)

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## The Global Auto Industry in 2000

- **Changing boundaries of suppliers, assemblers**
  - Delphi spun off from GM as independent firm
  - Wave of consolidation in parts manufacturers
  - Suppliers take on an increasing role in vehicle design, innovation, parts engineering

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## The Global Auto Industry in 2000

- **New Markets**
  - Eastern Europe
    - Growth not quite up to expectations
  - East Asia
    - Growth surpassing expectations until the Asian financial crisis of 1997-98
    - Japanese took a beating
  - China
    - The Next Big Thing?



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## The Global Auto Industry in 2000

- **Important new technological developments**

- Improvements in manufacturing technology
  - “Modular” design concepts
  - New powertrains
    - Hybrid vehicles
    - Electric vehicles
    - Fuel cell vehicles
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