The Determinants of Exit in an Open Economy*

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ABSTRACT. In this paper the determinants of exit are investigated for the manufacturing sector of the United States economy, which has been subjected to growing international influences. The analysis uses United States cross-sectional data. The results of the exit equation suggest that low profitability, declining industry growth, and displacement of incumbents by entrants foster exit. International influences are also seen to have an impact on U.S. manufacturing exit. Specifically, imports into an industry have a small effect on exit and protection has little influence in stemming exit.

I. Introduction

When thinking about exit, one can imagine that there are two types of exit from industries: regular or steady-state turnover, and exit due to overall contraction of an industry. Many factors contribute to each type of exit. Firms become unprofitable or the industry as a whole may become unprofitable. Turnover occurs when unprofitable firms are displaced by new entrants who view themselves as more efficient and capable of survival. Contraction occurs when competition from abroad intensifies, tastes change away from a firm's product, aggregate demand falls as a result of a business cycle, or supply conditions change because of unexpected exogenous shocks. Moreover, small size firms are more likely to exit as well as enter in an industry. Indeed, Dunne *et al.* (1988) found that exiting (and entering) firms were approximately one-third the size of existing firms in the industry. Also, in Dunne *et al.* (1989), they find that in their four age categories, the smallest size firms have the highest exit rates.

Final version accepted on December 21, 1990

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Overall, theoretical work on exit is sparse. Studies that focus on the dynamic aspects of entry and exit include Gabszewicz and Thisse (1980) and Eriksson (1984).[1] Gabszewicz and Thisse (1980) examine entry and exit in a differentiated industry. Their model suggests that only a finite number of firms, n, can coexist in a differentiated industry. If more than n firms remain in the market, they will necessarily struggle with each other, and this struggle will provoke exit by some of them. This upper bound on the number of firms in an industry is shown not to hinder its tendency toward pure competition that potential and actual entry will induce. Eriksson (1984) investigates growth, entry, and exit. He finds that when the costs of exit are high, exit decreases. He also finds that exit decreases when output prices are increasing or production costs are falling.

In this paper, an empirical model of exit is estimated for the U.S. manufacturing sector. While there is little controversy as to the importance of exit in the competitive model, few empirical studies have attempted to model the determinants of exit. Early work in this area by Mansfield (1962) and Marcus (1967) suffered from severe data limitations. More recently, several papers have examined exit including Duetsch (1984), MacDonald (1986), Shapiro and Khemani (1987), and Dunne *et al.* (1988 and 1989). The goal of this paper is to complement existing work on exit by accounting for international trade in the U.S. manufacturing sector.

Traditionally, the study of industrial organization has primarily concerned itself with applications to domestic markets and the study of international trade theory has been cast in a general equilibrium framework. Recently, however, there is a growing number of industrial organization papers that take into account international trade flows and domestic market

Small Business Economics 3: 225–232, 1991.

structure. For instance, Pagoulatos and Sorensen (1976), Marvel (1980), Pugel (1980), and Turner (1980) find that imports tend to reduce domestic profitability. Koo and Martin (1984) find that scale economies promote trade flows unless concentration is high, and Aw and Roberts (1985) demonstrate that imports into the United States from newly industrializing countries are complements with domestic labor while imports from developed countries are substitutes. In this paper, trade flows and measures to account for protection are explicitly included in the model.

The next section presents the model specification. Following that, in Section III, the data is described. The estimation and empirical results are reported in Section IV. In Section V, the empirical results are extended to determine the impact of imports on exit in two manufacturing bifurcations: consumer versus producer goods and durable versus nondurable goods. Finally, the paper is concluded in Section VI.

II. The model specification

The exit measure in this model is defined as the *gross* number of firms that have exited from an industry during the period 1978 to 1984.[2] This is referred to as the exit period, t. It seems reasonable to assume that the exit process is unlikely to be instantaneous. Thus, the model is specified to reflect the fact that exit occurs after the industry structural parameters are known. Furthermore, it is assumed that the values of the industry parameters in period $t-1$ reflect the expected state of the industry over the exit period. In this model, these parameters include industry profitability, industry concentration, industry growth, industry size, and the level of protection granted the industry. However, other factors may affect the exit decision contemporaneously. These factors include new entrants and trade flows, both of which will affect the exit decision. Finally, note that entry and trade flows in period $t-1$ are accounted for by profits in period $t-1$. Therefore, a model of exit can be expressed as:

$$\text{Exit}_t = f(\text{Entry}_t, \text{Trade}_t \mid \text{Profitability}_{t-1}, \text{Concentration}_{t-1}, \text{Growth}_{t-1}, \text{Size}_{t-1}, \text{Protection}_{t-1}).$$

An important determinant of exit is the displacement of incumbent firms by new entrants. This issue is dealt with by Gabszewicz and Thisse (1980), and they demonstrated that displacement, at least theoretically, does occur. To test whether this actually occurs, gross firm entry into industry i (over the exit period) is included in the model. Entry is expected to be positively related to exit.

A firm's profitability is also likely to be an important factor in the exit decision. As a firm fails to maintain an acceptable level of profits, its likelihood of survival diminishes. A distinction should be made between current profitability, which can affect liquidity and cause bankruptcy, and expectations of future profitability, which affects the long-run viability of the firm. Profitability (as well as expectations on future profitability) is expected to be inversely related to exit. The profitability of an industry is used as a proxy for the profitability of a firm. Indeed, industry profitability may matter because it indicates how much tolerance there is for variance around this mean before the exit decision is made.[3] The profitability measure used here is a variation of the standard price-cost margin (PCM) and is similar to the measure used in Kessides (1986). Specifically, PCM for each industry is given by: PCM = (VA-PAY-SUP-KCOST)/VOS, where VA = value added, PAY = payroll; SUP = supplemental payroll costs; KCOST = the cost of capital; and VOS = industry sales. The cost of capital measure is calculated by accounting for the opportunity cost of capital (assumed here to be 8%) and the rate of depreciation.[4]

Another potential determinant of exit is the degree of concentration within an industry. In an industry that is highly concentrated, the firms are likely to be large and established. Consequently, these industries are not prone to much change. On the other hand, industries that are characterized by relatively larger percentages of small, young firms should be more volatile. Therefore, an inverse relationship is expected between concentration and exit. The degree of concentration is proxied by the four-firm concentration ratio as measured by the U.S. Department of Commerce.

Two more important elements of industry structure are employed as determinants of exit. First, domestic industry growth is likely to affect exit. Both theoretical and empirical evidence showing that industry growth positively affects

entry has recently been presented by Hause and DuRietz (1984). Conversely, exit is expected to be inversely related to industry growth. Domestic industry growth is calculated as the percentage change in the value of shipments for industry i.[5] Second, to control for differences in industry size, the number of firms in an industry is included. The expectation is that larger industries will experience more exit.[6]

The above specification is the basic model of the determinants of exit in the U.S. manufacturing sector. But as was indicated earlier, international trade flows may have significant impacts on domestic market structure. Therefore, several measures of international trade flows are included in the model.

Imports into the domestic economy are a potentially important determinant of exit. As import competition increases in an industry, it may become more difficult for domestic firms to survive. Thus, a positive relationship is expected between imports and exit. The import measure used here is the change in the value of *net* imports during the exit period.

Whether an industry is protected from import competition should play an important role in the survivability of inefficient firms in that industry. Two measures are used to test the importance of protection from imports: tariffs and nontariff barriers (NTB). First, exit should be inversely related to tariff protection. Industries with high tariff rates should experience a persistence of inefficient domestic producers. The most favored nation *ad valorem* tariff rate is employed here. Second, the presence of nontariff barriers should also be inversely related to exit for similar reasoning. To account for NTB's, a dummy variable is used that takes the value of one in the presence of at least one NTB applying to an industry. The exit equation, including the expected signs, is specified as:[7]

$$\begin{aligned} EXIT_{i,t} = \beta_0 &+ \underset{(+)}{\beta_1} ENTRY_{i,t} + \underset{(-)}{\beta_2} PCM_{i,t-1} \\ &+ \underset{(-)}{\beta_3} CR4_{i,t-1} + \underset{(-)}{\beta_4} GROWTH_{i,t-1} \\ &+ \underset{(+)}{\beta_5} FIRMS_{i,t-1} + \underset{(+)}{\beta_6} NETM^{i}_{i,t} \\ &+ \underset{(-)}{\beta_7} TARIFF_{i,t-1} + \underset{(-)}{\beta_8} NTB_{i,t-1} + \varepsilon_0. \end{aligned}$$

III. The data

The exit (entry) data used in this model are from the U.S. Establishment and Enterprise Microdata file (USEEM) which is a subset of the Small Business Data Base constructed by the U.S. Small Business Administration (SBA). The SBA constructed the USEEM file utilizing business data from Dun and Bradstreet's (D&B) Market Identifier File (MIF). The MIF identifies firms attempting to establish credit or interacting with other businesses seeking credit information. Although this feature of the source file may not lead to an identification of all possible firms, the MIF is likely to encompass nearly all manufacturing firms. Another desirable characteristic of the MIF is that it is continuously updated. For instance, new firms are added and out-of-business firms are deleted as new information becomes available.

A firm is defined as a business organization consisting of one or more establishments under the same ownership and control. An exit is defined to have occurred when a firm appears in D&B's records one year, is not there the following year, and cannot be traced. Hence, mergers and divestitures are not counted. Over the time period 1978 through 1984, D&B recorded a total of 131,983 manufacturing exits with an average of 295 exits per 4-digit SIC industry. An entrant is defined as a new, autonomous firm. Similarly over this time period, D&B recorded a total of 183,265 manufacturing entrants with an average of 410 entrants per 4-digit SIC industry. No industry had zero exits (entrants) in this time period.[8]

The measures for the industry structural parameters (profitability, concentration, growth, and size) are taken from the *Census of Manufactures*. The import data are from *U.S. Imports/Consumption and General, SIC-Based Products by World Areas*, and the export data are from *U.S. Exports/Domestic Merchandise, SIC-Based Products by World Areas*. Finally, the tariff data are from the *Protection in Major Trading Countries*.[9] See Table I for the variable definitions and sources.

IV. The estimation results

The results for the exit equation are given in

TABLE I
Variable definitions and sources

Variables			Source
$EXIT_{i,t}$	=	Gross number of firms that exited industry i between 1978 and 1984	(1)
$ENTRY_{i,t}$	=	Gross number of firms that entered industry i between 1978 and 1984	(1)
$\hat{PCM}_{i,t-1}$	=	Price-cost margin in industry i in 1977 (predicted)	(2)
$\hat{CR4}_{i,t-1}$	=	Four firm concentration ratio in industry i in 1977 (predicted)	(2)
$GROWTH_{i,t-1}$	=	Percentage change in the value of shipments in industry i between 1977 and 1982	(2)
$FIRMS_{i,t-1}$	=	The number of firms in industry i in 1977	(2)
$NETM^{j}_{i,t}$	=	The change in the value of net imports into industry i from country group j between 1978 and 1984 (millions of dollars)	(2)
$TARIFF_{i,t-1}$	=	The most favored nation *ad valorem* tariff rate for industry i in 1980	(3)
$NTB_{i,t-1}$	=	Nontariff barrier dummy measured in 1975: 1 if at least one NTB is present 0 otherwise	(3)

Sources: (1) U.S. Small Business Administration; (2) U.S. Department of Commerce; (3) U.S. International Trade Commission.

TABLE II
Estimation of the exit equation

	Dependent variable: EXIT		
	(1)	(2)	(3)
ENTRY	0.457[a]	0.457[a]	0.457[a]
	(42.10)	(42.15)	(42.13)
PĈM	−438.56[a]	−408.84[a]	−409.42[a]
	(−4.01)	(−3.67)	(−3.70)
ĈR4	−2.61[a]	−2.46[a]	−2.45[a]
	(−5.08)	(−4.70)	(−4.71)
GROWTH	−35.80[a]	−37.59[a]	−36.69[a]
	(−2.03)	(−2.13)	(−2.08)
FIRMS	0.067[a]	0.068[a]	0.068[a]
	(9.99)	(10.07)	(10.09)
$NTEM^{Total}$	0.008[a]		
	(1.99)		
$NETM^{G10}$		0.003	
		(0.54)	
$NETM^{NIC}$			0.043[b]
			(1.93)
$NETM^{ROW}$		0.021[a]	0.004
		(2.01)	(0.72)
TARIFF	−0.70	−0.74	−0.90
	(−0.66)	(−0.70)	(−0.84)
NTB	25.92[b]	23.87[b]	25.94[b]
	(1.90)	(1.74)	(1.91)
Intercept	252.99[a]	242.11[a]	241.41[a]
	(5.94)	(5.59)	(5.60)
$\bar{R}^2$	0.96	0.96	0.96
Model F-value	868.3	774.1	776.2
N	298	298	298

[a] Significant at the 0.05 level (two-tail test).
[b] Significant at the 0.10 level (two-tail test).
Notes: Numbers in parentheses are t-statistics. A collinearity diagnostic test derived in Belsley, Kuh, and Welsch (1980) was performed. The condition index value for each of the equations is well below the level they consider indicates that the degree of multicollinearity might be of concern. Also, a Goldfeld and Quandt (1965) test was performed. The results indicate that the null hypothesis of homoscedasticity could not be rejected.

column 1 of Table II. The results are encouraging with many significant coefficients and model F-values significant at the one percent level. Due to the imperfect concordance between the import-, export-, and output-based SIC classifications, as well as a few missing values, the resulting sample consists of 298 4-digit SIC manufacturing industries.

First consider the industry structural parameters. Caves and Porter (1976) point out that industries vary in their rates of turnover and use an entry measure to proxy for one of the underlying forces that might speed the rate of exit. Similarly, Shapiro and Khemani (1987) include an entry measure to account for actual displacement of firms caused by successful entry. In both of these studies a significant positive relationship was expected and found. Here ENTRY is included in the exit equation, and, similarly, a strong positive influence on EXIT is found. This result suggests that successful entry by new firms fosters the exit of incumbent firms. Specifically, the entry of two new firms, *ceteris paribus*, leads to the demise of

one firm in the U.S. manufacturing sector. This result is also consistent with the theoretical findings of Gabszewicz and Thisse (1980).

Both PCM and CR4 exert a significant influence on EXIT in the hypothesized direction. In industries where profitability is low the exit of firms is higher. Also, in less concentrated industries there is more exit, suggesting that this industry structure is more volatile. The negative sign on GROWTH indicates that in those industries where growth in the value of shipments is declining, the exit of firms is higher. As expected, FIRMS has a positive and significant coefficient indicating that larger industries (in terms of the number of firms) have more exits.

Now consider the influences of the international variables. $NETM^{Total}$ (the change in net imports into manufacturing industries) have a significant positive influence on EXIT, *ceteris paribus*. However, the effect is quantitatively small. Note that the coefficient for $NETM^{Total}$ indicates that an increase of one million dollars in net imports over this period led to 0.008 manufacturing exits. This suggests that other factors such as declining industry growth or increased competition from new entrants may be the driving force behind exits in manufacturing industries.

Given the significant positive relationship between imports and exit, imports are further disaggregated to examine specific groups of countries including: G10, the major developed country trading partners of the United States,[10] and NIC, trading partners with the United States who are considered newly industrializing countries.[11] The coefficient on the change in imports from G10 (column 2) is not significantly different from zero. However, $NETM^{ROW}$ (the change in net imports from the rest of the world excluding the net imports from G10) is significant, suggesting a negligible impact on exit caused by imports from the major trading partners of the United States. Conversely, the change in imports from the NIC's (column 3) has a weakly significant influence on domestic exit. This result may reflect the NIC's growing threat in this sector of the U.S. economy.[12]

The influence of protection in the manufacturing sector is tested with the remaining two variables. First, TARIFF retains the hypothesized sign but is insignificant. This result is not surprising given the low levels of tariffs in the United States resulting from recent multilateral trade negotiations such as the Tokyo Round. Second, NTB has a weakly significant coefficient but with an unexpected positive sign. Marvel and Ray (1983) point out that "NTBs were introduced systematically in industries that were becoming increasingly vulnerable to competition from imports" (p. 190). This coupled with recent questions regarding the health of such industries may indicate that industries most susceptible to imports are gaining protection, however, it may not stem exits. Hence, the positive relationship found here may reflect that in declining industries, firms are likely to exit regardless of the trade protection they are afforded. Taken together, the results from these latter two variables suggest that the limitation of imports arising from trade barriers have not significantly deterred the decline of the U.S. manufacturing sector.

V. Extension of the exit estimation

In this section, the exit equation is estimated to ascertain the impact of imports on various subsets of the manufacturing sector. The exit equation is tested for the following subcategories of manufacturing industries: consumer goods, producer goods, nondurable goods, and durable goods.[13]

Table III presents the results of the consumer versus producer goods bifurcation. The explanatory power of these estimations is reflected in the high adjusted R^2 values and F-values significant at the one percent level. The sample consists of 89 consumer goods industries and 208 producer goods industries. In consumer goods industries new entrants, declining industry growth, and imports have a significant impact on exit. In comparison, profitability, concentration, entry, and declining industry growth have an impact on exit in producer goods industries. This suggests that consumer goods industries are susceptible to both international and domestic market conditions, while producer goods industries are primarily affected by domestic market conditions.

Also reported in Table III are the results of the nondurable goods versus durable goods estimations. This bifurcation also yields estimations with high explanatory power. The sample consists of 130 nondurable goods industries and 167 durable goods industries. In the nondurable goods indus-

TABLE III
Estimation of the exit equation: consumer versus producer goods, and nondurable versus durable goods

	Dependent variable: EXIT			
	Consumer goods industries	Producer goods industries	Nondurable goods industries	Durable goods industries
ENTRY	0.504[a]	0.450[a]	0.327[a]	0.667[a]
	(22.54)	(37.45)	(22.60)	(40.91)
PCM	11.90	−442.62[a]	−319.47[a]	−138.88
	(0.08)	(−2.76)	(−2.53)	(−1.24)
CR4	−0.382	−2.48[a]	−1.63[a]	−1.09[a]
	(−0.70)	(−3.36)	(−2.77)	(−2.06)
GROWTH	−41.14[b]	−34.68[b]	−25.45	−78.25[a]
	(−1.63)	(−1.68)	(−0.89)	(−5.47)
FIRMS	0.176[a]	0.065[a]	0.178[a]	0.010[b]
	(10.02)	(8.86)	(13.94)	(1.85)
$NETM^{Total}$	0.021[a]	0.007	0.019[a]	−0.004
	(2.45)	(1.46)	(2.40)	(−1.12)
TARIFF	1.52[b]	−1.58	0.288	−1.97
	(1.85)	(−0.86)	(0.27)	(−1.41)
NTB	−9.52	32.87[b]	10.94	23.31
	(−0.73)	(1.76)	(0.65)	(1.34)
Intercept	9.91	252.14[a]	164.22[a]	129.97[a]
	(0.19)	(4.17)	(3.09)	(3.08)
$\bar{R}^2$	0.97	0.96	0.98	0.97
Model *F*-value	322.6	692.4	878.5	625.3
N	89	208	130	167

[a] Significant at the 0.05 level (two-tail test).
[b] Significant at the 0.10 level (two-tail test).
Notes: See Table II.

tries profitability, concentration, new entrants, and imports have a significant effect on exit. In contrast, only concentration, new entrants, and declining industry growth significantly impact exit in durable goods industries. The results of this bifurcation suggest nondurable goods industries are susceptible to international and domestic market conditions, while durable goods industries are primarily affected by domestic market conditions.

VI. Summary and conclusions

In this paper the determinants of exit are investigated for the manufacturing sector of the United States economy, which has been subjected to growing international influences. Exit is modeled as a function of industry profitability, growth, concentration, and size. To account for new competition in an industry, the number of new entrants is also included. The effects of international competition is captured by including imports into each industry. Protection is accounted for by including measures for tariffs and nontariff barriers.

The results of this paper support the long held beliefs about which factors would lead a firm to exit an industry. Clearly, it is no surprise that low profitability and declining industry growth foster exit. However, it may be surprising that the results of the model indicate that competition from entering firms has the most impact on the exit decision.

The results of the international factors lead to an interesting conclusion. The protection variables indicate that tariffs and nontariff barriers have little influence in stemming exit in the U.S. manufacturing sector. On the other hand, competition from imports does have a small effect on exit. However, the results of the model show that imports from the NICs rather than from the major developed countries have an impact in U.S. manufacturing industries. Taken together, the results of the model point to competition, both from entrants as well as from the NICs, that puts the most pressure on U.S. manufacturing firms. This suggests that a more efficient manufacturing sector will emerge regardless whether or not this sector is protected.

Notes

* I would like to thank John Mayo, Don Clark, Ron Shrieves, Robert Feinberg, Joseph Shaanan and an anonymous referee for their comments on earlier drafts of this paper. The views in this paper do not necessarily reflect those of the Commission. The usual caveat applies.

[1] For other theoretical work see Friedman (1979), Ghemawat and Nalebuff (1985), Fudenberg and Tirole (1986), and Frank (1988).

[2] Gross exit was chosen over net exit so that an important determinant of exit could be tested, namely, displacement of incumbent firms by new entrants.

[3] These observations on profitability were pointed out by an anonymous referee.

[4] KCOST = [(0.08 + DCBS/GVDABS)*GVDABS] + [(0.08 + DCME/GVDAME)*GVDAME], where

DCBS = depreciation charges for buildings and structures,
DCME = depreciation charges for machines and equipment,
GVDABS = gross value of depreciable assets — buildings and structures,
GVDAME = gross value of depreciable assets — machines and equipment.

All the values are from the *1977 Census of Manufactures.*

[5] The growth rate of the domestic industry is taken to be exogenous. Nevertheless, one might want to consider the effect of import growth on the growth rate of the domestic industry as well as its impact on domestic price-cost margins. However, these questions are beyond the scope of this research.

[6] This variable is included because data limitations precluded the use of exit rates.

[7] Recent research (Cowling and Waterson (1976) and Clarke and Davies (1982)) indicates that profitability and concentration should be treated as endogenous variables. Since PCM and CR4 are both on the right-hand side of the exit equation, this model corrects for any simultaneity between these measures by estimating them as part of a block-recursive system (see Pindyck and Rubinfeld (1981)). Specifically, a simultaneous system following Strickland and Weiss (1976), Martin (1979), and Pagoulatos and Sorensen (1981) is estimated and the predicted values for profitability and concentration are substituted into the exit equation. The first block is estimated using 2SLS and is specified as:

$$CR4_i = \alpha_0 + \alpha_1 ADV_i + \alpha_i \mathbf{Z}_i + \varepsilon_1,$$
$$PCM_i = \gamma_0 + \gamma_1 ADV_i + \gamma_2 CR4_i + \gamma_i \mathbf{Z}_i + \varepsilon_2,$$
$$ADV_i = \delta_0 + \delta_1 CR4_i + \delta_2 PCM_i + \delta_i \mathbf{Z}_i + \varepsilon_3,$$

where CR4 = the four-firm concentration ratio; PCM = the price-cost margin; ADV = the advertising to sales ratio; and **Z** = a vector of exogenous variables as suggested by the extant literature. The results from the first block of this block-recursive system are available from the author upon request. The second block, which consists of the exit equation, is estimated using OLS.

[8] For a complete description of the data from this source see *The State of Small Business: A Report of the President 1984*, Appendix C.

[9] These trade data are concorded by the U.S. Department of Commerce (DOC) into import- (export-) based SIC product codes. This concordance allows comparisons with data collected in the manufacturing census, which is organized by output-based SIC product codes. However, the output-based SIC product codes do not match the import- (export-) based SIC product codes on a one-to-one basis. In many cases assigning the entire content of a TSUSA commodity (for imports) or a Schedule B commodity (for exports) into a single output-based SIC product code would seriously distort the import (export) data. Therefore, in these instances DOC combined two or more output-based SIC product codes into a single code and assigned the import (export) data to the single code. This concordance method results in approximately 330 import- (export-) based SIC product codes, whereas the output-based SIC consists of 450 product codes. Consequently, cross-sectional analysis that takes into account trade flows in the manufacturing sector is limited to approximately 330 4-digit SIC industries.

[10] The United States's major trading partners include Australia, Belgium, Canada, France, West Germany, Japan, The Netherlands, Sweden, Switzerland, and The United Kingdom.

[11] The definition of a NIC will follow that of Balassa (1981) and Mathieson (1979). Balassa (1981) defines a NIC as having per-capita income between $1100 and $3500 in 1978, and a manufacturing sector which represents at least 20 percent of gross domestic production in 1977. Mathieson (1979) defines a NIC as a country with rapid economic growth, large diverse industrial sectors, significant trade in the manufacturing sector, and aggressive development strategies. The NIC's include Brazil, Columbia, Hong Kong, Mexico, Philippines, Singapore, South Korea, and Taiwan.

[12] Aw and Roberts (1984) examine the rise in importance of imports from NIC's especially into the U.S. manufacturing sector. They show that manufacturing imports from NIC's have grown to about 20% of total U.S. manufactured imports. The increase in net imports in manufactures over the 1978 to 1984 period from the NIC's is $28 billion.

[13] The classification of industries into these categories follows that of Ornstein (1977). Note that these four categories are not mutually exclusive.

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