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Has Import Disciplined Swedish Manufacturing Firms in the 1990s?

by

Nan Nan Lundin*

Abstract

This paper analyses how increased integration and the ongoing enlargement of European Union's internal market affected the performance of Swedish manufacturing firms. The pro-competitive effect of international trade, in terms of intensified import competition on domestic firms' market power, has been investigated extensively at industry level. In contrast to previous studies, this analysis is based on detailed firm-level information. Import data are divided into an EU member group and a group of recently proved EU member candidates. It focuses on how imports from these groups, together with imports from other non-European trading partners, impact on firm profitability, while taking firm-specific efficiency effects into account. The findings are that import from the new EU-candidates seems to have a substantial disciplinary effect on Swedish firm profits, whereas import from EU-member countries only appears to have an impact on firms with large market shares and in highly concentrated industries.

Keywords: Import discipline; market structure; market share; firm-level efficiency
JEL classification: F12; F15; L13; L60

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* Department of Economics, ESI, Örebro University, and Trade Union Institute for Economic Research (FIEF), Wallingatan 38, SE-111 24 Stockholm, Sweden. E-mail: nannan.lundin@fief.se

1. Introduction

Import competition has been regarded as a disciplinary device to constrain market power of domestic firms. At industry level and within the structure-conduct-performance paradigm, this disciplinary effect of imports on profit margins has been investigated extensively. For Sweden, there are two earlier studies, Stålhammar (1991) and Hansson (1992), carried out on manufacturing industries in the 1980s. Yet so far, as pointed out by Tybout (2001), only a handful of studies have tried to explain cross-firm variation in profits using a combination of industry-wide and firm-specific factors.[1]

This paper is based on a panel of firm level data on Swedish manufacturing for the period 1990-1999. The panel structure of the data has the advantage that it is possible to distinguish temporal fluctuations from cross-sectional variations in profit margins. Furthermore, firm level data provides a possibility to shed some light on the controversial question whether the often found positive correlation between profitability and concentration at the industry level is due to intra-industry efficiency differences, exercising of market power, or both.

In the paper I use a conjectural variation model, where the idea is that firms' conjectures concerning import penetration, and thus their reactions, differ with respect to the countries of origin. The import is divided into five different country groups to determine whether the strength of import discipline varies by the origin of imports. The European Union countries – as being Sweden's most important trading partners – and the European Union candidates are of specific interest. Moreover, the interaction effects between industry level characteristics, such as import penetration and producer concentration, and firm-specific characteristics, such as market share, are examined in more detail.

The paper proceeds as follows. Section 2 discusses the theoretical framework. Section 3 presents the data and gives some descriptive facts on the exposure and the development of foreign competition in Swedish manufacturing in the 1990s. Section 4 sets out the empirical specifications and shows the results. Section 5 concludes.

[1] See, e.g. Levinsohn (1993) and Roberts & Tybout (1996). However, their studies are all on less developed countries.

2. A theoretical background

This section aims to illustrate three major points. First, in the context of a closed economy, I compare the price-cost margin expression at the firm level with the corresponding expression at the industry level. Second, I use a partial collusive model and introduce a distribution of firm level marginal costs to show how efficiency differences among firms within an industry are related to the industry level concentration ratio. Third, I apply the same partial collusive model to an open economy and allow imports from different country groups to have varying impact on price-cost margins.

2.1 Firm level efficiency versus industry level concentration

In the classical tradition of industrial economics the industry or the market is the unit of study. Differences among firms are assumed transitory or unimportant. In general equilibrium industry profitability is assumed to be determined primarily by the ability of established firms to restrict rivalry among themselves and by protection through barriers to entry. A key hypothesis is that higher concentration tends to raise industry-wide profits by facilitating collusion (Scherer & Ross 1990). To illustrate how concentration and firm-level efficiency affect price-cost margins, I utilize the model developed by Clarke & Davies (1982).

Let us assume an industry in a closed economy with n firms that produce a homogenous good. The i:th firm has the following profit function:

$$\pi_i = p(q)q_i - c_i q_i \qquad i = 1, \ldots, n \tag{1}$$

where π_i is profit, q_i is output and c_i is marginal cost of firm i. Marginal cost is assumed to be constant and all firms set the same price p on the homogenous good.

The inverse demand function is:

$$p = p(q) = p\left(\sum_{i=1}^{n} q_i\right) \tag{2}$$

The first-order condition for firm *i*'s profit maximization with respect to its output q_i is:

$$\frac{\partial \pi_i}{\partial q_i} = p + \left[\frac{\partial p}{\partial q}\frac{\partial q}{\partial q_i} + \frac{\partial p}{\partial q}\sum_{j \neq i}\frac{\partial q}{\partial q_j}\frac{\partial q_j}{\partial q_i} \right] q_i - c_i = 0 \tag{3}$$

Equation (3) is rewritten in term of firm *i*'s Lerner index L_i, which can be considered as a measure of its market power.

$$L_i = \frac{p - c_i}{p} = \frac{1}{\eta}\frac{q_i}{q}\left(1 + \lambda_i\right) \tag{4}$$

$$\lambda_i = \frac{\partial \sum_{j \neq i} q_j}{\partial q_i} \tag{5}$$

where the market elasticity of demand $\eta = -(\partial q / \partial p)(p / q) > 0$ and λ_i is firm *i*'s conjecture about its competitors' reaction to its output change. Equation (4) shows that at the firm level the Lerner index L_i or the price-cost margin PCM depends on firm *i*'s market share q_i / q.

To describe firms' conjecture in more detail, I follow Clarke & Davies (1982) where the conjecture is defined as:

$$\frac{\partial q_j}{q_j} = \alpha \frac{\partial q_i}{q_i} \Leftrightarrow \frac{\partial q_j}{\partial q_i} = \alpha \frac{q_j}{q_i} \qquad 0 \leq \alpha < 1 \tag{6}$$

where α is a parameter indicating the degree of competition between producers; $\alpha = 0$ means that Cournot conjectures prevail, while perfect collusion is approached as α tends to be 1.

By using (6) in (5) I obtain:

$$\lambda_i = \frac{\alpha \sum_{j \neq i} q_j}{q_i} = \frac{\alpha\left(\sum_{i=1}^{n} q_i - q_i\right)}{q_i} = \alpha\left(\frac{q}{q_i} - 1\right) \tag{7}$$

and inserting (7) into (4) gives a new expression of firm *i*'s Lerner index

$$L_i = \frac{p - c_i}{p} = \frac{1}{\eta}\left(\alpha + (1-\alpha)\frac{q_i}{q}\right) \tag{8}$$

By multiplying each side of (8) with firm *i*'s market share and summing over the *n* firms, I obtain the corresponding Lerner index at the industry level *L*:

$$L = \sum_{i=1}^{n} \frac{q_i}{q} L_i = \frac{pq - \sum_{i=1}^{n} c_i q_i}{pq} = \frac{\alpha}{\eta} + \frac{(1-\alpha)}{\eta} \sum_{i=1}^{n} \left(\frac{q_i}{q}\right)^2 = \frac{\alpha}{\eta} + \frac{(1-\alpha)}{\eta} H \tag{9}$$

where *H* is the Herfindahl index. We observe that at the industry level the Lerner index *L* or price-cost margin PCM is an increasing function of concentration, measured by the Herfindahl index, while at the firm level, in equation (8), the Lerner index L_i (price-cost margin) is an increasing function of firm *i*'s market share. These are important characteristics of the theoretical model I will make use of in the specification of my empirical models.

So far, I have assumed constant marginal cost for each firm. Suppose now that the marginal cost still is constant for each firm, but varies across firms. In other words, it means that there are cost/efficiency differences among firms within the same industry and I assume that the marginal costs at industry level have a distribution with the mean μ_c and the variance σ_c^2.

Clarke & Davies (1982) have, within the theoretical framework above, shown that industry concentration, measured by the Herfindahl index *H*, and the price-cost margin are related to cost/efficiency differences at the industry level. To derive an expression of *H*, at first, I rewrite equation (8)

$$\frac{q_i}{q} = -\frac{\alpha}{1-\alpha} + \frac{\eta}{1-\alpha}\left(1 - \frac{c_i}{p}\right) \tag{10}$$

Then I get the following expression for the price by summing (10) over *n* and rearranging

$$p = \sum_{i=1}^{n}(c_i)\eta\left[n(\eta-\alpha)-(1-\alpha)\right]^{-1} \tag{11}$$

Substituting (11) into (10), which is then squared and summed, gives[2]

$$H = \frac{1}{n} + \frac{1}{n}\left[1 - n\frac{(\eta-\alpha)}{(1-\alpha)}\right]^2 \frac{\sigma_c^2}{\mu_c^2} \tag{12}$$

Equation (12), in combination with equation (9), shows that concentration (and price-cost margin) will be higher when cost/efficiency differences among firms, measured by the coefficient of variation of marginal cost $v_c^2 = \sigma_c^2 / \mu_c^2$, are greater. This provides support for the argument that the positive relationship between industry profitability and market concentration may be explained by higher efficiency of the largest firms.

2.2 A conjectural variation model for an open economy

The model above gives some insights how concentration and variations in firm efficiency are related to price-cost margins. I will now extend the model to an open economy by introducing imports into the domestic market and allow the firm's conjectures to vary depending on the origins of imports.[3]

Let us assume that the domestic market conditions are the same as in section 2.1, i.e. there are *n* domestic firms in an industry producing a homogenous good. However, now there are also foreign firms belonging to *s* different regional groups competing with the domestic firms on the

[2] For more details see Clarke & Davies (1982).
[3] See Urata (1984) and Hansson (1992).

domestic market. The profit function of a domestic firm i ($i = 1, \ldots, n$) is still described by equation (1), while the inverse demand function that the domestic firms face is modified into

$$p = p(q) = p\left(q^d + q^m\right) = p\left(\sum_{i=1}^{n} q_i^d + \sum_{k=1}^{s} q_k^m\right) \tag{13}$$

where q is total quantity demanded, q_i^d is quantity produced by domestic firm i, and q_k^m is the quantity imported from region k.

The first-order condition for a domestic firm i's profit maximization with respect to its output q_i^d is

$$\frac{\partial \pi_i}{\partial q_i^d} = p + \left[\frac{\partial p}{\partial q}\frac{\partial q}{\partial q_i^d} + \frac{\partial p}{\partial q}\sum_{j \neq i}\frac{\partial q}{\partial q_j^d}\frac{\partial q_j^d}{\partial q_i^d} + \frac{\partial p}{\partial q}\sum_{k=1}^{s}\frac{\partial q}{\partial q_k^m}\frac{\partial q_k^m}{\partial q_i^d}\right] q_i^d - c_i = 0 \tag{14}$$

The Lerner index at firm level L_i (price-cost margin) can then be expressed as

$$L_i = \frac{p - c_i}{p} = \frac{1}{\eta}\frac{q_i^d}{q^d}\frac{q^d}{q}\left(1 + \lambda_i^d + \sum_{k=1}^{s}\lambda_k^m\right) \tag{15}$$

$$\lambda_i^d = \frac{\partial \sum_{j \neq i} q_j^d}{\partial q_i^d} \text{ (cf. equation (5)) and } \lambda_k^m = \frac{\partial q_k^m}{\partial q_i^d} \tag{16}$$

Hence, λ_i^d is firm i's conjecture about its domestic competitors' response to its output change and λ_k^m is firm i's conjecture about its foreign competitors' in region k response to its output change. Likewise, as in section 2.1, I further specify the conjectures as

$$\frac{\partial q_j^d}{\partial q_i^d} = \alpha \frac{q_j^d}{q_i^d} \qquad \text{for all } j \neq i \text{ and } 0 \leq \alpha < 1 \tag{17a}$$

$$\frac{\partial q_k^m}{\partial q_i^d} = \varphi_k \frac{q_k^m}{q_i^d} \qquad k = 1, \ldots, s \text{ and } 0 \leq \varphi_k < 1 \tag{17b}$$

Substituting (17a) and (17b) into (15) gives another expression of the Lerner index (price-cost margin) at the firm level.

$$L_i = \frac{1}{\eta}\frac{q^d}{q}\left[\alpha + (1-\alpha)\frac{q_i^d}{q^d}\right] + \frac{1}{\eta}\sum_{k=1}^{s}\varphi_k \frac{q_k^m}{q} =$$
$$\eta^{-1}\left(1 - \sum_{k=1}^{s} m_k\right)\left[\alpha + (1-\alpha)s_i^d\right] + \eta^{-1}\left(\sum_{k=1}^{s}\varphi_k m_k\right) \tag{18}$$

The market share of the domestic firms $q^d / q = 1 - \sum_{k=1}^{s} m_k$, where m_k is the share of import from region k in consumption, q_k^m / q, and s_i^d is the domestic firm i's share of total domestic output, q_i^d / q^d. The larger the market share of firm i s_i^d, the higher the PCM on firm level. We also notice that the market share s_i^d interacts with import competition m_k in determining PCM.

Summing over the n domestic firms in (18) gives the aggregated Lerner index. The weighted Lerner index L below equals the price-cost margin PCM at industry level.

$$L = \sum_{i=1}^{n} s_i^d L_i = \frac{pq^d - \sum_{i=1}^{n} c_i q_i^d}{pq^d} = \eta^{-1}\left(1 - \sum_{k=1}^{s} m_k\right)\left[\alpha + (1-\alpha)H\right] + \eta^{-1}\sum_{k=1}^{s}\varphi_k m_k \tag{19}$$

where the Herfindahl index of domestic producer concentration, i.e. $H = \sum_{i=1}^{n} \left(s_i^d\right)^2$. The larger the concentration *H*, the higher is the PCM at industry level. Moreover, *H* interacts with import competition $\sum_{k=1}^{s} m_k$ to determine PCM. The larger the conjecture parameter φ_k, the less is the disciplinary effect of imports from region *k*. When trade barriers are reduced φ_k will decrease; however, the competitive pressure imposed by imports may differ for imports originating from different regions, i.e. φ_k varies. Notice that impact of the share of import from region *k* in consumption m_k on PCM is ambiguous. The net effect of m_k depends on the degree of concentration *H*, the degree of collusion among domestic producers α, and the competitive pressure of imports from region *k* φ_k.[4] Yet, given the concentration *H*, the larger the competitive pressure from region *k* relative to the competition among domestic producers, i.e. the larger α relative to φ_k, the more likely the imports from region *k* has a disciplinary effect on PCM. The equations (18) and (19) are key equations on which the empirical analyses at firm- and industry level in section 4 are based.

3. Data and import penetration in Swedish manufacturing

The data I use include firm-level data on profit, output, capital stock, employment and wage for firms with more than 50 employees in Swedish manufacturing for the period 1990-1999. This gives me a panel consisting of 3 197 unique firms belonging to 93 manufacturing industries at the 3-digit level of the SNI92 classification. The coverage of the panel in terms of total manufacturing employment is around 70 percent.[5]

[4] The sufficient condition for a disciplinary effect of imports $\partial L / \partial m_k < 0$ is that $H + \alpha(1 - H) > \varphi_k$.

[5] Table A1 in Appendix contain more detailed information on the panel. The firm data comes from Statistics Sweden's compilation of firms' annual financial reports.

Table 1 Import penetration from different country groups 1990 and 1999

Country groups	1990	1999
EU 14 members	0.33	0.37
EU 10 candidates	0.01	0.03
Japan & Asian NICs	0.06	0.04
Other high-income countries	0.08	0.09
Other low-income countries	0.04	0.04
All countries	0.52	0.57

Notes: Table A2 in Appendix gives a more detailed description of the Countries included in each country group.

The firm level data has then been linked to data on exports by industries and imports by industries and trading partners from Statistics Sweden. *Table 1* shows the trends in the import share from various country groups of consumption in the 1990s.[6] We observe that Swedish manufacturing is highly exposed to import competition. More than half of the consumption of manufacturing products comes from abroad and the share has increased over the 1990s. Most of the manufacturing import originates from the EU member countries and the distribution of import shares among country groups has been relatively stable. Nevertheless, we notice a modest increase in the import shares from EU members and the EU candidate countries and a slight fall in the import share from Japan and Asian NICs.

4. Empirical analysis

Two basic types of empirical models are analyzed. To compare my result with earlier industry level studies, I start off in section 4.1, from a conventional industry level model. After that I proceed in section 4.2, and estimate a more appropriate firm level model, which enables me to control for and separate competition effects from efficiency effects.

[6] Consumption = sales value + import – export.

4.1 The conventional industry-level model

To determine the impact of import on profitability at industry level, I estimate the following regression equation (cf. equation (19)):

$$PCM_{it} = \alpha + \sum_{k=1}^{s} \gamma_k IMC_{ikt} + \beta H_{it} + \kappa \ln(K/L)_{it} + \lambda_1 DT_t + \lambda_2 DI_i + \varepsilon_{it} \quad (20)$$

where PCM_{it} is the price-cost margin in industry *i* at time *t* and is defined as (value added − payroll)/value added. IMC_{it} is the same industry level measure of import penetration as discussed above, i.e. the import share for country group *k* in consumption. H_{it} is the Herfindahl index. $\ln(K/L)_{it}$ is the logarithm of the capital stock per employee at industry level. Since the numerator of PCM consists of both pure profit and capital compensation, capital intensity is included as a control variable in the regression. DT_t are year dummies and DI_i are industry dummies defined at the 3-digit level of the SNI92 classification.

In the model in equation (20) I allow for differences in the disciplinary effects of imports depending on the countries of origin, i.e. I let γ_k vary between country groups *k*. To a large extent the integration among the present EU members has, due to similarities in income and factor endowments, resulted in increased intra-industry and intra-firm trade. One may therefore expect less competitive impact of imports originating from these countries than of imports from more dissimilar countries (Jacquemin & Sapir 1991). Of particular interest for the future European integration is the effect of imports from the recently proved EU candidate countries.

Hansson (1992) found a quite large disciplinary impact of imports from Japan and Asian NICs on domestic Swedish manufacturing firms in the 1980s. Is this a pattern we can observe also in the 1990s?

These are the motives of why I have allowed for differential disciplinary effects of imports from the following five country groups: (i) EU14 member countries, (ii) EU10 candidate countries, (iii) Japan and Asian NICs, (iv) other high-income countries, and (v) other low-income countries. As an alternative classification I merge EU14, Japan and Asian NICs, and other high-income countries into a high-income country group and EU10 and and other low-income countries to a low-income country group.

Table 2 shows the results from the estimations of equation (20). In column 1 (without fixed industry effects) and column 2 (with fixed industry effects) the coefficient on total import penetration has the expected negative sign, but is insignificant. If imports, as in column 3, are divided into high- and low-income country groups and without fixed industry effects, imports from low-income countries has a negative and significant effect, while imports from high-income countries is insignificant. However, the significant effect of imports from low-income countries disappears if, as in column 4, fixed industry effects are introduced. Further division of imports, in column 5, into the five country groups, indicates that import from the EU candidate countries has a large negative and significant effect on industry level price-cost margins. This impact persists even when, in column 6, industry fixed effects are included.

As I pointed out above, return to capital is included in my measure of price-cost margins and accordingly the capital-labor ratio should be positively related to PCM. Another interpretation is that high capital requirements constitute an entry barrier. In all specifications the capital-labor ratio coefficient has the expected positive sign and is highly significant. Furthermore, concentration, measured by the Herfindahl index, has always a positive effect, but is never significant.[7]

A methodological problem is the potential simultaneity between import penetration, concentration and profitability. High profits in an industry will attract foreign firms to enter the market and thus induce more imports. OLS estimates are therefore expected to be inconsistent and biased. Concentration affects PCM positively, but on the other hand, PCM may over time influence the concentration ratio; high profits may attract entry of domestic firms. A Durbin-Wu-Hausman test in columns 1, 3 and 5 show that the hypothesis that regressors are exogenous cannot be rejected for the specifications without industry fixed effects.

[7] As a robustness check I replace the Herfindahl index with the market share of the largest four firms C4. This yields similar results, except that the coefficient on C4 is significant in specifications without industry fixed effects. Moreover, I have experimented with including industry level export intensities into the model. This additional control does not lead to any substantial changes in my original results.

Table 2 Determinants of price-cost margin at the industry level

Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Import penetration (All countries)	–0.036 [–1.30]	–0.005 [–0.05]				
Import penetration (High-income)			0.015 [0.54]	0.030 [0.30]		
Import penetration (Low-income)			–0.448 [–2.62]	–0.364 [–1.08]		
Import penetration (EU14)					–0.046 [–1.60]	–0.079 [–0.71]
Import penetration (EU10)					–1.360 [–2.77]	–1.812 [–2.20]
Import penetration (Japan & Asian NIC)					–0.050 [–0.40]	–0.237 [–1.10]
Import penetration (Other high-income)					0.259 [3.43]	0.139 [0.82]
Import penetration (Other low-income)					–0.134 [–0.99]	0.162 [0.71]
Herfindahl index	0.044 [1.60]	0.076 [1.51]	0.056 [1.87]	0.099 [1.68]	0.034 [1.15]	0.097 [1.64]
Capital-labor ratio	0.123 [5.92]	0.066 [2.14]	0.116 [6.23]	0.067 [2.15]	0.117 [5.46]	0.057 [2.09]
Year dummies	yes	yes	yes	yes	yes	yes
Industry dummies	no	yes	no	yes	no	yes
$\overline{R}^2$	0.25	0.53	0.28	0.54	0.30	0.55
Observations	849	849	849	849	849	849
Durbin-Wu-Hausman Chi-square test	p-value 0.70	p-value 0.96	p-value 0.13	p-value 0.03	p-value 0.19	p-value 0.04

Notes: The Durbin-Wu-Hausman tests use lagged import penetration and Herfindahl indices as instrument for tests of endogeneity; H_0: regressors are exogenous. Square brackets [ ] give White's heteroskedasticity-consistent t-statistics.

The penetration ratios from different regions can be highly collinear. For example, trade liberalization between EU member countries may divert trade from outside the EU to trade within the EU, the penetration ratios will then be negatively correlated. Alternatively, exchange rate fluctuations affect penetration ratios simultaneously, and cause them to move together. Calculations of variance inflation factors (VIF-test) show that multicollinearity is not a considerable problem in specifications without

industry fixed effects. The mean of VIF is at a low value of 1.62 and all individual VIF values are less than 2.[8]

Apparently, according to equation (19), import penetration may have a larger dampening effect on PCM in more concentrated industries. I examine this, as shown in equation (21), by inserting an interaction variable between import penetration and concentration $IMC_{ikt} \times H_{it}$ in equation (20) and *Table 3* presents the results.

$$PCM_{it} = \alpha + \sum_{k=1}^{s} \gamma_k IMC_{ikt} + \beta H_{it} + \sum_{k=1}^{s} \varphi_k IMC_{ikt} \times H_{it} + \ldots \tag{21}$$

In *Table 3* we observe that it is only import competition from high-income countries (column 3) and the EU member countries (column 5) that have the expected impact on PCM in concentrated industries and this effect disappears in specifications with fixed industry effects (columns 4 and 6).

To evaluate the varying impact of import penetration on PCM in more or less concentrated industries, I calculate the marginal effect of increased import competition on PCM. Disregarding the possibility that import competition affects concentration, we may derive the expression for marginal effect from equation (21) as:

$$\frac{\partial PCM_{it}}{\partial IMC_{ikt}} = \gamma_k + \varphi_k H_{it} \tag{22}$$

By using the estimate of γ_k and φ_k in Table 3 and the average concentration ratios in the first and the third quartiles of the industry distribution of the Herfindahl index I get values of the marginal effect of import penetration, which are shown in *Table 4*.

[8] According to rules of thumb applied to VIF, there is evidence of multicollinearity if the largest VIF is greater than 10 and the mean of all VIFs is considerable larger than 1 (Chatterjee, Hadi & Price 2000).

Table 3 Interactions between import penetration and concentration at industry level

Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Import penetration (All countries)	–0.001 [–0.05]	0.004 [0.05]				
Import penetration (High-income)			0.096 [3.09]	0.054 [0.65]		
Import penetration (Low-income)			–0.735 [–3.05]	–0.468 [–1.18]		
Import penetration (EU14)					0.070 [1.78]	0.137 [1.46]
Import penetration (EU10)					–1.690 [–2.47]	–2.468 [–2.29]
Import penetration (Japan & Asian NIC)					–0.114 [–0.56]	–0.386 [–1.46]
Import penetration (Other high-income)					0.268 [1.75]	–0.056 [–0.19]
Import penetration (Other low-income)					–0.305 [–1.35]	0.399 [1.30]
Import penetration × H (All countries)	–0.116 [–1.00]	–0.021 [–0.09]				
Import penetration × H (High-income)			–0.242 [–2.14]	–0.065 [–0.26]		
Import penetration × H (Low-income)			0.832 [2.54]	0.256 [0.65]		
Import penetration × H (EU14)					–0.327 [–2.53]	–0.193 [–0.65]
Import penetration × H (EU10)					1.877 [0.81]	2.273 [1.01]
Import penetration × H (Japan & Asian NIC)					0.040 [0.15]	0.557 [1.36]
Import penetration × H (Other high-income)					–0.068 [–0.23]	0.163 [0.38]
Import penetration × H (Other low-income)					0.325 [0.87]	–0.549 [–1.12]
Herfindahl index (H)	0.117 [1.36]	0.090 [0.48]	0.125 [1.46]	0.114 [0.60]	0.134 [1.45]	0.113 [0.58]
$\overline{R}^2$	0.25	0.53	0.30	0.53	0.31	0.54
Observations	849	849	849	849	849	849

Notes: Square brackets [ ] give White's heteroskedasticity-consistent t-statistics. Capital-labor ratios and time dummies are included in all specifications. Columns 2, 4 and 6 contain industry fixed effects.

Table 4 Marginal effects of import penetration from different country groups in high and low concentrated industries

Country group	High concentration (third quartile = 0.16)	Low concentration (first quartile = 0.04)
High-income countries (column 2)	0.096+(–0.242)×0.16= 0.057	0.096+(–0.242)×0.04= 0.086
Low-income countries (column 2)	–0.735+(0.832)×0.16= –0.602	–0.735+(0.832)×0.04= –0.702
EU member countries (column 5)	0.07+(–0.327)×0.16= 0.018	0.07+(–0.327)×0.04= 0.057
EU candidate countries (column 5)	–1.690+(1.877)×0.16= –1.390	–1.690+(1.877)×0.04= –1.765

Table 4 demonstrates that the result I obtained earlier in Table 2 appears to hold when interactions between import penetration and concentration are taken into account. The disciplinary effect of imports on industry level price-cost margins comes from imports originating from low-income countries and the EU candidate countries.

4.2 Firm-level analysis: Market power or efficiency?

As I mentioned above, the most important reason for using firm level data is to control for and separate competition effects and efficiency effects. As shown by equation (18) and as argued by, e.g. Tybout (2001), higher profits do not necessarily only reflect deficient competition pressure. High profits may also be due to higher efficiency or large sunk cost. Firm level analysis provides a possibility to distinguish whether the profitability of a firm is correlated with its efficiency and lead to a larger market share, or whether profitability, as a result of oligopolistic coordination between firms within industries, is correlated with concentration, or both.

To determine the impact of imports on profitability on firm level I estimate the following regression equation (cf. equation (18)):

$$PCM_{jit} = \alpha + \sum_{k=1}^{s} \gamma_k IMC_{ikt} + \beta S_{jit} + \kappa \ln(K/L)_{jt} + \delta Firm_{jt} + \rho Industry_{it}$$

$$+ \lambda_1 DT_t + \lambda_2 DI_i + \varepsilon_{jit} \qquad (23)$$

where PCM_{jit} is the price-cost margin of firm *j*, in industry *i* at time *t* and IMC_{ikt} is the same import penetration variable as in the industry level analysis above.[9] S_{jit} is firm j's market share, i.e. its share of production in industry *i* at time *t*. Following Scherer & Ross (1990) and Roberts & Tybout (1996), I specify a non-linear relation between market share and PCM by also adding a quadratic term of market share $(S_{jit})^2$. $\ln(K/L)_{jt}$ is the logarithm of firm j's capital-labor ratio. $Firm_{jt}$ and $Industry_{it}$ are vectors of firm and industry level control variables.

As firm level control variables, I include relative total factor productivity $RTFP_{jit}$ and the export to shipment ratio (export intensity) EXS_{jt}. Higher productivity (efficiency) relative to other firms within the same industry may lead to lower costs and, as shown by equation (18), to a higher price-cost margin. Previous studies have argued that the firm's market share S_{jit} will pick up the efficiency effect. I maintain that $RTFP_{jit}$ is a more precise measure of efficiency.[10] Adding the export intensity may be justified if the margins on domestic and export sales differ since a firm's price-cost margin is a weighted average of these. The export share affects the PCM of the firm if the firm is able to segment markets and price discriminate. Whether prices and margins will be higher on the export market depends on the relative elasticity of demand for the firm's product at home and abroad. This means that we cannot a priori determine the sign of the effect of the export share on PCM.

The results of the firm level analysis in *Table 5* point out that the disciplinary effect of imports from low-income countries, or more specifically, from the EU candidate countries remain negative and significant. Moreover, and in contrast to the industry level analysis in Table 2, the imports from Japan and Asian NIC turn out to be negative and significant.

The market share appears, at least in columns (3) and (5) where I do not control for fixed industry effects, to have the expected positive effect, although at a diminishing rate. Other firm level controls, such as capital and export intensity have positive and significant effects on PCM, which

[9] Import penetration can only be observed at the industry level so when firm level data is used the import penetration variable takes the same value for firms within same industry.

[10] Relative total factor productivity $RTFP_{jit}$ is defined as the ratio of TFP in firm *j* to average TFP in industry *i* at time *t*. Hansson & Lundin (2003) Appendix 2 gives a detailed description of how TFP has been calculated.

Table 5 Determinants of price-cost margins at the firm level

Variables	(1)	(2)	(3)	(4)	(5)	(6)
Import penetration (All countries)	–0.044 [–1.01]	0.149 [0.88]				
Import Penetration (High-income)			–0.06 [–0.13]	0.197 [1.18]		
Import penetration (Low-income)			–0.594 [–2.74]	–0.665 [–1.15]		
Import penetration (EU14)					0.045 [0.84]	0.259 [1.54]
Import penetration (EU10)					–1.647 [–2.88]	–1.775 [–1.53]
Import penetration (Japan & Asian NIC)					–0.541 [–2.29]	–0.647 [–3.01]
Import penetration (Other high income)					–0.016 [–0.10]	0.546 [1.06]
Import penetration (Other low-income)					–0.123 [–0.49]	–0.197 [–0.35]
Market share	0.215 [1.45]	0.269 [1.50]	0.322 [2.54]	0.275 [1.55]	0.372 [2.88]	0.306 [1.74]
Market share×market share	–0.227 [–1.29]	–0.265 [–1.25]	–0.319 [–2.08]	–0.265 [–1.27]	–0.407 [–2.79]	–0.321 [–1.58]
Capital-labor ratio	0.086 [5.25]	0.076 [4.24]	0.086 [5.29]	0.076 [4.24]	0.083 [5.15]	0.076 [4.24]
Relative TFP	0.190 [2.36]	0.181 [2.32]	0.189 [2.37]	0.181 [2.32]	0.187 [2.37]	0.180 [2.32]
Export intensity	0.071 [2.42]	0.059 [1.74]	0.064 [2.23]	0.059 [1.76]	0.064 [2.23]	0.059 [1.76]
Herfindahl index	0.073 [0.58]	0.077 [0.54]	0.070 [0.57]	0.110 [0.82]	0.096 [0.81]	0.168 [1.30]
Year dummies	yes	yes	yes	yes	yes	yes
Industry dummies	no	yes	no	yes	no	yes
$\overline{R}^2$	0.02	0.03	0.02	0.03	0.02	0.03
Observations	15264	15264	15264	15264	15264	15264
Hausmans specification test	p-value 0.86	-	p-value 0.48	-	p-value 0.06	-
Durbin-Wu-Hausman Chi-square-test	p-value 0.29	p-value 0.52	p-value 0.38	p-value 0.48	p-value 0.62	p-value 0.67

Notes: In an alternative base specification industry-level annual sale growth is used as proxy for demand growth. This additional control is not significant in any specification and does not lead to any noticeable change in the results. Standard errors are adjusted for both heteroskedasticity and potential dependency among firms in the same industry. Due to collinearities detected among instruments industry dummy variables are dropped as instruments in the Hausmans specification test.

confirm the hypothesis that capital intensive and exporting firms have higher profits. Interestingly, the coefficient on relative TFP is positive and significant in all specifications. This indicates that more efficient firms have higher profits.

A notable difference between the industry- and the firm level analyses is that adjusted R^2 is considerably lower in the firm level analysis (0.03 compared to 0.55), which is not unusual in this kind of structure-conduct studies using micro-level data.[11] Contrary to the industry-level analysis, industry dummy variables contribute virtually nothing to the explanation of PCM in firm-level analysis. This is also consistent with what most other similar studies have found.[12] Hence, for brevity, I will in the subsequent firm level analysis exclude the results from specifications with industry dummy variables.

A methodological problem needed to be discussed once again is simultaneity. Using additional firm-level controls provides a possibility to separate efficiency effects from import disciplinary effects. Nevertheless, this new possibility can also convey simultaneity between PCM and those firm level control variables, and even with industry level variables in those specifications. I estimate all specifications with IV regressions by GMM using lagged values as instruments for suspected endogenous variables and compare the coefficients with the standard OLS coefficients. Both Hausman test and Durbin-Wu-Hausman test are reported, and both tests consistently indicate that regressors are exogenous and OLS can be used as the more efficient estimator.

Measurement error is another well-known problem in structure-conduct studies. The results in Table 5 would be more convincing if they are robust to the use of alternative measures of the variables. Re-estimating the same firm-level models as in Table 5, but instead of PCM, I use operating surplus divided by turnover as measure of excess profit and replace import penetration ratios with import shares and these robustness checks yield very similar results.[13]

Finally, I ask if import has a larger disciplinary effect on larger firms? Are firms with a dominant market position affected more by import competition? To answer these questions I include in equation (23) an interaction variable between import penetration from different country

[11] Cf. Roberts & Tybout (1996) and the various country studies therein.
[12] See the previous footnote.
[13] See Appendix Table A3.

Table 6 Interaction between import penetration and firm market share

Variables	
Import penetration (EU14)	0.078 [1.28]
Import penetration (EU10)	−1.504 [−2.54]
Import penetration (Japan & Asian NIC)	−0.550 [−1.73]
Import penetration (Other high-income)	−0.069 [−0.37]
Import penetration (Other low-income)	0.008 [0.03]
Import penetration×S (EU14)	−0.438 [−1.99]
Import penetration×S (EU10)	−0.919 [−0.17]
Import penetration×S (Japan & Asian NIC)	0.263 [0.40]
Import penetration×S (Other high-income)	0.317 [0.75]
Import penetration×S (Other low-income)	−0.761 [−1.00]
Year dummies	yes
Industry dummies	no
$\bar{R}^2$	0.02
Observations	15264
VIF-test	2.28
Hausmans specification test	p-value: 0.18
Durbin-Wu-Hausman test	p-value: 0.84

Notes: In all specifications, the Herfindahl index is included as industry level control. Capital intensity, market share, relative TFP and export intensity are added as firm level controls. All the firm-level variables have positive and significant effects on firm-level PCM. The coefficient on the Herfindahl index is positive, but never significant. In instrument variable regressions, penetration ratio, market share, relative TFP and export intensity are treated as potentially endogenous variables and lagged values are used as instruments. Standard errors are adjusted both for heteroskedasticity and potential dependency. As a robustness check all specifications are also estimated by using the four-firm concentration ratio C4 as the measure of industry concentration and gives similar results.

groups with firm level market shares $IMC_{ikt} \times S_{jit}$.[14] The key parameters are given in the regression equation (24) below and *Table 6* shows the results:

$$PCM_{jit} = \alpha + \sum_{k=1}^{s} \gamma_k IMC_{ikt} + \beta S_{jit} + \sum_{k=1}^{s} \varphi_k IMC_{ikt} \times S_{jit} + \ \ldots \qquad (24)$$

countries the result indicates the opposite. However, there is a large negative and significant effect of import penetration separately, which is consistent with the result I obtained in the specification without interaction term in Table 5.

5. Concluding remarks

This paper has examined how price-cost margins in Swedish manufacturing are affected by the increased international integration in the 1990s, in particular the launch and the ongoing enlargement of the European Union's internal market. The results, from both the industry level and the firm level analyses, show that import penetration from low-income countries, and more specifically, from the EU candidate countries has a disciplinary effect on price-cost margins. This outcome is robust to alternative profit and import competition measures. Moreover, the results indicate that the impact of import penetration from EU members on price-cost margins at industry level is higher in more concentrated industries. At the firm level, import penetration from EU members has a negative effect on profitability in firms with large market shares. This suggests that a disciplinary effect of import competition from EU members is felt among large Swedish producers.

The hypotheses that concentration and barriers to entry facilitate firms' opportunities to increase their mark-ups get somewhat mixed support. Capital requirements – an indicator of barriers to entry have a positive and clearly significant effect on profitability. The coefficient on the concentration ratio, on the other hand, is positive indeed, but rarely

[14] This kind of interactions can also be thought of as allowing the regression coefficient to depend linearly upon other regressors. It can be an efficient way to capture the effect shifts among relative large number of heterogeneous firms. Interaction effects are also estimated for the total import penetration ratio and import penetration from high- and low-income countries. The results are not presented here but can be obtained upon request.

significant, especially if concentration is measured by the Herfindahl index. Yet, in the firm level analysis a firm's market share is positively related to its profitability, which is consistent with the maintained idea that efficient firms are larger and have higher profits.

An extension of earlier studies is that a firm-specific efficiency variable – firm's relative productivity performance measured by total factor productivity TFP – is included into the analysis. This additional firm control variable has the expected positive effect on profitability, which confirms that more efficient firms have higher profits. Interestingly, after this efficiency related variable has been included, the firm's market share still remains to have an effect on the firm's price-cost margin. A possible interpretation is that, while the concentration ratio reflects potential implicit collusion at the industry level, the market share may capture a single firm's prospect to exercise market power. Thus, the result point to that, given that efficiency related differences among firms are taken into account, large Swedish manufacturing firms appear to take advantage of their market power.

In sum, the results from the industry- and the firm level analyses are not contradictory, rather complementary. The evidence of pro-competitive effects of import competition can be observed from the direct effect of the penetration from EU candidate countries or from the indirect effect of the penetration from EU members through an interaction with concentration ratios on industry level or market shares of firms.

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Appendix

Table A1 Panel information

Year	Number of firms
1990	1921
1991	1853
1992	1706
1993	1542
1994	1551
1995	1623
1996	1696
1997	1674
1998	1737
1999	1755
Total number of firm-years:17058	

Years in the panel	Number of firms
10	816
9	150
8	135
7	161
6	173
5	174
4	232
3	348
2	453
1	555
Total number of firms:	3197

Table A2 Country classification

EU 14 member countries	EU 10 candidate countries	Japan & Asian NIC	Other high-income countries	Other low-income countries
Belgium	Czech Republic	Japan	Australia	Mexico
Denmark	Estonia	Taiwan	Canada	Bulgaria
Germany	Cyprus	Hong Kong	Iceland	Turkey
Greece	Latvia	South Korea	New Zealand	Romania
Spain	Lithuania	Singapore	Norway	Other low-income
France	Hungary		Switzerland	countries
Ireland	Malta		United States	
Italy	Poland			
Luxembourg	Slovenia			
The Netherlands	Slovakia			
Austria				
Portugal				
Finland				
United Kingdom				

Table A3 Robustness check using different profitability and import penetration measures

Variables	(1) PROFIT	(2) PROFIT	(3) PROFIT	(4) PCM
Import (All countries)	0.016 [1.17]			
Import (High-income)		0.024 [1.80]		
Import (Low-income)		–0.109 [–3.19]		
Import (EU14)			0.022 [1.29]	–0.072 [–0.77]
Import (EU10)			–0.346 [–2.63]	–0.520 [–2.89]
Import (Japan & Asian NIC)			–0.078 [–1.45]	–0.631 [–2.73]
Import (Other high-income)			0.081 [1.55]	
Import (Other low-income)			0.007 [0.15]	–0.208 [–1.14]
Market share	0.232 [3.80]	0.256 [4.10]	0.264 [4.17]	0.316 [2.31]
Market share×market share	–0.216 [–3.06]	–0.237 [–3.26]	–0.249 [–3.44]	–0.349 [–2.36]
Capital-labor ratio	0.009 [1.89]	0.008 [1.88]	0.008 [1.77]	0.084 [5.30]
Relative TFP	0.089 [1.82]	0.089 [1.82]	0.088 [1.82]	0.188 [2.37]
Export intensity	0.013 [1.50]	0.011 [1.36]	0.010 [1.27]	0.067 [2.47]
Herfindahl index	–0.007 [–0.18]	–0.008 [–0.20]	–0.010 [–0.24]	0.102 [0.97]
Year dummies	yes	yes	yes	yes
Industry dummies	no	no	no	no
$\overline{R}^2$	0.03	0.03	0.03	0.02
Observations	15264	15264	15264	15264

Notes: In specification (1)-(3) I use an alternative profit measure PROFIT, operating surplus divided by turnover. The dependent variable in specification (4) is the usual price-cost margin PCM, while the import penetration ratios are replaced with import shares.

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