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SCALE ECONOMIES, INTERNALIZATION, AND FOREIGN DIRECT INVESTMENT IN THE U.S. COMMERCIAL VEHICLE INDUSTRY[1]

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I. INTRODUCTON

Recent analysis of the motives for Foreign Direct Investment (FDI) by multinational enterprises (MNE's) has focused on internalization theory. (See, for example; 10, Casson, 1979; and 34, Rugman, 1981.) The theory of internalization holds that FDI occurs as MNE's respond to externalities such as the failure of the market to set a price for the production and dissemination of knowledge. The MNE uses its internal market to maintain control over knowledge and research and development information as well as marketing, production, and managerial skills (34, Rugman, 1981, pp. 24-51; 35, Rugman, 1982, pp. 9-14; 23, Giddy and Young, 1982, pp. 57-58). The thesis presented here is that internalization theory and existence of scale economies, particularly in component parts production, offer an explanation for recent FDI in the U.S. commercial vehicle industry. The FDI in the commercial vehicle industry also has important implications for the Ohio economy.

The methodology of the study is primarily institutional. Descriptive statistics are utilized as are extensive interviews of executive officers and production managers of commercial vehicle manufacturers having FDI in the U.S. The interviews were conducted primarily in the last half of 1984.

II. THE COMMERCIAL VEHICLE INDUSTRY

Commercial vehicles are medium and heavy trucks used for interstate hauling of freight, for construction work, and for local delivery, etc. Medium-duty trucks are vehicles in classes, 5, 6, and 7 (16,000 to 33,000 pounds gross vehicle weight, GVW) and heavy-duty trucks are class 8 vehicles (33,000 GVW and above). The study does not encompass light-duty pick-up trucks and vans often used as substitutes for passenger automobiles.

The markets for medium and heavy-duty trucks in the United States demonstrate sensitivity to the business cycle. Expansions and contractions in commercial vehicle production are about coincident with phases in the business cycle. Tables 1 and 2 give registrations and market shares of U.S. medium and heavy truck manufacturers. A decline in truck registrations accompanied the relatively weak economy of the 1979-1982 period. A subsequent expansion in the economy after 1983 was accompanied by an increase in truck demand. Other work by the author confirms the cyclical sensitivity of the commercial vehicle market (21, Ebert, 1985).

The U.S. medium-duty truck industry has been dominated by three producers. General Motors Corporation (GMC), Ford and International Harvester (now called Navistar International Corporation) have a combined market share exceeding 90 percent (See Table 1).

The heavy-duty truck industry has undergone consolidation over the past four decades. PACCAR purchased Kenworth in the 1940's and Peterbilt in the 1950's. White purchased Autocar, Diamond-T, and Reo in the 1950's and later sold its Diamond Reo division. Diamond Reo went bankrupt in 1974 and was revived by a former dealer, Osterland Incorporated, on a limited production basis. Dodge exited the heavy truck market in 1975. Mack liquidated its Brockway Division in 1977, and White Motor went bankrupt in 1980. Another change in market structure has occurred since 1981 with foreign based firms undertaking significant foreign direct investment in the industry.

III. COMMERCIAL VEHICLE INDUSTRY IN OHIO

In 1984, fifty-one facilities employed 133,305 persons in motor vehicle manufacturing in Ohio (29, Motor Vehicle Manufacturers Association,

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1985, pp. 67-71). In the commercial vehicle industry 3,017 persons were employed in 31 establishments manufacturing truck and bus bodies with an annual payroll of $88.9 million in 1983 (9, Bureau of the Census, 1985, p. 9). In addition to truck body production, data provided the author by manufacturers indicate about 5,000 persons are employed in medium and heavy truck assembly in the state. (A 1978 paper by the author elaborated on the Ohio commercial vehicle industry) (22, Ebert, 1978).

Assembly of medium and heavy-duty trucks in Ohio increased from 54,177 (13 percent of the U.S. total) in 1979 to 79,548 (26 percent of the U.S. total) in 1984 (29, Motor Vehicle Manufacturers Association, 1985, pp. 10-13). Therefore, an examination of FDI in the commercial vehicle industry may be undertaken in the context of its impact on the national and Ohio economies.

IV. FOREIGN DIRECT INVESTMENT

Foreign firms have entered the U.S. medium-duty truck market through establishment of U.S. assembly plants. Mercedes-Benz Truck Company is part of Freightliner Corporation of Portland, Oregon which is a wholly-owned subsidiary of Daimler-Benz AG of West Germany. MBTC built an assembly plant in Hampton, Virginia in 1980 that assembles classes 6 and 7 Mercedes trucks from completely knocked down (CKD) kits. The CKD's with frames, engines, transmissions and bodies are imported into the U.S. from a fully integrated Mercedes truck plant in Sao Paulo, Brazil. Radiators and steering gear come from Germany. Parts constituting 10 percent of the value of the trucks are sourced in the U.S. The 130,000 square foot plant has a two shift maximum capacity of 10,000 units per year and cost $8.1 million to build in 1980 (18, Dauth, 1984).

Hino Motors, U.S.A., a subsidiary of Hino Motors, Ltd. of Japan began assembly of class 6 and 7 trucks in a Jacksonville, Florida plant in 1983. The trucks are assembled from CKD kits sent from Japan. Annual capacity of the U.S. plant is 5,000 units (45, Walsh, 1983, p. 2).

Foreign direct investment in the heavy-duty truck industry has occurred through acquisition of existing U.S. manufacturers. Daimler-Benz AG purchased Freightliner Corporation from Consolidated Freightways Corporation for $260 million in 1981 (2, Wall Street Journal, May 6, 1981, p. 37). Freightliner has capacity to produce about 24,500 trucks annually in three assembly plants. The firm has several parts plants as well but purchases major drivetrain components from outside vendors (25, Lamey, 1984). Daimler-Benz AG is the world's largest producer of heavy-duty trucks with annual global production (including Freightliner) ranging between 50,000 and 65,000 units in the 1978-1984 period (16, Daimler-Benz, 1985).

AB Volvo of Sweden purchased the heavy truck manufacturing assets of the bankrupt White Motor Corporation in 1981 for about $70 million (3, Agreement, 1981). Volvo White Truck Company has an annual capacity to produce about 24,000 units in two assembly plants. Major powertrain components are purchased from outside vendors. White and Autocar heavy trucks are built by Volvo White which also assembles heavy and medium-duty Volvo trucks in the U.S. from CKD kits. Worldwide, Volvo produces about 42,000 heavy trucks per year (42, Automotive News, March 10, 1986, p. E44).

In a series of steps commencing in 1979, Regie National des Usines Renault acquired about a 45 percent interest in Mack Trucks, Inc. for about $228 million from the Signal Companies, Inc. Signal retained approximately a 15 percent interest in Mack with the remaining stock sold through a public offering in 1983 (28, Mack, 1983).

V. SCALE ECONOMIES IN COMMERCIAL VEHICLE PRODUCTION

Plant specific scale economies in particular are associated with FDI in the U.S. commercial vehicle industry.[2] Plant-specific scale economies are exhausted when Minimum Optimal Scale (MOS) has been achieved. That is, MOS is the output at which unit material plus production costs first attain a

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minimum value. Rhys found the minimum annual output required for optimum production in single plants exceeds 200,000 for truck cabs, 200,000 for truck engines, and 100,000 for final assembly. Given the world demand for medium and heavy-duty trucks, Rhys concluded most firms are of sub-optimum size (33, Rhys, 1984, p. 34).

Estimated annual world demand for medium trucks is between 300,000 to 400,000 units and for heavy trucks again in the range of 300,000 to 400,000 (16, Daimler-Benz, 1985, p. 107). The U.S. normally accounts for about one-third of world demand. Therefore, the market is not large enough to allow all existing world competitors to attain optimum size. In Europe the consequence has been for some firms to collaborate in joint production of powertrain components (such as MAN and Daimler-Benz in engine production and Iveco and Rockwell in axle production.) In the U.S. the consequence has been the shake out and consolidation of firms discussed earlier.

Rhys' work demonstrated that for European firms substantial cost penalties exist for sub-optimal levels of production (33, Rhys, 1984, p. 27). The author found U.S. manufacturers unwilling to reveal cost data comparable to the data Rhys obtained on the European industry. However, as noted below, published data and the results of interviews of industry officials in the U.S. support the general conclusion that considerable cost penalties exist for suboptimal output, particularly in components production.

A. SCALE ECONOMIES IN ASSEMBLY

The Rhys study indicated European commercial vehicle firms obtain a 5.4 percent per unit cost reduction for increasing output from 25,000 to 50,000 units and a 5.7 percent per unit cost reduction for increasing output from 50,000 to 100,000 units. The per-unit cost benefit of producing 100,000 trucks annually in a single assembly plant as opposed to 10,000 units is approximately 17 percent. Doubling output to 200,000 units would result in a further reduction in cost of 3 percent per unit (33, Rhys, 1984, p. 27).

Only three U.S. producers have single facilities with medium and heavy truck assembly capacity of 100,000 units (See Table 3). One of the three largest U.S. firms, which seeks anonymity, stated in an interview that per-unit costs in assembly are not measurably greater at 50,000 units per year than at 100,000 units per year. (A word of caution is in order: the term "not measurably greater" could mask a considerable absolute cost differential. On a heavy truck with a factory price of $60,000, a one-percent cost reduction is $600 per unit -- on an output of 100,000 units, that amounts to $60,000,000 per year.)

An important contrast in assembly strategy is in evidence in Table 3. Four of the seven major truck manufacturers have multiple plant locations. Three have single plant locations. As shown in Table 3, PACCAR, Freightliner, and Volvo White have individual plants that are relatively small given the scale economies obtainable with larger plants.

A full discussion of the multiple-plant issue is beyond the scope of this paper. (See, for example, 20, Ebert, 1984.) Some observations are in order, however. Scherer et al suggest multi-plant firms may have sales promotional and risk-spreading advantages (38, Scherer, et al, pp. 253-260, 289, and 386). The concensus of officials that were interviewed was that some firms have multiple plants to provide truck customers with direct access to plant engineers, production personnel, and plant managers.

The president of one centralized truck producer stated that the firm would not duplicate its single centralized facility today if it were starting from scratch. In addition to the marketing advantages, he stated having several regional assembly plants each of which has a capacity of 12,000 to 15,000 units per year on a two shift basis would give the firm manufacturing flexibility by being able to close regional plants at relatively low cost during recession

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periods. During the 1980-1982 period, for example, four multiple plant manufacturers closed a total of six plants.

Firms with single large plants are faced with the overhead of large plants when sales decline. To maintain output in these plants during recessions larger firms minimize losses by making price concessions rather than shutting down production (8, Brown, 1981, pp. 80-89). For example, International lowered prices during 1983 to below full costs (but still covered unit variable costs) to maintain market share and production (41, Shellenbarger, 1983, p. 8).

B. SCALE ECONOMIES IN COMPONENT PRODUCTION

Scale economies in the production of component parts and especially powertrains have been an important factor resulting in FDI in the U.S. truck industry. For example, at an annual production of 200,000 diesel engines of the size used in commercial vehicles Rhys estimates per unit costs are over 30 percent lower than at 10,000 units and seven percent lower than at 100,000 units (33, Rhys, 1984, pp. 27-32).

Three U.S. manufacturers, Cummins Engine Company, Caterpillar Company, and Detroit Diesel division of General Motors Corporation, supply diesel engines to the heavy-duty truck industry. Cummins typically has a market share of 50 to 60 percent of heavy truck engine installations (14, Cummins, 1984, p. 6). Mack Trucks, Inc. also manufacturers its own powertrains but installs them only in Mack products. Ford, International, General Motors, and Cummins produce engines for the medium-duty truck market.

Data were made available for Cummins and Mack which enabled an estimate of engine production capacity for those two firms. In its single plant Mack is able to produce 50,000 diesel engines per year (13, Costa, 1984). The capacity for Cummins was extrapolated from its actual sales and company estimates of the potential market for its engines (14, Cummins, 1984, pp. 5-8). Total Cummins diesel engine making capacity is 320,000 units in four plants. Its largest and newest engine plant (built in the early 1980's as a joint venture with J. I. Case Division of Tenneco) has a capacity of 200,000 units which substantiates Rhys' finding that scale economies in truck engine production exist out to 200,000 units (12, Consolidated Diesel, 1980).

The penchant of U.S. firms for secrecy regarding specific costs has made it impossible to develop a cost index of U.S. diesel engine manufacturers. Casual evidence, however, supports the assertion of substantial reductions in unit costs as output of diesel engines expands. Cummins, for example, states it is able to offer efficiencies in production cost, quality and advanced technologies that no single manufacturer can obtain by producing engines for one line (its own) of trucks (14, Cummins, 1984, p. 11).

VI. INTERNALIZATION

Internalization enables firms to avoid the risk of losing control of competitive advantages in knowledge, technology, organization, and managerial or marketing skills. The internal market of a multinational enterprise permits the managerial hierarchy to assign property rights in knowlege to itself (35, Rugman, 1982, pp. 9-14).

Casson has concluded that internalization will predominate in two types of industries. Industries which rely heavily on knowledge and proprietary information constitute one of these groups (10, Casson, 1979, p. 55). Firms with a heavy investment in research and development (R and D) are faced with obtaining an adequate return from the R and D given the public good characteristics of knowledge. Use of an internal market protects the R and D investment of these firms. The R and D investment may be interpreted broadly to include not only technological developments but also the development of marketing skills and management systems (23, Giddy and Young, 1982, pp. 57-58).

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The second type of industry where internalization is likely to predominate are those operating multi-stage production processes under increasing return to scale or with capital-intensive techniques (10, Casson, 1979, pp. 55-61). Caves observed that when scale economies are modest in assembly but significant in component production the MNE has an incentive to produce components at a single location and assemble them in several foreign markets (11, Caves, 1982, p. 95).

Volvo has engaged in internalization by operating integrated facilities in Sweden and Belgium which manufacture components for export in CKD form to truck assembly plants in a dozen countries (1, AB Volvo, 1983). Given that scale economies in production of certain components exist up to 200,000 units per year Volvo has an incentive to extend its assembly operations to many foreign markets to increase its annual volume of production.

The purchase of White in the U.S. did not automatically increase the ability of Volvo to exploit scale economies in component production. White builds its own cabs and offers Cummins, Detroit Diesel, and Caterpillar engines to customers. However, Volvo is assembling Volvo medium-duty trucks from CKD kits at the Virginia assembly plant. In addition, Volvo drivetrain components are expected to be offered in White trucks, at least as an option, in the future. (40, Young, 1984).

Establishment of a medium-duty assembly plant and acquisition of Freightliner have had the effect of helping Daimler-Benz move further down its unit cost curve in component production. The Mercedes-Benz Truck Company U.S. plant assembles medium-duty trucks from parts shipped from integrated facilities in Brazil and Germany. Daimler-Benz diesel engines are being tested in Freightliner trucks and, ultimately, will be offered in Freightliner trucks. Also, one of Freightliner's models utilizes cab components shipped from Daimler-Benz in Germany to the U.S. for assembly (18, Dauth, 1984; 19, Dougherty, 1984; 25, Lamey, 1984).

Renault's investment in Mack Trucks gave it access to Mack's dealer network through which it distributes the Renault-built Mack "Midliner" medium-duty trucks. Exporting Midliners to the U.S. enables Renault to absorb excess capacity in its French assembly plant and, thereby, lower unit costs. In addition Renault is exploiting scale economies in its French casting, bus body, and component plants by providing some engine block castings to Mack and bus body components which are assembled in the U.S. by Mack (15, Curcio, 1984; 26, Plain Dealer, 1985, p. 7-13). Mack is planning to "outsource" some of the engine/powertrain/rear-axle work that it currently does for itself. It is expected some of that outsourcing will be with Renault in France (7, Bohn and Connelley, 1986).

Production techniques for commercial vehicles are capital intensive and the facilities require substantial capital investment. Rhys estimated the costs of development of a new truck engine plant at between £150 million and £200 million (33, Rhys, 1984, p. 26). Mack estimates the cost of building a state-of-the-art powertrain plant at $500 million in 1984 prices (13, Costa, 1984). The Cummins-J. I. Case joint venture to produce 200,000 diesel engines per year required an investment of $355 million in a highly automated, advanced technology plant (12, Consolidated Diesel, 1980, p. 1).

Through FDI the commercial vehicle firms studied here have internalized their markets for component parts and assembly. The internalization enables them to utilize their component plants, which have significant scale economies, and capital investment more efficiently. This conclusion is consistent with the findings of Casson and Caves.

Knowledge possessed by truck producers is another source of internalization in the commercial vehicle industry. Each of the firms studied stressed the importance of being able to extend its technical, marketing, and management skills to the U.S. market.

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The transfer of this knowledge has been manifested in several ways. Volvo White and Freightliner managements have adapted a European "concensus" style of management which replaces more hierarchical styles. Both firms have become more aggressive in their marketing strategies under the guidance of their foreign owners (47, Young, 1984; 25, Lamey, 1984; 19, Dougherty, 1984).

Included in the property rights in knowledge possessed by Volvo and Daimler-Benz is expertise in truck product development, design, technology, manufacturing, and testing. The Volvo investment in White has resulted in an increase in product development efforts with an expanded and modernized product line (47, Young, 1984). The Daimler-Benz investment in Freightliner has led to increased engineering and testing of products as well as investment to upgrade U.S. manufacturing facilities (25, Lamey, 1984; 48, Zaslow, 1984, p. 1).

Volvo White and Freightliner have increased their market shares since 1981 (See Table 2). The firms attribute that market success to the successful internalization of the marketing, engineering, and management functions (19, Dougherty, 1984; 18, Lamey, 1984; 47, Young, 1984).

VII. ACQUISITION VERSUS GREEN-FIELD ENTRY

A major question confronting firms is whether internalization should take the form of green-field entry or acquisition of existing firms. When green-field entry occurs the MNE adds a new firm to the host country's market. Initially acquisition leaves concentration unchanged but could become procompetitive if a failing business is acquired and subsequently rejuvenated.

If a MNE gains control of an established business it is, in essence, in competition with equity shareholders. That rivalry requires the MNE to pay a price for the acquired business such that an ordinary investor would earn only a normal rate of return on the investment. The only way the MNE might earn more than a normal rate of return would be if it exploits some economies from use of its special assets or if it enjoys a lower cost of capital. The MNE starting a new venture avoids paying the going concern value for the business but incurs a greater risk because a going concern is a working and established entity (11, Caves, 1982, pp. 81-82, 102).

Both green-field and acquisition entries have been undertaken by entrants into the U.S. commercial vehicle industry. Table 4 summarizes the entries that have occurred and the form they have taken. In additon, Hino of Japan entered via establishment of a green-field CKD assembly plant but specific financial data on that investment were unavailable to the author.

Two entrants into the medium-duty truck industry (Daimler-Benz and Hino) established green-field assembly plants. Direct investment into this segment of the commercial vehicle industry by any other means was virtually precluded. The only possible acquisitions -- the medium truck businesses of Ford, General Motors, and International -- were not for sale.

In the heavy-duty truck industry, White Motor was a failing firm in bankruptcy proceedings, Freightliner had lost $16 million in 1980 and its parent, Consolidated Freightways, was actively interested in selling the division (47, Young, 1984). Mack trucks lost $60 million in 1982 and 1983 (27, Mack 1984). The Signal Companies, which owned Mack, merged with Wheelabrator-Frye in 1983. Subsequent to the merger Mack management, which feared ultimate liquidation of Mack, received permission from The Signal Companies to seek a partner on an acquisition basis (15, Curcio, 1984).

Therefore, three major heavy-duty truck manufacturers were in a position where they could be acquired. The attractiveness of these firms to potential foreign investors had several dimensions identified in interviews at each of the three heavy truck firms.

(a) Although the U.S. truck market was depressed in the early 1980's, it still accounts for one-third of

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world heavy truck production and is the single largest market;

(b) Significant over-capacity exists in the U.S. industry which has a capacity to produce nearly 250,000 heavy trucks; green-field entry would merely add to that excess capacity;

(c) Green-field entry at a reasonable scale to compete with existing firms would cost a minimum of $250 million and perhaps as high as $500 million;

(d) Even if the capital expenditure in (c) were made it could take as long as a decade to gain satisfactory product recognition and develop a dealer and distribution system;

(e) The U.S. heavy truck customer is used to specifying a considerable amount of custom equipment whereas European trucks are more standard in specification;

(f) An intimate knowledge of the U.S. regulatory environment, including complex emission, safety, weight, and width laws at the federal and state levels, which influences truck design and engineering is required. Existing firms are most likely to possess the required regulatory knowledge.

The data in Table 4 indicate that Daimler-Benz in its acquisition of Freightliner and Renault in its investment in Mack paid more than current asset value. Following the line of thinking advanced by Caves these two firms apparently believe their firm-specific assets and knowledge and the internalization process will yield them more than a normal rate of return in the long-run.

Volvo paid considerably less than current asset value for White's truck making assets. Given the bankruptcy proceedings at White, Volvo was able to participate in what amounted to a "sheriff's sale" atmosphere.

VIII. SUMMARY AND POLICY IMPLICATIONS

A desire to exploit specific knowledge advantages and scale economies has led foreign firms to engage in foreign direct investment in the U.S. medium and heavy-duty truck industries. Through acquisition of U.S. heavy-duty truck makers the foreign firms have obtained manufacturers with multiple assembly plants of less than optimal size. Given the geographic spread of the U.S. market and consumer tastes for having direct access to manufacturing facilities the cost penalties of operating less than optimally sized plants are among the costs foreigners must incur to enter the U.S. market. These costs may be offset by the benefits of internalization and the ability to exploit more fully scale economies in component production.

Entry of foreign firms into the U.S. commercial vehicle industry appears to have had a pro-competitive effect. The entry of Hino, Mercedes-Benz, and Volvo into medium-duty truck manufacturing in the U.S. has added three competitors to a relatively concentrated industry. The three-firm concentration ratio decreased from 98.2 percent to 93.3 percent (See Table 1) and the three firm Hirshman-Herfindahl Index decreased from 3316 to 2906 in the 1978-1984 period.[3]

The entry of Daimler-Benz, Volvo, and Renault into the U.S. heavy-truck industry through acquisition also was pro-competitive. The four-firm concentration ratio decreased slightly in the heavy truck industry in the 1979-1985 period from 71.3 percent to 70.4 percent (See Table 2). The Hirschman-Herfindahl Index decreased from 1333 to 1270. In that period of time changed market rankings of the producers also indicate the existence of active rivalry. In 1979, the top four firms were International, Mack, PACCAR, and GMC. In 1985, those rankings had changed to International, PACCAR, Mack and Freightliner.

From a low of 4.2 percent market share in 1981, Volvo White increased its market penetration to 8.8 percent in 1985. If White had been allowed to fail and exited the market entirely and (for the sake of simplicity) the 8.8 percent market share of Volvo White had been evenly divided among the other six major truck producers the 1985 four-firm concentration ratio would have been 76 percent and the Hirschman-Herfindahl

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Index would have been 1472. The salvaging of the failing firm, therefore, can be argued to have reduced concentration below what it might otherwise have been.

How competitive the foreign-owned and domestic commercial vehicle producers will be may be a function of the strategic groups to which they belong. The concept of strategic groups indicates active rivals in a market are not necessarily identical firms and may differ in their participation in other markets (11, Caves, 1982, pp. 108-109). The more complex an industry's strategic groups structure the more rivalry the market is likely to display. That is, differences in goals of firms in industries with complex structures deters the formation of an oligopolistic concensus (31, Newman, 1978, p. 418).

Commercial vehicle producers are diverse firms that are members of different strategic groups. Five of the seven U.S. firms are full line motor vehicle producers but the percentage importance of commercial vehicles to total unit sales differs significantly among those five firms. Commercial vehicles account for 100 percent of International's and PACCAR's vehicle production, between 10 and 12 percent of Volvo's and Daimler-Benz's vehicle production, and under two percent of total vehicle production of Ford, General Motors, and Renault.

The U.S. commercial vehicle industry is likely to become still more complex as Japanese firms enter the market. Hino already is assembling medium trucks on a modest CKD basis in the U.S. Isuzu is planning to manufacture trucks in the U.S. sometime during the 1980's (24, Kelderman, 1984, p. 1). Industry participants expect increased competition from Japanese truck manufacturers through both truck assembly and truck component (especially engine) production (15, Curcio, 1984; 14, Cummins, 1984, pp. 10-11).

The increasing competition and complexity in the U.S. commercial vehicle industry raises an interesting issue for the firms building medium and heavy trucks in Ohio. Only one major Ohio facility, a Volvo White stamping plant in Orrville, is operated by a firm in which there is significant FDI.

The two major medium and heavy truck assembly plants in Ohio (See Table 3) are Kenworth (PACCAR) in Chillocothe and International in Springfield. These two firms are the only major U.S. builders of medium and/or heavy trucks that are independent of larger U.S. or foreign firms. Therefore, they can be expected to face intensified competition in an industry having approximately 50 percent overcapacity (6, Bolin, 1986, p. E42). Renault/Mack, Mercedes-Freightliner, and Volvo White with significant FDI in the U.S., can be expected to exploit the benefits of internalization as they strive to gain market share. The future health of the Ohio commercial vehicle industry may well be a function of the outcome of the competitive struggle between the independent U.S. producers, firms in which there is FDI, and General Motors and Ford.

The U.S. is a host country for FDI in commercial vehicle production. If the normative argument is assumed that more competitive markets are superior to less competitive markets there does not appear to be reason to mobilize policy against foreign-based firms investing in U.S. commercial vehicle production. The cause of increased rivalry seems to be well served as a result of the new entrant and preservation of existing (failing) firms through FDI. National economic welfare is likely to be enhanced by the synergistic results of foreign firms transferring technical and manufacturing knowledge to the U.S. commercial vehicle industry through the internalization process.

National competition policy is aimed toward national markets and maximization of national welfare. When FDI takes the form of acquisitions the number of world sellers is reduced. National competition policy, though, does not necessarily take into consideration the world's interest in maintaining competitive markets. For the latter to be achieved it may be necessary to have international coordination of competition policy (11, Caves, 1982, p. 117). A discussion of international

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competition policy toward the commercial vehicle industry is beyond the scope of the present work but does point the direction for future research efforts in the commercial vehicle industry where intense competition and further global consolidation is a possiblity.

ENDNOTES

1. The author expresses appreciation to an anonymous referee for helpful comments on the paper and to Jan Coldwell for her help in preparing the manuscript.

2. Product-specific scale economies and economies of scope are in evidence in the production of commercial vehicles. The limits of the present paper preclude a complete discussion. The author has elaborated on these issues elsewhere (20, Ebert, 1984).

3. The Hirschman-Herfindahl Index is given by the formula $H = \sum_{i=1}^{N} Si^2$ where Si is the market share of the ith firm. The Hirschman-Herfindahl Index weights more heavily the values for the larger firms by squaring their market shares (39, Scherer, 1980, p. 58).

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TABLE 1. Registrations: Medium-Duty Class 5, 6, and 7 Trucks

Firm	1985	1984	1983	1982	1981	1980	1979
General Motors[a]	45,460	40,738	29,064	30,403	36,167	51,829	65,814
	(31.6)	(32.8)	(30.1)	(30.5)	(30.2)	(35.5)	(34.0)
Ford	44,492	37,849	29,181	34,123	39,338	52,758	69,071
	(31.0)	(30.4)	(30.2)	(34.2)	(32.8)	(36.2)	(35.6)
International	43,475	37,404	31,145	28,930	36,989	25,074	54,530
	(30.3)	(30.1)	(32.3)	(29.0)	(30.9)	(24.1)	(28.1)
Mack[b]	4,690	4,134	3,020	2,711	1,922	688	--
	(3.3)	(3.3)	(3.1)	(2.7)	(1.6)	(0.5)	--
Mercedes-Benz[c]	4,013	2,480	2,888	2,960	4,054	4,051	3,708
	(2.8)	(2.0)	(3.0)	(3.0)	(3.3)	(2.8)	(1.9)
Volvo White	1,478	1,350	1,010	536	913	--	--
	(1.3)	(1.1)	(1.0)	(0.5)	(0.8)	--	--
Misc.	56	381	240	175	509	1,398	676
	--	(0.3)	(0.2)	(0.2)	(0.4)	(1.0)	(0.3)
TOTAL	143,664	124,336	96,548	119,828	145,798	118,982	193,799

Percentage Market Shares in Parenthesis.

Source: Automotive News Annual Market Data Issues (Detroit: Crain Publications); preliminary data for 1985.

[a]Chevrolet and GMC.

[b]1980-1984, built by Renault imported by Mack under Mack Midliner name.

[c]U.S. production began in June, 1980; 1979, 1980, 1981, data provided by Mercedes-Benz Truck Company.

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TABLE 2. U.S. Class 8 Truck Registrations

Firm	1985	1984	1983	1982	1981	1980	1979
Ford	15,201	12,320	7,541	9,056	9,471	13,685	22,476
	(11.4)	(9.5)	(9.4)	(12.4)	(9.9)	(12.0)	(13.6)
Freightliner	18,054	16,409	11,111	7,292	9,095	10,465	13,636
	(13.5)	(12.6)	(13.9)	(10.0)	(9.5)	(9.2)	(8.2)
General Motors	11,632	13,222	7,735	8,525	12,395	18,640	23,443
	(8.7)	(10.2)	(9.7)	(11.6)	(13.0)	(16.4)	(14.1)
International	28,523	29,309	19,381	16,972	22,539	21,686	38,585
	(21.4)	(22.5)	(24.2)	(23.2)	(23.6)	(19.1)	(23.3)
Mack	23,696	21,483	12,018	12,879	17,776	21,055	29,266
	(17.7)	(16.5)	(15.0)	(17.6)	(18.6)	(18.6)	(17.6)
PACCAR[a]	23,771	26,731	15,998	13,125	17,033	18,171	23,586
	(17.8)	(20.5)	(20.0)	(17.9)	(17.8)	(16.0)	(14.2)
Volvo White[b]	11,773	8,734	4,865	3,492	3,982	3,982	7,664
	(8.8)	(6.7)	(6.1)	(4.8)	(4.2)	(6.7)	(7.5)
Misc.	931	1,934	1,363	1,944	3,181	1,938	2,360
	(0.7)	(1.5)	(1.7)	(2.7)	(3.3)	(1.7)	(1.4)
TOTAL	133,581	130,142	80,012	73,285	95,472	113,691	165,895

Percentage Market Shares in Parenthesis.

Source: Automotive News Annual Market Data Issues (Detroit: Crain Publications); preliminary data for 1985.

[a]Includes Kenworth and Peterbilt

[b]Includes Autocar, White Western Star (1979-1980), and Volvo

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TABLE 3. Estimated Annual Capacity:
U.S. Medium and Heavy Truck
Assembly Facilities in Current Operation[a]

Firm	Location	Annual Capacity in Units	
Ford	Louisville, KY[c]	150,000	(137,110)[b]
International	Springfield, OH[c]	100,000	(74,801)[b]
General Motors	Pontiac, MI[c]	100,000	(89,257)[b]
Mack	Macungie, PA	22,000	
	Allentown, PA	40,000	
			(29,013)[d]
Hino	Jacksonville, FL	5,000	(600)[b]
Freightliner/Mercedes	Hampton, VA	10,000	(4,350)[b]
	Mt. Holly, NC	12,000	(9,000)[b]
	Portland, OR	10,000	(10,000)[b]
PACCAR	Seattle, WA	7,500	(7,200)[b]
	Madison, TN	7,500	(5,800)[b]
	Newark, CA	7,500	(6,100)[b]
	Chillicothe, OH	6,000	(5,600)[b]
	Denton, TX	6,000	(3,500)[b]
	Kansas City, MO	5,000	(2,600)[b]
Volvo White	Dublin, VA[c]	18,000	(7,901)[b]
	Ogden, UT	6,000	(3,000)[b]

[a]Sources: Facts and Figures (Annual Editions). Detroit: Motor Vehicle Manufacturers Association, and Industry interviews.

[b]Peak production of medium and/or heavy trucks at the facility.

[c]Single plant complex produces medium and heavy trucks.

[d]Peak combined output of Macungie and Allentown plants.

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TABLE 4. Investment in and Assets of Foreign-owned U.S. Commercial Vehicle Producers

Firm	Method of Entry	Book Value of Assets Acquired (Millions of $)	Price Paid for Assets Acquired (Millions of $)
Daimler-Benz[a]	Green-field (Medium-Duty Trucks)	$ 8.1	$ 8.1
Daimler-Benz[b]	Acquisition (Freightliner Corp. Heavy-Duty Trucks)	$184.0	$260.0
Volvo[c]	Acquisition (White Motor Heavy-Duty Trucks)	$171.9	$ 70.0
Renault[d]	Acquisition (45% interest in Mack Trucks: Heavy-Duty Trucks)	$213.6	$228.0

[a]Source: Dauth, 1984.

[b]Source: Business Weeks, March 23, 1981, p. 40; Wall Street Journal, May 6, 1981, p. 37.

[c]Source: Volvo-White Agreement, 1981 and White, 1981.

[d]On March 31, 1983, Mack's total assets were $474.7 million; a 45 percent interest would be $213.6 million: Source: Mack, 1983.

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