THE FUTURE OF THE AUTOMOBILE

RELOCATING AUTOMOBILE PRODUCTION TO THE DEVELOPING WORLD: THE MULTINATIONAL VIEW

by US-B-81-5

William B. Johnston

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Background Paper #2358

INTERNATIONAL POLICY FORUM
Eagle Lodge, Pennsylvania, U.S.A.
28 June - 1 July 1981

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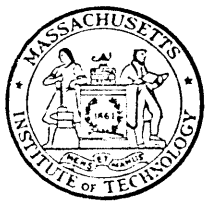

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Introduction

Throughout the twentieth century, most of the world's automobile production facilities have been located in the developed nations of Western Europe, North America, and later, Japan. Despite some erosion of this predominance in recent years, the mature industrial countries still produced more than four fifths of the world's motor vehicles in 1980.

During the 1980's this historic pattern may shift substantially, with major automobile and component production facilities being relocated to the less developed countries of Central and South America, and the Far East.

Obviously, these changes and the rate at which they occur will have profound impacts on the economies of the world, both developed and developing. To forecast the trends, and to understand their impacts, it is necessary to review the factors that have governed the plant siting decisions of the world's automakers. Many of these factors have changed significantly over the past decade, altering the calculus of corporate decision-making.

AUTOMOBILE PLANT LOCATIONS - THE HISTORICAL PATTERN

Transportation Costs and Economies of Scale

As with any major manufacturing facility, the siting of an automobile plant involves a balancing of the factor costs of alternative locations. In these location decisions, the trade-off between scale economies and transportation costs is one of the most critical considerations. Other things being equal, larger, more efficient plants must serve larger markets, and will incur higher outbound transportation costs.

Historically, this trade-off has strongly influenced the location of automobile assembly facilities, tending to disperse them toward final markets. On the one hand, the economies of

scale for automobile assembly appear to flatten out for plants of greater than 250,000 - 300,000 units per year.(1) On the other, the costs of transporting finished vehicles (which by their nature are bulky, somewhat fragile space capsules) rise continuously with higher volumes and longer distances from the plant.

As a result, automobile assembly facilities have generally followed automobile markets as soon as these markets have reached sufficient size.

The high cost of transporting assembled vehicles helps to explain the predominance of the developed countries in the production of automobiles. The developed countries that produced 81% of the world's vehicles in 1980 also consumed about 74% of those vehicles.(2) Or looked at another way, in 1978 only about 16% of the motor vehicles sold in the world were exported beyond their region of manufacture.(3)

The worldwide distribution of automobile assembly plants near to final markets has affected, but not so decisively determined the locations of major component production facilities. Of course, nearness to assembly plants reduces component transportation costs. But the economies of scale for production of various components tend to be greater, and their transportation costs to be lower (proportionately) than for finished automobiles. As a result, major component facilities are generally much more centralized than assembly plants.

Larger scale economies are particularly important. Estimates of minimum scale economies for various types of component facilities range from 1-2 million units per year for casting plants, to 400,000-1,000,000 units for plants machining and assembling engines or transmissions, to 500,000 annual units for plants stamping body parts.(4) The differences in capital costs for low and high volume component facilities can be substantial. For example, an engine plant capable of producing 600,000 units per year might cost $1000-1300 per unit of annual capacity, compared to almost twice that for a smaller plant designed to produce only 100,000 engines per year.

Lower proportional transportation costs also affect the equation, often making it feasible to ship major components very long distances. For example, engines, which are relatively compact and less vulnerable to damage in transit, can be shipped from the Far East to Detroit for 3-4% of their landed cost while transportation adds 6-8% to the cost of finished vehicles over the same distance.(5) On the other hand, the bulkiness and high cost of packaging stamped body parts to prevent damage in transit tends to prevent maximum exploitation of the scale economies possible from larger stamping plants.

In siting a few, very large component plants to serve several assembly markets, the balancing of scale economies and transportation costs can become quite complex. For a plant whose markets are broadly dispersed, inbound transportation costs and nearness to raw materials may assume greater importance. For example, foundries must be located very near to major engine or transmission plants, and both will tend to be sited near to sources of cheap iron and steel.

In evaluating the economics of very high volume component plants, one transportation cost variable is sometimes overlooked: the cost of long supply lines. Inevitably, assembly plants supported by fewer, more distant component plants are more vulnerable to surges and interruptions of supply from strikes, poor freight service, fluctuations in demand, or acts of God. Because of the extremely high cost of unexpected assembly plant shut-downs, long supply lines require higher inventories, both at the assembly plant and in the pipeline itself. While they are hard to quantify, the costs of these inventories, measured in interest, higher space costs, greater damage from excessive materials handling, or overstocking during market downturns, can be quite significant. Quality control can also be more difficult, since defects discovered at the point of assembly will likely exist throughout the entire inventory, making adjustments and corrections much more costly and time-consuming.

Other Factors

Of course, transportation costs are only one factor affecting total unit costs at alternative sites. Labor cost and productivity differentials, raw material and purchased parts costs, land start-up and overhead expenses all may vary within and between countries. Depending on the plant, these differences in other factor costs may outweigh transportation differentials.

Labor costs are the most often cited example. While industry-wide contracts have sharply narrowed wage differentials within some countries such as the United States, wide differences in wage rates and productivity levels exist between countries. For example, even for a highly automated process such as the machining and assembly of engines, Japanese producers appear to hold a significant labor cost advantage over U.S. producers, totaling almost $100 per engine:

Labor Costs For Engine Machining and Assembly

	U.S.	Japan
Direct Labor Hours per Engine	7.0	3.5
Hourly Labor Cost (1979)	$19.30	$10.86
Direct Labor Cost per Engine	$135.10	$38.01

Sources: Harbour and Associates,1980; Abernathy, Harbour and Henn, 1981

Other factors besides labor may also be important. For example, steel is typically about $.02 cheaper per pound in Japan (6) and some developing countries than in the U.S. or Europe, while U.S. aluminum has generally been the cheapest in the world. Land costs tend to be lower in developing countries, while purchased parts cost less in Japan due to high volumes and efficient production systems.

It is important to understand that while these economic factors are carefully weighed by firms before locating new facilities, the final decisions are greatly influenced by the peculiar circumstances of each firm. With their varying shares of regional and national markets, different levels of vertical integration, and different cost and locational structures, the calculus of each firm is different.

Strategic considerations and the nationalistic biases of managements may play some part, as do the experiences of different firms as they enter new markets. Firm size is also important. Most firms holding small shares of segmented markets must serve relatively broad regions with a few major facilities. Given the "lumpiness" of these investments, only the very largest companies operating in dense markets, eg., GM in the U.S., can truly seek to optimize location efficiencies.

Perhaps most importantly, the flexibility of corporate investment planners to site new plants according to considerations of present economic efficiency is sharply constrained by history. No matter how large the new investment, it is usually far outweighed by the sunk costs already present in the production system. A new stamping plant must serve existing assembly plants; existing foundries may lose their economic viability if they cannot serve new axle or transmission plants. The rigidity of

the status quo extends, of course, well beyond the firm to the assemblage of parts and equipment suppliers and to the presence of a large, trained labor force needed to support a major automobile production facility. The economics of new locations are often compromised because they must incur the costs of developing this supporting infrastructure.

Finally, political factors also tend to reinforce the status quo. Local and state governments and local unions are likely to oppose plant relocations within countries; national governments and unions resist relocations across national borders. At each investment decision point, the rigidities in the system are substantial. This inherent locational inflexibility is reflected in statistics on the age of auto production facilities in mature markets. For example, the average age of GM assembly plants in the U.S. is 39 years.(7)

Investment in Developing Countries

Beyond the general factors that have tended to discourage the automakers from relocating existing facilities, there have been other obstacles to the construction of automobile plants in the developing countries. Foremost among these has been the lack of an industrial infrastructure adequate to support major automobile plants: industries to produce low-cost, high-quality iron, steel, aluminum, plastics and castings, and a labor force capable of handling a full range of engineering, management and repair tasks. In many developing countries, auto manufacturers have found that in particular,the lack of technical experience often results in higher start-up costs and chronic quality problems, particularly for purchased parts.

In addition, the small size of local markets, coupled with rigid import restrictions in many countries, has prevented the installation of plants of minimum economic scale. With relatively small national populations, low per capita incomes and low levels of automobile ownership in most areas of the world, only five countries outside of North America, Europe and Japan had auto sales of greater than 200,000 at any time during the 1970's. Since each of the larger developing country markets is shared by several manufacturers, assembly plants, and especially component facilities must be scaled far below optimum sizes. As long as these markets are isolated by tariff, quota, and content restrictions, larger plants cannot be supported unless part of their production is exported back to the home countries (potentially displacing existing capacity in the older markets.)

Finally, investments in automobile production facilities have been inhibited by the perception of greater political risks. These risks extend beyond the dangers of suddenly overthrown governments or expropriated facilities. In most countries it is more likely to be chronic problems with changing laws and regulations that undermine the attractiveness of new investments, rather than major upheavals. In policies governing such things as import licences, local content requirements, earnings repatriation, and ownership controls (as well as in major macroeconomic matters such as exchange rates and fiscal policy) laws and policies can change abruptly. For a capital intensive industry whose facilities must be amortized over long periods, the threat of politically induced changes that reduce profit expectations can be a significant obstacle to investment. (The developing countries, of course, have no monopoly on such profit minimizing policy changes.)

The Risk-Return Trade-off

In considering new investments in developing countries, auto manufacturers must consider not only factor costs, but these various risk factors. Even if the costs turn out to be as forecast, will the product be consistently delivered on time? Will quality be adequate, especially given the long supply line and the difficulty of correcting problems not discovered until assembly?

For major components these risks assume tremendous importance. Once a decision is made to source an engine or a transaxle from one plant, there is usually no alternative. Not only are these major components specific to a make and family of models, there is seldom any spare capacity capable of handling the sudden surge in demand caused by the failure of a large facility.

For this reason, most automakers have been quite cautious in evaluating the risks of relocating major production facilities away from traditional sources of supply. For high volume production of basic components - stampings, large castings and forgings, engines and axles - most automakers prefer full operational control and low-risk locations.

This minimum risk strategy may have been reinforced by the multiplicity of decision-makers. Typically, a decision to locate a major new plant will require the approval not only of local production managers and central finance and planning staffs, but also of other production units acting as purchasing agents for the plant's output. The several layers of

decision-makers, each with different objectives and each holding veto power, will tend to promote lower risk location strategies, particularly with regard to developing countries.

This propensity toward lower risk "stay-at-home" investment patterns may have been most characteristic of the U.S. manufacturers, whose markets were concentrated in large, high-profit cars that were relatively insulated from world competition. Given the factors encouraging reinvestment at home, the lumpiness of the investments, the evident risks of overseas plant locations, and the reduced price and cost pressure in the middle and upper ranges of the market, it would not be suprising if American companies failed to pursue least cost location strategies during the post-war period.

Whether or not such a charge is supportable, there is no doubt that U.S. vehicles are still built almost entirely in North America. For example, even the forthcoming Ford Erika, which is to be powered by a Mexican built engine, will still be 88% American made.

THE DESTABILIZATION OF THE STATUS QUO

This conventional description of the factors that have influenced the location of automobile production facilities underscores the powerful forces that have tended to keep production at existing sites in the developed countries. Over the past ten years, however, a number of counter trends have emerged that have begun to encourage relocation of automobile production plants from Europe and the United States to the developing nations. Both economic and political factors have played a part.

Economic Factors

One basic change encouraging the relocation of production facilities has been the gradual shift of the world auto market toward the developing nations. From 1970 to 1980 the proportion of the world's motor vehicles sold in the developed markets (North America, Western Europe, and Japan) dipped from 85 to 74%.(8) Forecasts of future demand suggest that this trend will continue, with auto sales in the developed nations likely to rise by less than 2% per year through the 1980's, while sales in

the developing world are forecast to double over the decade. By 1990, the developing countries are expected to account for one third of all auto sales (9)

Given the importance of markets in determining production sites, this shift in the market is likely to influence plant siting significantly. All of the automakers recognize that they must follow, and indeed anticipate the realignment of their markets. As auto registrations in the developed countries reach saturation levels, sales growth will stagnate and the market will become more cyclical as replacement sales predominate. Only the developing world offers new opportunities for growth.

Beyond the broad trends in the market, several single country markets have emerged that can now, or will soon be able to support world-scale production facilities. Among these, Brazil (1980 vehicle sales of 1,012,000) Mexico (476,000) and Argentina(1979 - 260,000) are the largest, while markets in Taiwan, Korea, and Venezuela are smaller but growing.

In addition to the increasing absolute and relative size of developing country markets, several of these nations have become more attractive sites for production over the last decade. As markets have grown during the 1970's the capabilities of the associated supporting industries have improved. In Brazil, Mexico, Korea and Taiwan, for example, well developed basic metals, fabrication and foundry industries have emerged, along with large relatively proficient labor forces with technical and engineering skills.

This strengthening of the industrial infrastructure and the base of human capital has narrowed the wage gap somewhat, but it has not eliminated it. In 1979 average wages in the motor vehicle industry in Korea were about $1.45 per hour, compared to about $2.25 in Brazil, $4.00 in Mexico, $7.00 in Japan, and $15.00 in the U.S. and West Germany. (10)(In part these continuing wide differences were the result of more rapid increases in the wages of autoworkers in the U.S. and Europe, compared to the increases in the wages of other manufacturing workers in those regions.) With increasing volumes and accompanying scale economies, productivity in most developing countries has risen steadily, narrowing the gap in output per worker and increasing the unit labor cost advantage.

Other factor costs have also declined in some countries. For example, Korean iron and steel, which are efficiently produced with very low capital and labor costs per ton, have helped to increase that country's potential advantage in the production of cast and forged parts. Low Mexican energy costs offer a similar potential national advantage.

Real transportation costs for both finished vehicles and parts

appear to have declined over the past fifteen years. Containerization, which cut handling costs, pilferage and damage, and increased the speed and ease of inland transshipment, has had an impact on component freight costs. Similarly, the covered railroad auto carrier, and improvements in the management of rail freight services have cut overland transportation costs for vehicles. Most importantly, Japanese innovations with specially designed, dedicated car carrying ships have apparently reduced ocean freight charges significantly. These improvements may open new possibilities for shipment of vehicles or parts from developing countries to the industrialized nations.

Finally, shifts in currency values subsequent to the advent of floating exchange rates in the early 1970's have played a part in the relative attractiveness of plants in developing countries. The strength of the Deutchemark has certainly played a part in Volkswagon's worldwide investment decisions. Reciprocally, the relative weakness of some developing country currencies has affected their attractiveness as auto production sites. Expectations about shifts in relative currency values are as important as actual fluctuations. Currencies that are expected to depreciate over the medium term more rapidly than their relative rates of inflation would predict (Taiwan might be an example) will appear to be more attractive manufacturing sites than those which may expect an opposite pattern (such as oil rich Mexico).

These improvements in the relative economic advantages of some of the developing countries may be less important, however, than changes in the competitive conditions facing many U.S. and European automobile manufacturing firms. As competition has intensified in the wake of the 1973 oil crisis, most of these firms have been forced to re-evaluate the risk-return trade-off for plants located in developing countries. Particularly for U.S. firms, low risk, stay-at-home strategies may not be sustainable.

The most important change in world auto markets over the past decade has been the narrowing of the size range of vehicles in the United States, Europe and Japan, partly eliminating the segmentation of markets that had previously insulated some regions from international competition. The average size of U.S. vehicles has declined rapidly from a very heavy base, while European vehicles have shrunk moderately, starting from a smaller base. In Japan, car sizes have actually increased from their earlier concentration on the smallest models. Worldwide, automobile demand has become more homogenized near the mean - a 4-5 passenger vehicle much lighter than the American standard and slightly smaller than the most typical European models of the early 1970's.

Not only does this product homogeniztion mean more competition internationally; for most firms it has meant considerably greater standardization of components: fewer body sizes, fewer engine options, more interchangeable parts. This greater level of complimentarity between models obviously offers firms greater flexibility, and opens up new areas of cost competition as more firms explore the limits of scale economies.

For the American companies, and to a lesser degree for the Europeans, these changes in the auto market have meant a tremendous telescoping of the investment cycle, with huge proportions of existing production equipment scheduled to be scrapped over the next few years. This has had the effect of partly freeing investment planners from the sunk cost, interlocking plant rigidities that historically have limited plant location options. With virtually total retooling occurring within a few years, and with the new, standardized models likely to be marketed worldwide, the option to relocate production to the developing countries has become much more feasible.

More importantly for these firms, the shift to small cars has created new pressures to reduce costs. For both U.S. and European companies, small cars have always been low profit cars. Indeed, some analysts have speculated that the lightest American models have actually been no-profit vehicles for many years, carried only to assure a presence in that segment of the market where many young buyers make their first purchase. Having lost the luxury of a segmented market in which big, high-profit cars could subsidize small low-profit models, firms wishing to remain full line producers must find ways to make small cars more profitable. If components or vehicles can be manufactured more cheaply in the developing countries, production is far more likely to be relocated to these areas in the current intensely competitive environment.

Finally, markets in the U.S. and Europe have become much more competitive over the past decade as a result of the export initiative mounted by the Japanese. Not only have Japanese exports had direct impacts on U.S. and European firms' profitability by reducing capacity utilization,but aggressive Japanese price leadership in the growing small car market has also made it especially difficult for U.S and European producers to serve that market segment from their existing production base. Because Japanese companies have achieved superior overall productivity levels their price leadership is likely to continue indefinately.

To meet the Japanese challenge, firms must either adopt Japanese production techniques in their domestic plants, move production to Japan, or potentially, relocate facilities to the developing countries with lower factor costs.

Political Factors

Although economic considerations offer a partial explanation for possible shifts of production to developing countries, political factors may play an equal or greater role. The trade, regulatory, and promotional policies of the developing countries have had great impacts on corporate location decisions.

Among these, trade policies are most important. At present, a substantial proportion of the world market for assembled vehicles is protected by trade barriers of one sort or another. In the mature auto producing nations these restriction are limited to informal quotas on Japanese imports and relatively low tariffs.(These tariffs have been falling steadily since 1968 from 5.5% to 2.9% in the U.S., from 22% to 10.9% in the EEC, and from 35% to 0 in Japan.) But the emerging markets of the major developing countries are almost completely insulated behind a wall of high tariffs, quotas, and local content restrictions. In varying ways, Brazil, Mexico, Argentina, Korea, Taiwan, and Venezuela - in short every new market of any size - have all virtually excluded imports of assembled vehicles. In addition, most have sharply limited imports of parts, with tariffs or quotas or both.

These restrictions have generally succeeded in their intended objectives: to attract local investment by the multinational automakers desiring to serve the markets. Because of their recognition of the need to establish a presence in these long term growth markets (if not for immediate profit then for strategic reasons) many of the multinationals have established subsidiaries in the developing nations with larger markets. Typically most of these facilities were initially plants to assemble knocked-down kits of imported parts. Later, usually in response to new host country regulations requiring higher levels of local content, these assembly plants have been supplemented with component plants for casting, machining and stamping parts.

In many cases these production plants have been brought on stream well before they were economically justified as part of a strategy to build market share (or prevent others from building it) and to gain manufacturing experience. Because these facilities are often not fully utilized, or were originally facilitized at less than optimum scales, they are usually not cost competitive with home country sources. A strong incentive exists to rationalize production in these markets by integrating them with nearby markets, or by exporting production to home countries.

Until recently, such rationalization of production has been inhibited in most countries by rigid local content requirements and high tariffs on parts. These policies have frustrated manufacturers who have been unable to achieve the minimum economies of scale needed to become internationally competitive, despite local labor cost advantages. Moreover, these policies have seldom been fully successful from the point of view of the developing nations. While most countries have been able to attract limited investments from many manufacturers, they have seldom suceeded in becoming the sites of major production facilities exporting to developed countries.

In recent years, (often in response to the suggestions of the multinational firms) a number of countries have recognized that strict local content policies have failed to serve their growth and export objectives. In place of these inflexible rules, some nations, notably Brazil, Mexico, Taiwan, and the Phillipines, have adopted policies that effectively allow higher levels of imports - either of parts or finished vehicles - in return for increased exports of equal or greater value. These arrangements are usually effected by tariff reductions or relaxation of local content rules or both.

The effect of these policy changes has often been dramatic. Presented with the opportunity to rationalize production at optimum scales, while increasing their penetration of local markets with highly profitable incremental production from other facilities, many firms have moved rapidly to expand investment in countries offering such flexibility. In Mexico alone, more than $1 billion of new outside investment in the automobile industry is underway, with production from most of the new facilities scheduled to be exported.

Indeed, so successful have these arrangements proven in serving the differing objectives of the auto manufacturers and the developing nations, that some auto makers such a GM explicitly plan their production facilities in order to be able to promise host governments that they will "balance their trade" or show net export surpluses. And several host nations have begun to extend the principle across industries by requiring automakers to market non-automotive manufactures or raw materials abroad, in return for greater access to local markets.

These policies to promote exports of parts and vehicles depend for their success on the existence of large, open markets capable of absorbing the increased production. Regional rationalization of production in South America and the Far East has been a first objective for most manufacturers, and much of the export increase has been absorbed in inter-regional trade. But with much of the American and European production base consisting of high-cost plants producing soon to be obsolete parts,

it seems likely that increasing amounts of the production from new, large overseas plants will be exported back to the developed nations, supplanting production from facilities being phased out. Perhaps soon the same rigidities that have locked production in the developed countries will limit the flexibility of firms to reduce their dependency on plants in developing nations.

Other promotional and regulatory policies of the developing countries also influence corporate siting decisions. Most countries offer a variety of location incentives such as income, property and sales tax holidays, direct export subsidies, suspensions of duties on capital goods, and government backed loans or equity capital. In general, while these types of financial aids can improve the attractiveness of proposed investments (and are typically the subject of extended negotiations between the manufacturers and host governments) they are not nearly so important as the opportunity to rationalize production and expand markets through export/import trade-off regimes.

AN ILLUSTRATIVE CASE - A FORD ENGINE PLANT

There is no single scale on which these often conflicting economic and political factors can be balanced. Every potential investment is different, and conditions change rapidly: labor cost differentials narrow and then diverge; currencies rise and fall; incentives are granted and then retracted; even such immutables as maximum and minimum economies of scale are sometimes revised in the light of new evidence.

Some idea of how these various factors interact to influence decisions may be gleaned from reviewing data and analysis prepared by the planning staff of one major automaker, Ford Motor Company.

In order to evaluate the relative attractiveness of alternative plant locations, and to plan investment and marketing strategies, Ford routinely analyses factor costs, business conditions, and political risks in most major countries of the world. For countries in which the company has a special interest, detailed economic comparisons and risk evaluations are prepared.

Table I

Ford Engine Sourcing Alternatives

	Purchase Japan	Build U.S.	Build Mexico (Peugeot)	
Total Investment ($millions)	$469	$1074	$834	
U.S. (1)	228	833	228	
Mexico (2)	241	241	606	
			Ex Benefits	W/Benefits (3)
Landed Cost (CIF Detroit) (4)	$1233	$1235	$1221	$821
Gas	998	1062	1078	738
Diesel	1665	1556	1487	975
Average Annual Profit (millions) (Compared to Purchase Japan)	-	$7	$32	$227
Time Adjusted Rate of Return	-	1%	5%	29%

(1) U.S. investment needs for all options include $228 million of engineering, design, and vehicle modifications.

(2) Mexico investment needs for Japan and U.S. options include $241 million for small Mexican engine plant.

(3) Mexican export incentives include rights to increase imports into Mexico (which increase Ford earnings by $.37 per dollar), and tax reductions equal to 8% of export volume.

(4) Weighted Average of 65% gas and 35% diesel.

Source: Office of Senator Howard Metzenbaum
(Not confirmed or denied by Ford)

But even the most sophisticated factor cost study may not be able to capture how critically some variables can influence location decisions. Documents concerning an actual recent Ford decision to build a major engine plant in Mexico (which surfaced during Congressional Hearings on the proposed move) illustrate how some of these factors influenced Ford.

In considering the Mexican investment, Ford weighed four major alternatives for sourcing engines to power its Topaz/Erika line, due to replace the Fairmont/Zephyr family in 1984. The choices were: purchasing engines from Toyo Kogyo, building either Togyo Kogo or Peugeot designed engines in Mexico, or building Toyo Kogyo engines in the United States. The basic facts concerning the three main options Ford considered are summarized in table I.

The Ford documents highlight several important aspects of the company's decision. First, in strictly economic terms, the landed costs (CIF Detroit) of engines procured via any of the alternatives were almost indistinguishable. Japanese gasoline engines were cheaper, as were Mexican produced Peugeot diesels, but the U. S. disadvantage on a weighted average basis for all engines was quite small. Had these numbers been determinitive, they almost certainly would not have convinced Ford management to accept the risks of longer supply lines, less assured Mexican government policies, and the inevitable criticism from

Table II

Ford Engine Sourcing Alternatives

	Purchase Japan	Build U.S.	Build Mexico (Peugeot)	
Total Investment ($millions)	$469	$1074	$834	
U.S. (1)	228	833	228	
Mexico (2)	241	241	606	
			Ex Benefits	W/Benefits(3)
Landed Cost (CIF Detroit)(4)	$1233	$1235	$1221	$821
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Source: Office of Senator Howard Metzenbaum

U.S. politicians and union leaders.

But after the Mexican export advantages were added to the calculation, the Mexican plant became compellingly attractive, with a rate of return of 29% on incremental investment,, an incremental profit of $400 per engine over the life of the facility, and a landed cost advantage of more than $ 400 per unit.

It is important to note that most of the export incentives in this case were not direct subsidies, but simply relief from artificial quota restrictions that were preventing Ford from fully exploiting its existing North American production base. Four fifths of the additional profit cam from exemptions from the Mexican quota rules that allowed Ford to import additional North American production into Mexico, at a profit of $.37 per dollar of sales.

Moreover, even before the export incentives were considered, Mexican government policies had already skewed the Ford analysis, by adding $241 million (the cost of a small engine plant to serve the Mexican market) to the estimated capital cost of either buying Japanese engines or building them in the U. S. In effect, the rate of return on either U.S. investment or Japanese purchase was artificially reduced by Mexican government policies that prevented the most efficient organization of Ford's engine production.

At least in this case, the Ford decision to move a major plant out of the United States was more the result of Mexican policies and economic considerations internal to Ford's operations (ie., excess production capacity in the U.S. capable of supplying the Mexican market very profitably) than of any significant factor cost advantage enjoyed by Mexico.

CONCLUSIONS AND QUESTIONS

Although it would be idle to generalize broadly from the Ford example, it does raise some interesting questions and suggest some possible conclusions.

First, in light of the conflicting evidence, do the developing countries now enjoy a true economic advantage for the production of automobiles or components? More importantly, what is the trend in factor costs - are these countries becoming more or less attractive as locations from automobile

manufacturing? Put in another context, is the relocation of production to sites in the developing world a potential competitive response by U.S. or European manufacturers to the Japanese challenge, or should these manufacturers try instead to adopt Japanese production systems at home (or simply shift production to Japan)?

At least at present it does not appear that economic factors favor most of the developing countries as locations for auto production.

The one factor in which the developing countries hold a clear advantage - labor cost - appears to be a declining fraction of total unit costs for vehicles and most major components. For the most efficient Japanese automakers, labor costs represent only 15% of unit costs, and the percentage appears likely to decline further. For some components labor is even less important. Japanese engines are manufactured with only 3.5 hours or $40 of labor each - less than 5% of total costs, and less, even, than the cost of freight from Japan to Europe. For the production of major components, and increasingly for vehicle assembly, capital - in the form of R&D, design, engineering, and tooling - is the most important factor. Since the developing countries are disadvantaged in these resources, it does not appear that automobile production will be driven by economic factors to the developing world, except in response to the gradual shift of the world auto market.

If economic factors are not yet driving investment toward the developing countries, are political factors more important? More concretely, is the interaction of the economic objectives of the developing nations (to maximize local production and employment) and the goals of the multinational automakers (to maximize profits by expanding markets and rationalizing production into units of greater efficiency) likely to produce a substantial realignment of production over the next decade?

For such a pattern to develop, the developed countries of North America and Europe must remain willing to absorb substantial trade deficits in automobiles and parts, while Japan and some developing countries show growing surpluses. The current debate has focussed almost exclusively on Japan and the trade in assembled vehicles, but the issues in the future may shift to parts and the local content rules of the developing countries, if production shifts rapidly out of the mature economies. Political pressures for universal local content rules could develop, as a "solution" to both Japanese imports and off-shore sourcing. Should such regimes win support, firms that had moved aggressively to source components in the developing countries or in Japan could be vulnerable. More basically the whole fabric of trade could be affected if a system of trade balanced firm by

firm and "content for content" began to develop.

Whether or not such restrictions are adopted, the impacts of realignments of auto production on the economies of the developed and developing nations, and on the fortunes of various firms, deserve more careful review. Will governments striving to maximize their shares of auto manufacturing employment find that they are chasing a vanishing rainbow, as the share of value-addded to automobiles by manufacturing labor shrinks? Will firms, seeking to respond to highly efficient, capital intensive Japanese production systems by chasing lower factor costs, find that the advantages of developing countries are soon nullified by home country trade restrictions or by elimination of host country trade subsidies?

The magnitude and timing of the shift of automobile production to the developing world is highly uncertain, because the changes appear to depend more on political than economic factors. The welfare implications of the changes, both for firms and nations, deserve more careful analysis before policy makers begin to fashion responses.

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