OECD Economics Department Working Papers No. 134

Market Structure, International Trade and Relative Wages

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https://dx.doi.org/10.1787/778332675011

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This paper investigates the link between trade flows and relative wages on a cross-section of 22 sectors in 12 OECD countries. Industries are classified according to stylised facts about market structure (fragmentation, segmentation and degree of product differentiation). Next, the import penetration trends during the period 1970-90 are analysed, with special attention paid to the imports from Asian NICs. Finally, panel data estimates of a relative wage equation, encompassing both the characterisation of industries by type of market structure, as well as import penetration and export-intensity variables, are carried out. The results show that the impact of import penetration on relative wages tends to be negative in industries with low product differentiation, whereas the reverse result occurs in industries with high product differentiation and market segmentation.

* * *

Ce document propose une étude de la relation entre les flux des échanges et les salaires relatifs au moyen d'une coupe transversale de 22 secteurs dans 12 pays de l'OCDE. Les industries ont été classifiées selon des faits stylisés sur la structure des marchés (fragmentation, segmentation et degré de différentiation des produits). Ensuite, ont été analysés les tendances de la pénétration des importations sur la période 1970-90 ; une attention particulière a été donnée aux importations en provenance des NPI d'Asie. Finalement, une estimation sur des données de panel a été effectuée englobant à la fois la caractérisation des industries par type de structure de marché et des variables de pénétration des importations et intensité d'exportation. Les résultats montrent que l'impact de la pénétration des importations sur les salaires relatifs tend a être négatif dans les industries avec un faible degré de différentiation des produits alors que l'on obtient un résultat inverse pour les industries à forte différentiation des produits et segmentation des marchés.

Contents:

Market Structure, International Trade and Relative Wages

Joaquim OLIVEIRA MARTINS [1]

1. Introduction

The increasing unemployment and widening wage inequality in OECD countries has raised concerns about the role of foreign trade and, particularly, the competition of low-wage developing economies in labour markets. Under very restrictive conditions, namely perfectly competitive markets, the traditional Heckscher-Ohlin-Samuelson (HOS) trade model has two answers to that question. First, it predicts the equalization of *relative* factor prices[2]. Therefore, opening OECD domestic markets to competition from low-wage countries should lead to a decrease on the relative price of unskilled labour. Secondly, according to the result known as the Stolper-Samuelson theorem, the owners of relatively scarce production factors in OECD countries should lose income, in absolute terms, from foreign competition.

Recent work on models of international trade with imperfect competition (e.g. Helpman and Krugman, 1985) challenged this view by stressing the role of market structures in shaping the pattern of trade and the income distribution effects of trade flows. Even, if in the latter type of

[1] This paper owes a lot to Henry Ergas and Michael Feiner for their support and very useful discussions. I also would like to thank Jørgen Elmeskov, Bénedicte Larre, John Martin, Peter Sturm, Raymond Torres and Andrew Wycokff for suggestions and comments on an earlier draft of this paper. Christophe Complainville and Isabelle Waner provided efficient statistical assistance. The views expressed are those of the author and do not necessarily reflect those of the OECD or its member countries.

[2] A recent paper by Rourke and Williamson (1992) puts this result into an historical perspective of increasing international integration.

models it can be shown that there is still a tendency towards factor price equalization, there are also additional gains from trade that --under certain conditions-- can reverse the Stolper-Samuelson result. The empirical evidence on the impact of trade on the wage structure is controversial. Some studies indeed suggest that increased import competition reduces wages and employment (e.g. Revenga, 1992). Other analyses find no evidence in the data for such a negative link (e.g. Lawrence and Slaughter, 1993).

To our knowledge there is no empirical study that introduces market structure explicitly as a determinant of the link between international trade and relative wages. This paper aims to take a step towards filling this gap.

The paper comprises three parts, as follows. The first part specifies a classification of individual sectors according to market structure characteristics. Then a set of indicators is computed in order to verify if the results by industry grouping match with stylised facts that could be expected on *a priori* grounds. The second part of the paper describes the evolution of import penetration trends in twelve OECD countries during the period 1970-90, with respect to both the market structure classification and exporting regions. Special attention is paid to the import penetration trends from Asian NICs. Finally, an econometric model of relative wage determination is estimated using a panel data. This model encompasses both the characterization of industries by type of market structure, as well as import penetration and export intensity variables.

2. Market structure

2.1 Characterization of industries by type of market structure

In principle, characterizing industries according to their market structure requires a set of micro-economic indicators: concentration ratios, size of markups, degree of returns to scale, product differentiation, etc. Unfortunately, this type of information is not available on a sufficiently systematic basis to allow for cross-country and industry comparisons. In order to bring market structure into the analysis of industry patterns, the strategy was followed here of using *a priori* information on the type of product differentiation and concentration[1] for each sector. The 22 individual industries of the OECD Structural Analysis data base (STAN) [2] were classified into several subsets. Each group was characterized, on the one hand, by the dynamics of market concentration and, on the other, by the extent of product differentiation.

With respect to the dynamics of **concentration**, two types of market structures are usually identified in the literature: fragmented and segmented industries[3].

In *fragmented industries* the number of firms grows in parallel with output growth, thus output expansion is achieved through the creation of new firms and concentration decreases when market size increases. Typically, fragmented industries have relative low setup costs and can create a wide range of product variety (or so-called horizontal

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[1]This type of classification procedure is often used in industrial economics. See, for example: "Structural Adjustment and Economic Performance", OECD(1987).
[2] See, "The OECD *STAN* Database for Industrial Analysis", OECD Documents, 1992.
[3]See, Sutton (1991), part I.

differentiation, see Box 1). Textile or the Machine Tools are good examples of fragmented industries.

In *segmented industries*, the number and size of firms remain relatively stable when market size increases, therefore concentration also remains stable. The forces causing market segmentation are often related to large setup (or sunk) costs. Also, when strong non-price competition occurs in segmented markets, it is usually focused on the relative quality of different brands (or so-called vertical differentiation, see Box 1). The Chemical or the Aircraft industries are two examples of segmented industries with high product differentiation. Real world industries are typically a mixture of these two extreme cases. For example, in most industries one can identify a core of dominant large-scale firms and a fringe of small and medium-sized competitors. Nonetheless, at the level of detail (22 industries) used in this study, differences are sufficiently marked to make this classification meaningful.

The characterization of the **product differentiation** dimension is more difficult because the potential number of differentiating characteristics of a given product can be very large. These product characteristics are usually classified into horizontal and vertical dimensions (see Box 1). Here, a looser criterion was adopted by only distinguishing two cases: "high" and "low" product differentiation.

When product differentiation categories are combined with the market concentration characteristics, emerges a relatively clear characterization of market structure prototypes; these are described in the 2x2 matrix in Table 1. Some stylised facts are referred to the distinguishing characteristics of each group.

The correspondence between the 22 industries of the OECD STAN data base (see, OECD, 1992) and the four categories is given Table 2. For those readers more used to a taxonomy related to the key production input, the individual sectors inside each group are classified by relative intensity of: (i) natural resources: (ii) labor; (iii) capital; or, (iv) R&D expenses. This indicates that there is no one-to-one correspondence of the latter classification and the market structure classification on which this paper focuses.

BOX 1: The dimensions of product differentiation

Basically, product differentiation can take place either through innovation or by adding new varieties of existing products. Accordingly, it unfolds in two dimensions: (i) *vertical differentiation* ; and (ii) *horizontal differentiation.*

Suppose that the ranking of quality characteristics of a given range of products is the same for all consumers. Then, two vertically differentiated products must have different prices and the lowest price is associated with the lowest quality brand. Indeed, if prices are equal, the lowest quality brand will be pushed out of the market.

On another hand, when products are differentiated horizontally there is no implicit product ranking. This implies that two varieties of the same product can have equal prices and coexist in the market. In other words, horizontal differentiation corresponds to a pure consumers' preference for variety.

Producers choose the most appropriate combination of differentiating characteristics according to their marketing strategy. Both forms of product differentiation relax price competition. However, competing in the vertical dimension generally needs costly investments, --namely R&D-- and therefore can generate large price gaps among the same type of products, whereas the horizontal differentiation is generally associated with a more uniform distribution of prices.

2.2 Some empirical regularities in twelve OECD countries

To describe the characteristics of each industry grouping, several indicators can be computed from the OECD STAN data base (see data annex). Twelve countries are included in our sample: USA, Japan, Germany (West), France, Italy, United Kingdom, Canada, Australia,

Finland, the Netherlands, Norway and Sweden. For each country, the following list of indicators was computed:

$$relative\,wage\,rate = (W_i/E_i)/(W_t/E_t)$$

$$relative\,margin\,rate = ((V_i - W_i)/V_i)/((V_t - W_t)/V_t)$$

$$relative\,investment\,rate = (GFC_i/V_i)/(GFC_t/V_t)$$

$$relative\,R\&D\,intensity = (R\&D_i/V_i)/(R\&D_t/V_t)$$

$$relative\,penetration\,ratio = (M_i/(Q_i + M_i - X_i))/(M_t/(Q_t + M_t - X_t))$$

$$relative\,export\,intensity = (X_i/Q_i)/(X_t/Q_t)$$

where:
W= Employees compensation
E = Number of employees
V = Value added
Q= Gross output
GFC= Gross capital formation
R&D= R&D expenditure
X= exports
M= imports

and i corresponds to a given industry and t to total manufacturing. All these variables, except E, are expressed in value terms[1].

As all indicators are normalized on the total manufacturing average in each country the results are comparable across countries. Figures 1-6 give the distribution of these indicators for each market structure grouping for all countries and industries. The data points displayed in the figures are averages over the period 1970-1990[2]. Notwithstanding the large cross-sectional variance, the results show some empirical regularities that match the stylised facts reported in Table 1.

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[1] In its present state, the STAN database does not have constant price data.
[2]Depending on the countries, this time frame can be smaller. When all information is available this produces 264 (12 countries x 22 industries) time averages split into the four industry groupings according to the key given in Table 2.

Relative wages tend to be lower in the fragmented industries with low product differentiation. Figure 1 shows that in the fragmented low-differentiation group only 10 per cent of the observations are above total manufacturing average. On the other groups, the same ratio is above 70 per cent. This corresponds to the conventional wisdom that relative product market power has a positive spill-over effect on wages[1].

The two groups of segmented industries display the highest *relative gross margins,* as could be expected (Figure 2). Nonetheless, the quality of this indicator seems less reliable as, in many cases, the relative margin is negative; this cannot be excluded, but seems implausible for an average calculated over twenty years.

Relative investment (Figure 3) also tends to be higher for segmented industries, particularly the low-differentiation industries that include large-scale manufacturing sectors such as Iron & Steel or Shipbuilding & Repair. On the other hand, *relative R&D intensities* are clearly associated with high differentiation sectors[2] (Figure 4).

A less contrasted pattern emerges for the *relative import penetration* as data points are relatively homogeneously distributed (Figure 5). The only case presenting a specific pattern is the fragmented high-differentiation group which displays a high proportion (69%) of above average penetration ratios. Noteworthy, this group also shows the largest proportion (64%) of above average export intensities (Figure 6). These two observations reveal that the bulk of intra-industry trade is located in this set of industries. More precisely, this type of product is characterized by large and simultaneous export and import flows. This is

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[1]For a related empirical test on the relation between product market power and productivity, see Haskil(1991). Higuchi (1987) also provides some evidence on the link between market power and wages.

[2] For data constraints, this variable is only available for six countries in the sample: France, Germany (West), Italy, Japan, the U.K. and the U.S.A.

in accordance with and could be expected from the market structure characteristics of the group[1].

The *relative export intensity* can be interpreted as a rough measure of revealed comparative advantage (Figure 6). Indeed, the high-differentiation industries among which there are the strong points of OECD industries also have the highest export ratios.

3. Import penetration trends in twelve OECD countries

3.1 Penetration trends at the level of total manufacturing industries

Penetration of imports of total domestic demand (M/D) for manufacturing products increased over the period 1970-80 in all countries of our sample with a large cross-country dispersion of growth rates and levels (Table 3).

Indeed, average level of import penetration over the period 1985-90, ranges from around 5 to 65 per cent of domestic demand. The twelve countries of our sample fall into three broad groups: i) the Netherlands[2], Norway, Sweden, Canada and Finland have penetration rates higher than 30 per cent of domestic demand; rates of 20-30 per cent are in the U.K., France, Germany (West), Australia and Italy; and, (iii) rates of only 13.3 and 5.4 respectively in the USA and Japan.

During the 80's, annual growth rates of import penetration range from less than 1 per cent in Japan, Norway and Italy to 6.5 per cent in the USA. During the 80's, the pace of penetration decreased in almost all countries compared with the 70's, except in Finland and Norway where

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[1] See, Helpman and Krugman, 1985.

[2] The indicator may be not totally reliable for the Netherlands because of a large amount of re-exports towards other European countries which can induce a statistical bias in the measure of import penetration.

penetration increased in the 80's and the United States where it grew at the same pace in the 80's as in the 70's. Consequently, there is no evidence on any acceleration of this process and moreover these growth rates should decline over time as import penetration levels rise.

Statistics for the export intensity indicator (X/Q) over the same periods are also shown in Table 3. It is striking, the very strong correlation (0.92) between import penetration and export intensity. In other words, in countries in which a relatively large share of their demand for manufactures is satisfied by imports, it appears that a relatively large part of their domestic industrial production is exported, and vice-versa. This observation partly brings to mind the strong role of intra-industry trade in OECD countries, noted above. In this perspective, the low penetration rates of the USA and Japan seem less peculiar given that these two countries have the lowest export intensities in the sample, respectively 8.4 and 2.4 per cent of their industrial production. Trade imbalances are reflected here by the disproportion between the import penetration ratio and export intensity --as in the case of Japan.

Similarly to import penetration, there was a general deceleration in export intensity growth between the two periods, and in Japan, Italy and Australia actually fall during the 80's.

3.2 Penetration trends by exporting region and market structure

Asian NICs are often held by conventional wisdom as important sources of import penetration growth in OECD countries. Table 4 decompose the overall import penetration ratio into four exporting regions: OECD countries excluding Japan, Japan, Asian NICs (South Korea, Taiwan, Hong-Kong and Singapore), and other LDCs. The import ratios are expressed not as percentage of total imports but as percentages of total manufacturing demand. In this way they directly give the shares of each

exporting region in a given national market and they add-up to the overall penetration ratio shown in Table 2.

In all countries, intra-OECD trade accounts for the largest share of import penetration. In particular, in all European countries, the share of Asian NICs and never exceeds 2 per cent of domestic demand and is typically ten to twenty times lower than the intra-OECD share. In the US and Japanese markets the share of the Asian NICs is relatively higher compared with the OECD share. Partly because it started from very low base levels, the export penetration of Asian NICs grew rapidly in the two periods. For example, during the 80's the market share of Asian NICs soared at around 10% per year in the USA and France. However, the data presented here show no acceleration of this process in the 80's compared with the 70's.

The relative import penetration from the Asian NICs by industry grouping is presented in Figure 7. It appears that only the two cases of fragmented industries have a significant above average penetration of Asian NICs, possibly reflecting the relatively low entry costs, easy entry and small market power of domestic firms in such sectors. This observation suggests that import competition from the NICs is not necessarily focused in low wage unskilled industries. Rather it can be related to the type of structure existing in domestic markets.

The conclusions from the analysis of import and export performance are: first, overall import penetration in OECD countries occurred at a high pace in the last two decades but there is no evidence of acceleration of this process; second, Asian NICs penetrated industries characterized by market fragmentation and where competition operates mainly through prices or horizontal differentiation (see Table 1); third,

imports of Asian NICs grew at a very fast rate but still account for a small share of domestic demand in all OECD countries.

The extremely good export performance over the last two decades of the Asian NICs is particularly striking in comparison with other LDCs' insertion in international trade. This point is illustrated in Figure 8 which gives the breakdown of overall LDCs' exports. The share of Asian NICs has risen from around 15% by 1967 to roughly 50% of total manufactured exports from LDCs, by 1990. In contrast, the share of all other developing regions remained stable or declined over the same period[1].

Finally, it can be noted that the strong points of OECD industries remain the highly differentiated products which account for the bulk of international trade. This can be verified in Figure 9 where world trade is split according to the four group classification. The two groups of high-differentiation industries account for a growing share of world trade that reaches almost 70 per cent by 1990.

4. Relative wages and openness to trade: an econometric evaluation

This section looks in detail at the link between relative wages and the trade variables defined above. This is carried out through the estimation of an equation involving a pooling across industries, and

[1] Another way of showing this would be to calculate a concentration index of LDCs exports. The result of this calculation, available upon request, is that the concentration of LDCs exports doubled during the period 1967 to 1990, mainly due to the above-average market share gains from the Asian NICs.

estimated country by country. This section addresses the following questions:

(i) Does the four-way industry classification adopted here helps to explain: the pattern of relative wages in each country, and inter-industry variance in relative wages ?

(ii) Are there any significant differences across groupings in the impact of import penetration and export intensity on relative wages ?

The model used here can viewed as reduced form of more general framework where the impact on relative wages of productivity gaps and trade variables depends on the type of market structure:

Relative wages = f (Market structure, Productivity, Trade)

Given the qualitative nature of the market structure grouping, it seems sensible to model it through fixed-effects, where the group heterogeneity is captured by a dummy variable taking the value 1 if the sector belongs to the group and zero elsewhere. In order to allow for productivity differentials across industries, a variable was introduced in the equation related to the relative value-added per worker[1]. The effects of trade are represented by the import penetration and the export intensity variables. The complete equation to be estimated for each country is then the following :

[1] There is no constant price data in the STAN data base, it is therefore not possible to compute a productivity residual. The relative value added per worker was calculated by dividing the ratio between value-added and total employment in a given sector by the same variable calculated at the level of total manufacturing. However, the OECD ISDB data base (which has a lower sectoral detail) was used to calulate the correlation between the relative output per worker in value and volume terms. This correlation was above 0.85 in all countries of our sample. Therefore the results should be not deeply modified by the use of one or the other of these variables.

$$RW_{it} = \sum_{k=HF,HS,DF,DS} \alpha_{kit}.D_{kit} + \beta.VAW_{it} + \sum_{k=HF,HS,DF,DS} \gamma_{kit}.MP_{kit} + \sum_{k=HF,HS,DF,DS} \delta_{kit}.XI_{kit} + u_{it}$$

with
i= 1,...,22 industries
t= 1970, 1990 (depending on the country)
RW= relative wages
D= Industry specific fixed-effects
VAW = Relative Value-added per worker
MP= relative Import penetration
XI = relative Export intensity

The index HF,HS,DF and DS corresponds to the four-way grouping of industries classified according to market structure characteristics. All the variables are expressed in relative terms to the average of total manufacturing industries. The equation was first estimated without the trade variables (the "basic equation") and, in a second step, the trade variables were added to the equation. The estimation was carried out with a ordinary least square method, and the results of this regression are shown in Table 5.

A high proportion of the observed wage variability across industries is already explained in the basic equation. The industry dummies are always significantly different from zero. The sign of the relative output per worker is significant in all countries and positive --as expected--, except for the Netherlands.

In the complete model, the trade variables add significant explanatory power to the equation as show by the F-test reported in Table 6. Moreover, the industry dummies remain significantly different from a common intercept term, except in three cases: Germany, Netherlands and Sweden.

The results provide evidence that import penetration is associated with reduced relative wages mainly in industries producing relatively

standardized products. More precisely, in the fragmented low-differentiation group (HF) the coefficients are all negative and significant in seven out of twelve instances. The same applies, though to a lesser degree (six cases) for the segmented low-differentiation group (HS). At the opposite, in the high-differentiation industries the estimated coefficients of the import penetration variables are positive and significant in eight cases in the segmented group (DS). In the fragmented (DF) group, the import penetration variables play the less important role as they only appear to be significant in four cases (three positive and one negative).

The effects of export intensity on relative wages are mainly concentrated in the segmented and high differentiation groups. The strongest effect is obtained for the segmented high-differentiation industries where export intensity is positively and significantly associated with relative wages in seven countries out of twelve. The sectors included in this group were assessed above as being the strongest points of OECD industries.

These results can be interpreted as pointing to the following conclusions:

(i) The impact of import penetration on domestic wages seems in line with traditional H-O-S trade theory results in industries with low product differentiation. In other words, import penetration is associated with lower relative wages if firms have typically low market power and/or products are homogenous. As a consequence, it may be expected that increasing import penetration in these industries could lead to income distribution conflicts among the owners of relatively scarce production factors (such as low-skilled labour or natural resources).

(ii) In industries where scale economies are large and competition takes place mainly through product differentiation, there is no evidence that increasing openness to trade leads to reduced relative wages. On the contrary, industries can be open to competition in both domestic and foreign markets and still have above-average wages.

Therefore, in the latter case there is no basis for expecting a potential income distribution conflict for the owners of production factors that are intensively used in the production process of these goods. The reason is that the impact of trade over income distribution in presence of strong product differentiation and scale economies may be very different from the one predicted by the Heckscher-Ohlin-Samuelson paradigm. From trade models with imperfect competition it turns out that, namely, when products are sufficiently differentiated, a reverse "Stolper-Samuelson" result could occur (see Box 2) [1]. If so, the arguments related to income distribution conflicts may not be valid. The trade theory suggest exactly the opposite, i.e. import penetration could be essential to benefit from increasing returns to scale or welfare effects of product variety in <u>all</u> sectors.

[1] Oliveira-Martins and Toujas-Bernate (1992) made an attempt to estimate elasticities of substitution within product bundles for domestic and imported goods. They found those to be typically low, a result which is in line with the usual estimates of trade elasticities.

BOX 2: What happens to the Stolper-Samuelson theorem in the presence of imperfect competition ?

The basic result from the Heckscher-Ohlin-Samuelson (H-O-S) model on income distribution (the Stolper-Samuelson theorem) is that --assuming that there is no redistribution mechanism at work-- owners of factors of production which are scarcer in a country than in the rest-of-the-world will lose as a result of trade relative to the non-trade situation.

Compared to the H-O-S framework, additional sources of gains from trade can arise in presence of increasing returns and product differentiation. The question is whether those gains can offset or even reverse the negative "Stolper-Samuelson" effects of trade on income distribution.

Some answers to this question can be found in the literature on international trade theory. For example, the Helpman-Krugman monopolistic competition model suggests that the net impact of trade on income distribution could depend crucially on several factors (see, Helpman and Krugman, 1985, chap. 9):

(i) the degree or extent of economies of scale.
(ii) the elasticity of substitution between varieties (both domestic and imported) of a given product, which measures the preference for product diversity.
(iii) the similarity of factor endowments between the two trading countries.

Intuitively, there is a trade-off between scale and product diversity as creating new brands can prevent producers from exploiting scale economies of existing products. However, when products are highly differentiated the gains from increased product diversity are likely to be large, as well as the equilibrium scale of production. If products are rather homogenous the net gain from trade will depend on how similar the countries are in terms of their factor endowments. If we define an appropriate index of factor endowment "similarity" and relate it to the intensity of intra-industry trade then if countries are similar enough still all factors will gain from trade. In other words, an intra-industry type trade will lead to fewer income distribution conflicts among countries and sectors than the inter-industry specialization.

5. Summary and further research

The aim of this paper was to bring market structure considerations into the explanation of the link between international trade and relative wages. In order to identify the market structure prototypes, the paper uses a four-way classification where each individual industry is grouped according to the type of product differentiation and market concentration.

The empirical evidence over twelve OECD countries reported here suggests that the interaction between market structure and trade variables, on one hand, and the sectoral patterns of relative wages, on another hand, are closely related. Indeed, the estimated impact of import penetration on relative wages appears to be largely negative in industries with low product differentiation and small scale economies. This result could be expected on the basis of the traditional Stolper-Samuelson result. Conversely, in industries with high product differentiation and large scale economies the estimated coefficients of the import penetration variables tend to be significantly positive in a majority of cases. An explanation for this result can be found on the trade theory models with imperfect competition models. The latter suggest indeed that in presence of large scale economies and high product differentiation there is no a systematic negative link between increased import penetration and below average wages.

These results have two important policy implications. First, they give some support to the idea that the intensification of foreign competition may hurt the wage remuneration of sectors where typically OECD countries have low or have lost market power. In some cases, this may require policy measures ensuring that the owners of relative scarce production factors (as unskilled labour) receive their share of benefits from

increased openness to international trade. Secondly, from the analysis of trade patterns and the econometric results it emerges that in industries which are strong points of OECD countries, the relative wages do not suffer at all from import penetration. Quite the contrary, the results show that openness to trade could benefit relative wages in that sectors.

The market structure analysis could be an useful framework for further analysis in this area. Namely, it would be interesting to provide more evidence on micro-data of market structure that were captured in this paper in a very stylised way. Moreover, those should be associated with variables on labour qualification and industry rents in order to give a complete picture of the market structure mechanisms at work. Price data would be a necessary element to a more accurate assessment of the product differentiation components of market competition. Finally, the wage structure aspects treated in this paper could interestingly be related to sectoral employment patterns.

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ANNEX: DATA SOURCES

The primary data sources for this paper are the STAN[1] and the CHELEM[2] data bases.

In its present state, the STAN data base isolates 22 individual industries (see table). Namely, it enables to break down the Chemicals and the Metal product sectors into a relevant product detail.

STAN covers the period from 1970 to 1990. The country coverage of STAN is limited to only twelve OECD countries: Australia, Canada, Finland, France, Germany (West), Italy, Japan, Netherlands, Norway, Sweden, UK and USA.

The CHELEM data base is built by the French Institute CEPII[3]. CHELEM allows to decompose total exports and imports by origin and destination, both for OECD countries but also for all non-OECD regions. This source is a complete and harmonized world trade matrix for 32 regions and 72 products, for the period 1967-1990. The correspondence used in this paper between the nomenclatures of the STAN and CHELEM databases is available upon request.

Table: The sectoral breakdown of the STAN database

Code STAN	ISIC groups	Classification Description
1	**3000**	**TOTAL MANUFACTURING**
2	**3100**	**Food, Beverages & Tobacco**
3	**3200**	**Textiles, Apparel & Leather**
4	**3300**	**Wood products & Furniture**
5	**3400**	**Paper products & printing**
6	**3500**	**Chemical products**
7	*351+352-3522*	*Chemicals exc. Drugs*
8	*3522*	*Drugs & Medicines*
9	*353+354*	*Petroleum refineries & products*
10	*355+356*	*Rubber & plastic products*
11	*3600*	*Non-metallic mineral products*
12	**3700**	**Basic metal industries**
13	*3710*	*Iron & steel*
14	*3720*	*Non-ferrous metals*
15	**3800**	**Fabricated Metal Products**
16	*3810*	*Metal Products*
17	*382-3825*	*Non-electrical Machinery*
18	*3825*	*Office & Computing equipment*
19	*383-3832*	*Electrical machines exc. communications*
20	*3832*	*Radio, TV & Communications equipment*
21	*3841*	*Shipbuilding & Repairing*
22	*3843*	*Motor vehicles*
23	*3845*	*Aircraft*
24	*3842+3844+3849*	*Other transport equipment*
25	*3850*	*Professional goods*
26	*3900*	*Other manufacturing*

[1] See "The OECD STAN data base for Industrial Analysis", OECD (1992).
[2] CHELEM stands for "Comptes Harmonisés sur les Echanges et L'Economie Mondiale".
[3] Centre d'Etudes Prospectives et d'Informations Internationales. The CEPII is a french public Institute which belongs to the Commissariat Général du Plan.

Table 1. Stylised Facts Characterizing each type of Market Structure

Concentration dynamics →	FRAGMENTED (F)	SEGMENTED (S)
Product differentiation ↓ **Low Differentiation or Homogeneity (H)**	-Strong price competition -Product Homogeneity or very high substitutability -Low concentration -Low entry costs -Small or no scale economies -Low market power	-Quantity competition -Product Homogeneity or very high substitutability -High Concentration -High entry costs -Large scale economies
High Differentiation (D)	-Price and non-price competition -Horizontal Differentiation -Low concentration -Moderate entry costs -Scale economies	-Strong non-price competition -Mainly vertical Differentiation -High Concentration -Very high entry costs -Large scale and scope economies -Strong market power

Table 2. Classification of Industries (STAN) according to their Market Structure

Concentration dynamics → / Product differentiation ↓		FRAGMENTED		SEGMENTED
LOW DIFFERENTIATION	*Resource intensive:*	4-Wood Products & Furniture 11-Non Metallic Mineral Products	*Resource intensive:*	5-Paper products & printing 9-Petroleum Products 14-Non Ferrous Metals
	Labour intensive:	3-Textiles, Apparel & Leather 26-Other Manufacturing		
			Capital intensive:	10-Rubber & Plastic 13-Iron & Steel 21-Shipbuilding & Repair
HIGH DIFFERENTIATION	*Labour intensive:*	16-Metal Products	*Labour intensive:*	2-Food, Beverages & Tobacco
	Capital Intensive:	17-Non Electrical Machinery	*Capital intensive:*	7-Chemicals 22-Motor vehicles 24-Other Transport Equipment
	R&D intensive:	18-Office & Computing Machinery 19-Electrical Machines 20-Radio, TV, Communication 25-Professional Goods	*R&D Intensive:*	8-Drugs & Medecine 23-Aircraft

NB: The numbers refer to the OECD STAN classification of industries

Table 3. Import Penetration trends for Total Manufacturing industries.

	IMPORT PENETRATION RATIO			EXPORT INTENSITY		
	average growth rates (1)		average levels 1985-90	average growth rates (1)		average levels 1985-90
	70's	*80's*	*M/D (2)*	*70's*	*80's*	*X/Q (3)*
United States	6.1	6.5	*13.3%*	6.9	1.3	*8.4%*
Japan	3.7	0.8	*5.4%*	2.8	-2.3	*12.4%*
Germany (West)	4.2	2.6	*24.6%*	3.4	2.4	*32.4%*
France	4.0	3.4	*27.7%*	4.5	1.9	*27.1%*
Italy	3.0	0.8	*21.0%*	3.8	-1.1	*23.2%*
United Kingdom	5.1	3.3	*29.3%*	4.5	1.3	*25.1%*
Canada	2.2	2.5	*36.4%*	2.5	1.5	*35.0%*
Australia	4.7	2.2	*23.9%*	2.5	-0.7	*13.2%*
Finland	0.0	2.3	*30.3%*	2.7	0.4	*34.0%*
Netherlands	2.7	2.8	*64.7%*	2.5	2.0	*66.9%*
Norway	-0.6	0.8	*42.2%*	-0.5	0.3	*31.2%*
Sweden	2.5	1.2	*40.9%*	2.5	0.8	*45.0%*

Notes: (1) Measured as tendencial growth rates over the periods 1971-80 and 1981-90 respectively (in %).

(2) Import penetration is defined as the ratio of imports to apparent consumption (domestic production minus exports plus imports)

(3) Export intensity is defined as the ratio of exports to domestic production.

Source: OECD/DSTI STAN database.

Table 4 Regional breakdown of import penetration rates, Total Manufacturing industries.

Source country / Market country	OECD, excluding Japan			Japan			Asian NICs			Other regions		
	average growth(1)		av. levels 1985-90	average growth(1)		av. levels 1985-90	average growth(1)		av. levels 1985-90	average growth(1)		av. levels 1985-90
	70s	*80s*	*Mij/D (2)*	*70s*	*80s*	*Mij/D (2)*	*70s*	*80s*	*Mij/D (2)*	*70s*	*80s*	*Mij/D (2)*
United States	4.4	5.1	5.9%	7.3	7.6	3.1%	14.5	10.7	2.2%	10.5	4.0	2.1%
Japan	-0.1	0.1	2.9%	..	..	..	14.2	4.4	1.3%	2.9	-1.9	1.3%
Germany (West)	3.4	2.5	20.0%	7.5	8.9	1.7%	14.5	6.5	1.0%	5.7	0.0	2.0%
France	3.6	3.3	23.5%	11.2	6.8	1.0%	26.6	10.0	0.6%	5.0	1.7	2.6%
Italy	1.6	0.8	17.8%	5.6	8.5	0.5%	14.3	6.3	0.4%	3.6	-2.4	2.3%
United Kingdom	6.3	3.3	23.9%	8.4	6.3	1.8%	8.6	6.9	1.4%	-0.1	0.1	2.2%
Canada	2.4	1.4	29.1%	0.4	5.4	3.2%	12.5	9.5	2.2%	1.6	8.4	1.8%
Australia	1.4	2.0	12.8%	6.1	2.8	5.8%	16.9	5.1	3.1%	10.5	0.4	2.2%
Finland	-1.4	2.2	24.1%	1.0	6.3	2.1%	22.3	12.9	0.7%	2.6	-3.7	3.4%
Netherlands	1.7	3.0	55.4%	7.1	7.5	2.5%	12.3	8.4	1.9%	6.9	-2.9	4.9%
Norway	-0.2	0.4	35.5%	-2.0	-2.3	2.2%	13.4	7.2	1.7%	-3.6	5.9	2.9%
Sweden	1.8	1.4	35.2%	10.2	6.4	2.2%	12.3	7.2	1.3%	5.2	-5.1	2.2%

Notes: (1) Measured as tendencial growth rates over the periods 1971-80 and 1981-90 respectively (in %).

(2) Import penetration is defined as the ratio of imports from country j to total apparent consumption (domestic production minus exports plus imports)

Source: calculations from the OECD/DSTI STAN and CEPII, CHELEM databases.

Table 5 Panel estimates for the relative wage equation (1)

	FIXED-EFFECTS (2)				Value-added per worker (1)	IMPORT PENETRATION (1)				EXPORT INTENSITY (1)					
	HF	HS	DF	DS		HF	HS	DF	DS	HF	HS	DF	DS	R2	NOBs
Australia	0.333 **	0.450 **	0.553 **	0.438 **	0.592 **									0.737	384
	0.310 **	0.372 **	0.555 **	0.212 **	0.615 **	-0.048	0.138 **	0.049	0.217 **	0.103	-0.075 **	-0.235 **	-0.048	0.799	384
Canada	0.539 **	0.778 **	0.631 **	0.638 **	0.390 **									0.720	408
	0.722 **	0.780 **	0.578 **	0.469 **	0.395 **	-0.310 **	0.017	0.009	0.206 **	-0.007	-0.019	0.029	-0.083 *	0.815	408
Finland	0.803 **	1.052 **	0.965 **	0.986 **	0.064 **									0.549	434
	0.958 **	1.090 **	0.964 **	0.916 **	0.059 **	-0.053 **	-0.059 **	0.075 **	0.081 **	-0.090 **	0.027	-0.118 **	-0.075 **	0.648	414
France	0.813 **	1.152 **	1.125 **	1.029 **	0.087 **									0.461	273
	1.153 **	0.875 **	0.589 **	1.007 **	0.105 **	-0.581 **	-0.305 **	-0.054	0.103	0.241	0.580 **	0.426	-0.080	0.632	273
Germany	0.771 **	0.956 **	1.008 **	1.077 **	0.073 **									0.622	396
	0.896 **	0.924 **	0.882 **	0.841 **	0.074 **	-0.262 **	-0.054 *	0.114 **	-0.157 **	0.260 **	0.097 **	-0.040	0.341 **	0.807	396
Italy	0.641 **	0.918 **	0.965 **	0.891 **	0.212 **									0.382	326
	0.783 **	1.189 **	0.821 **	1.015 **	0.082 *	-0.149	0.023	0.362 **	-0.257 **	0.051	-0.185 *	-0.146 **	0.398 **	0.573	326
Japan	0.713 **	0.977 **	0.858 **	0.911 **	0.162 **									0.722	412
	0.731 **	0.880 **	0.885 **	0.784 **	0.202 **	-0.048 **	-0.033 **	0.022	0.010 **	0.031	0.059 **	-0.054 **	0.037 **	0.789	412
Netherlands	0.919 **	1.187 **	0.960 **	1.240 **	-0.046 **									0.175	324
	1.164 **	1.141 **	1.247 **	1.201 **	-0.074 **	-0.304	-0.531 **	-0.260 **	0.744 **	0.112	0.614 **	0.117 *	-0.702 **	0.386	324
Norway	0.866 **	1.014 **	1.017 **	1.003 **	0.037 **									0.470	432
	0.916 **	0.998 **	1.054 **	0.943 **	0.036 **	-0.154 **	-0.042 *	-0.010	0.058 **	0.217 **	0.046 **	-0.012	-0.017	0.563	432
Sweden	0.719 **	0.923 **	0.932 **	0.762 **	0.164 **									0.732	446
	0.884 **	0.859 **	0.945 **	0.954 **	0.167 **	-0.026	0.051 *	-0.027	-0.364 **	-0.179 **	-0.010	0.019	0.214 **	0.790	426
United Kingdom	0.752 **	0.972 **	0.902 **	0.955 **	0.117 **									0.667	405
	0.805 **	0.961 **	0.849 **	0.697 **	0.120 **	-0.028	0.062	0.003	0.063 *	-0.004	-0.077	0.026	0.153 **	0.786	386
United States	0.598 **	0.844 **	0.807 **	0.890 **	0.241 **									0.728	436
	0.694 **	0.795 **	0.728 **	0.608 **	0.227 **	-0.237 **	0.087 **	0.022	0.095 **	0.351 **	-0.028	0.040 **	0.164 **	0.859	436

Legend: HF: Fragmented, Low-differentiation industries
DF: Fragmented, High-differentiation industries
HS: Segmented, Low-differentiation industries
DS: Segmented, High-differentiation industries

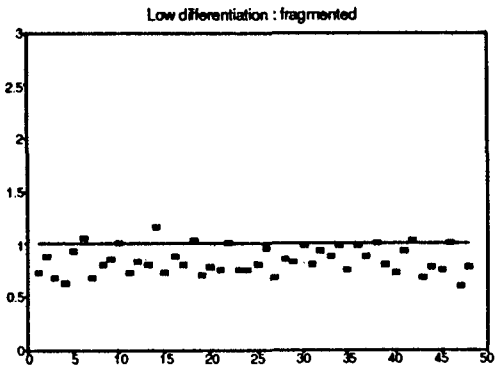
NB: (*) coefficients are significantly different from zero at 5% level
(**) coefficients are significantly different from zero at 1% level
(1) Variable expressed in relative terms to the total manufacturing average
(2) Dummy variable taking the value of 1 when the industry belongs to a grouping and 0 elsewhere.

Table 6
Test statistics for the relative wage model

	F-test trade variables jointly null		F-test no-industry specific effects	
Australia	14.43	**	8.42	**
Canada	25.30	**	72.72	**
Finland	4.40	**	4.44	**
France	15.17	**	4.32	**
Germany	46.10	**	2.23	
Italy	17.48	**	15.24	**
Japan	15.82	**	13.49	**
Netherlands	13.37	**	0.63	
Norway	11.24	**	11.11	**
Sweden	4.28	**	1.10	
United Kingdom	7.83	**	27.04	**
United States	49.32	**	14.98	**

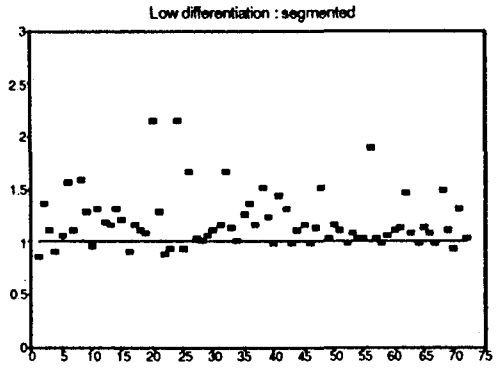
Note: (*) The test is significant at the 5% level.
(**) The test is significant at the 1% level.
NB: The critical values at 1% are:
F(3,infinite) = 3.78 and F(8,infinite) = 2.51.

Figure 1. Distribution of Relative Wage rate according to the Market Structure



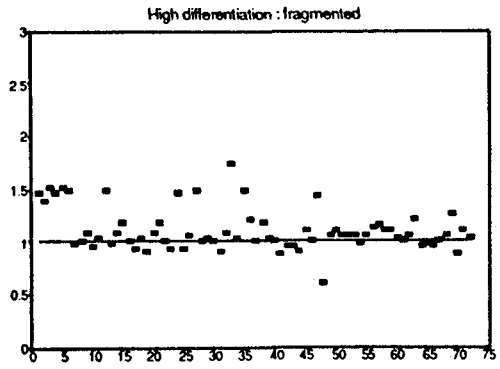
Mean = 0.84 Std deviation = 0.13

10% (1)



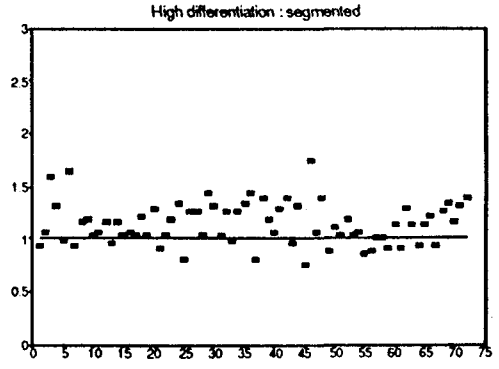
Mean = 1.19 Std deviation = 0.27

78% (1)



Mean = 1.11 Std deviation = 0.20

72% (1)



Mean = 1.14 Std deviation = 0.20

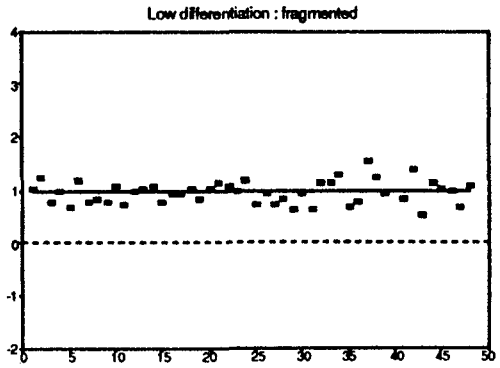
76% (1)

(1) Number of observations above total manufacturing average.

NB: The horizontal line represents the total manufacturing average.

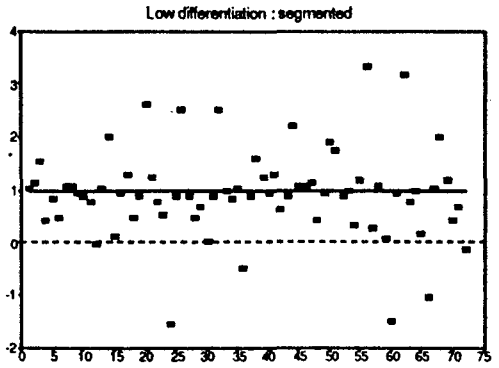
Source: OECD/DSTI Stan database.

Figure 2. Distribution of Relative Margin rate according to the Market Structure



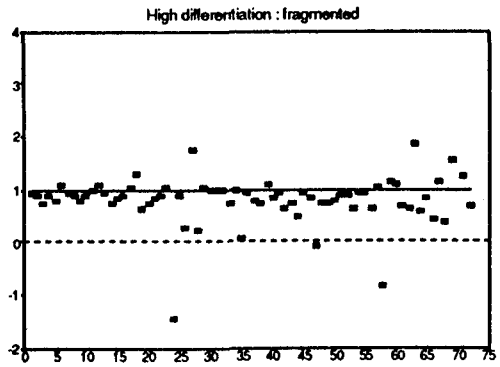
Mean = 0.86 Std deviation = 0.67

44% (1)



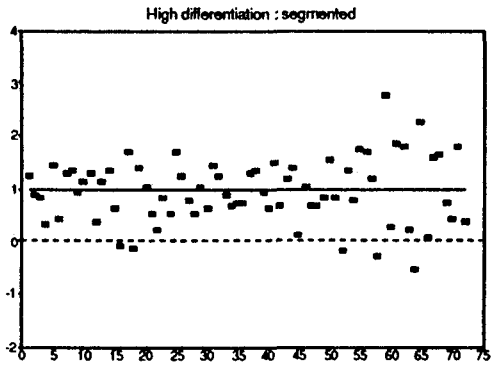
Mean = 0.92 Std deviation = 0.85

40% (1)



Mean = 0.75 Std deviation = 0.59

21% (1)



Mean = 0.95 Std deviation = 0.61

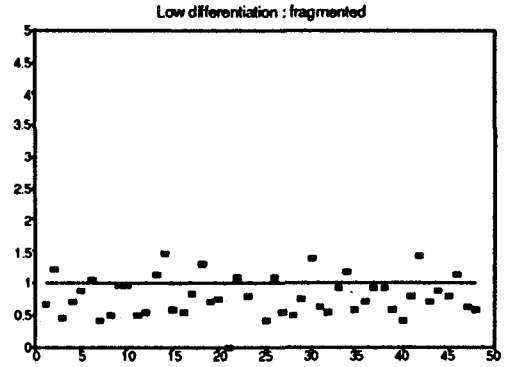
47% (1)

(1) Number of observations above total manufacturing average.

NB: The horizontal line represents the total manufacturing average.

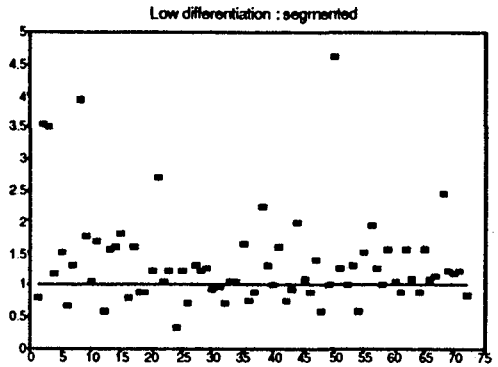
Source: OECD/DSTI Stan database.

Figure 3. Distribution of Relative Investment according to the Market Structure



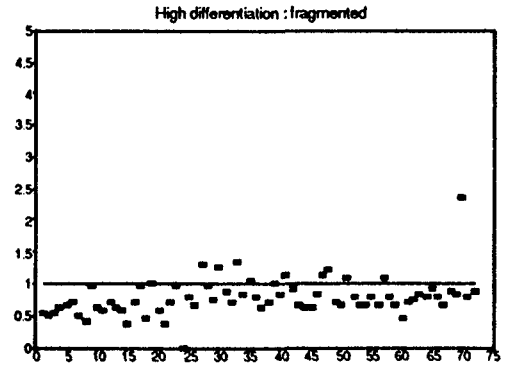
Mean = 0.86 Std deviation = 0.69

25% (1)



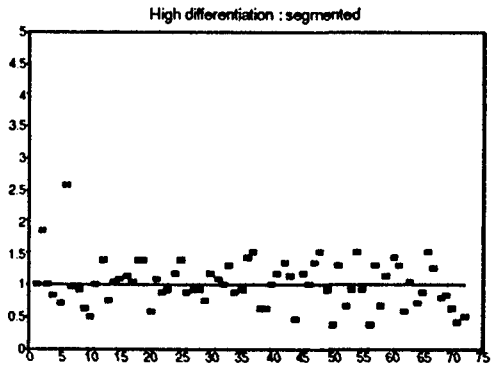
Mean = 1.35 Std deviation = 0.76

67% (1)



Mean = 0.78 Std deviation = 0.30

15% (1)



Mean = 1.01 Std deviation = 0.37

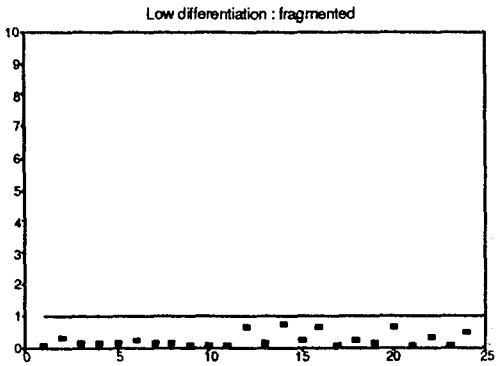
46% (1)

(1) Number of observations above total manufacturing average.

NB: The horizontal line represents the total manufacturing average.

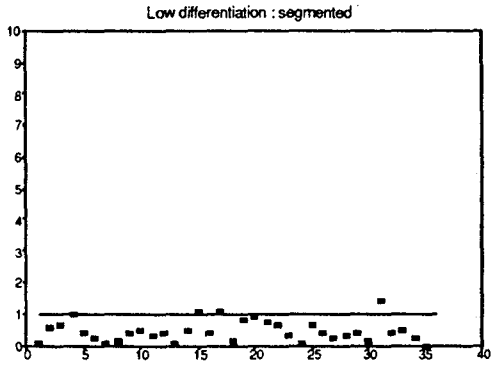
Source: OECD/DSTI Stan database.

Figure 4. Distribution of Relative R&D Intensities according to the Market Structure



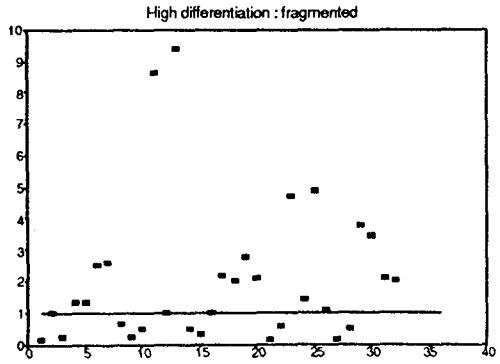
Mean = 0.23 Std deviation = 0.21

0% (1)



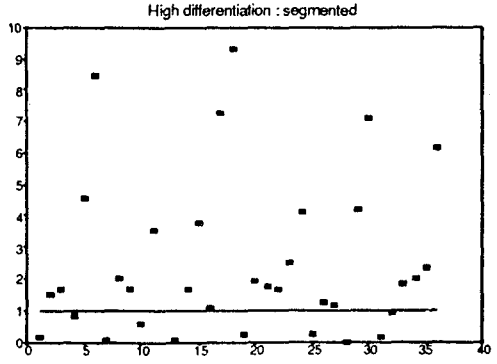
Mean = 0.44 Std deviation = 0.33

9% (1)



Mean = 2.02 Std deviation = 2.22

56% (1)



Mean = 2.77 Std deviation = 2.90

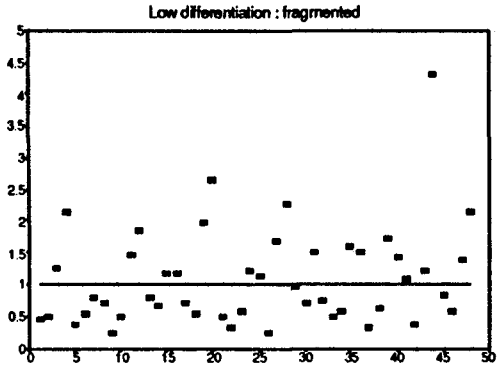
72% (1)

(1) Number of observations above total manufacturing average.

NB: The horizontal line represents the total manufacturing average.

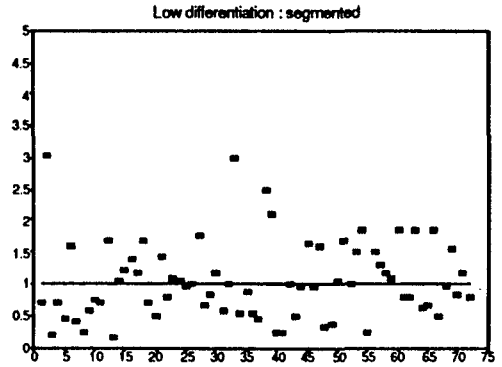
Source: OECD/DSTI Stan database.

Figure 5. Distribution of Relative Penetration ratio according to the Market Structure



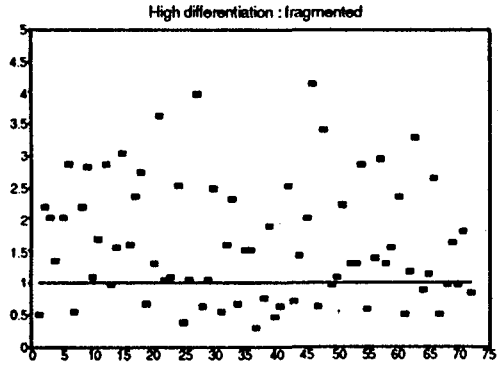
Mean = 1.09 Std deviation = 0.76

46% (1)



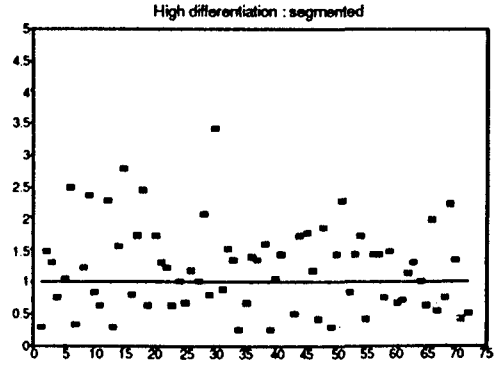
Mean = 1.04 Std deviation = 0.61

46% (1)



Mean = 1.63 Std deviation = 0.94

69% (1)



Mean = 1.32 Std deviation = 1.16

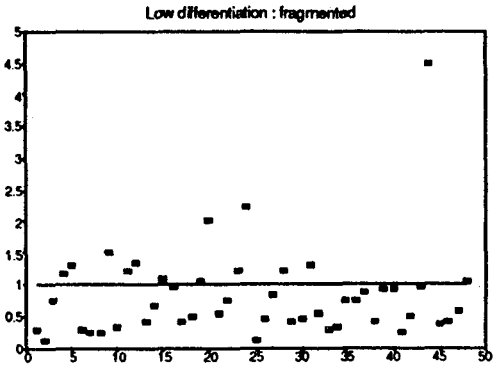
58% (1)

(1) Number of observations above total manufacturing average.

NB: The horizontal line represents the total manufacturing average.

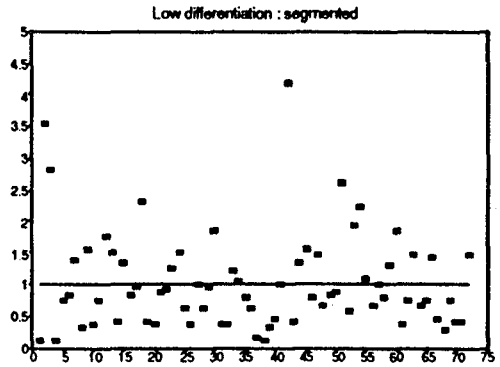
Source: OECD/DSTI Stan database.

Figure 6. Distribution of Relative Export Intensities according to the Market Structure



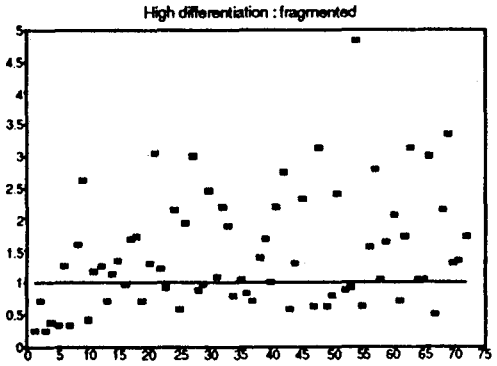
Mean = 0.82 Std deviation = 0.71

29% (1)



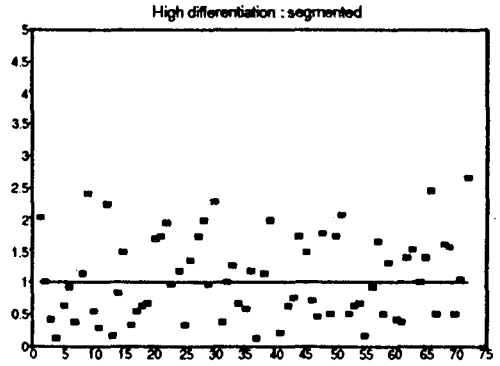
Mean = 1.02 Std deviation = 0.77

39% (1)



Mean = 1.53 Std deviation = 1.11

64% (1)



Mean = 1.16 Std deviation = 1.06

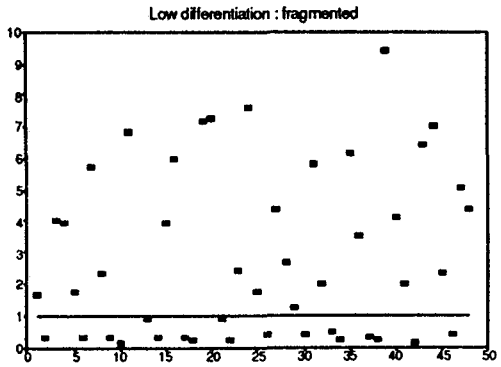
47% (1)

(1) Number of observations above total manufacturing average.

NB: The horizontal line represents the total manufacturing average.

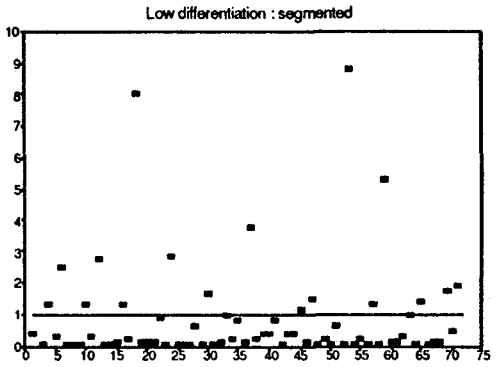
Source: OECD/DSTI Stan database.

Figure 7. Distribution of Relative Penetration ratio according to the Market Structure
Exports from Asian Nics



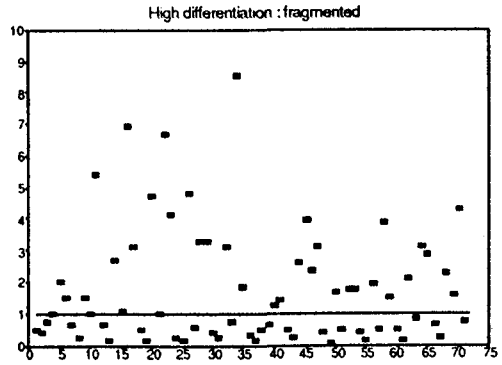
Mean = 3.03 Std deviation = 2.80

63% (1)



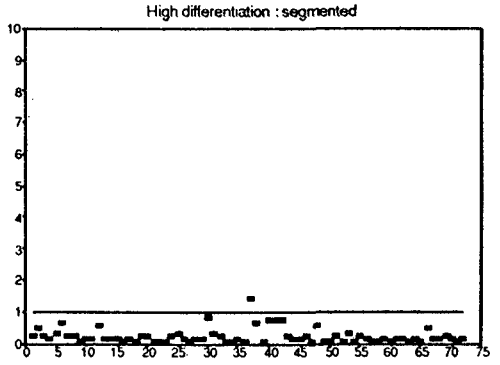
Mean = 1.00 Std deviation = 1.95

27% (1)



Mean = 1.74 Std deviation = 1.80

49% (1)



Mean = 0.21 Std deviation = 0.23

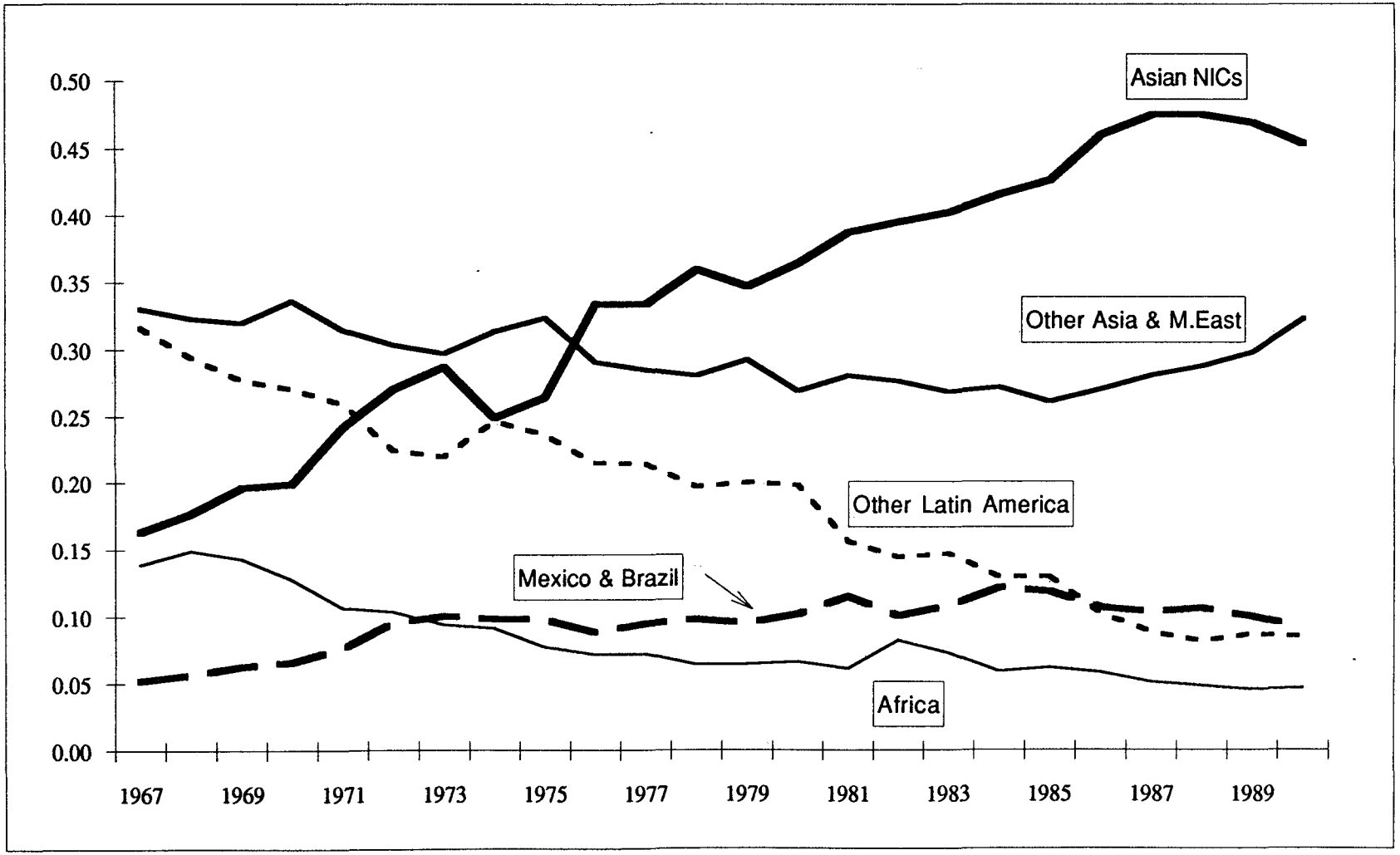
1% (1)

(1) Number of observations above total manufacturing average.

NB: The horizontal line represents the total manufacturing average.

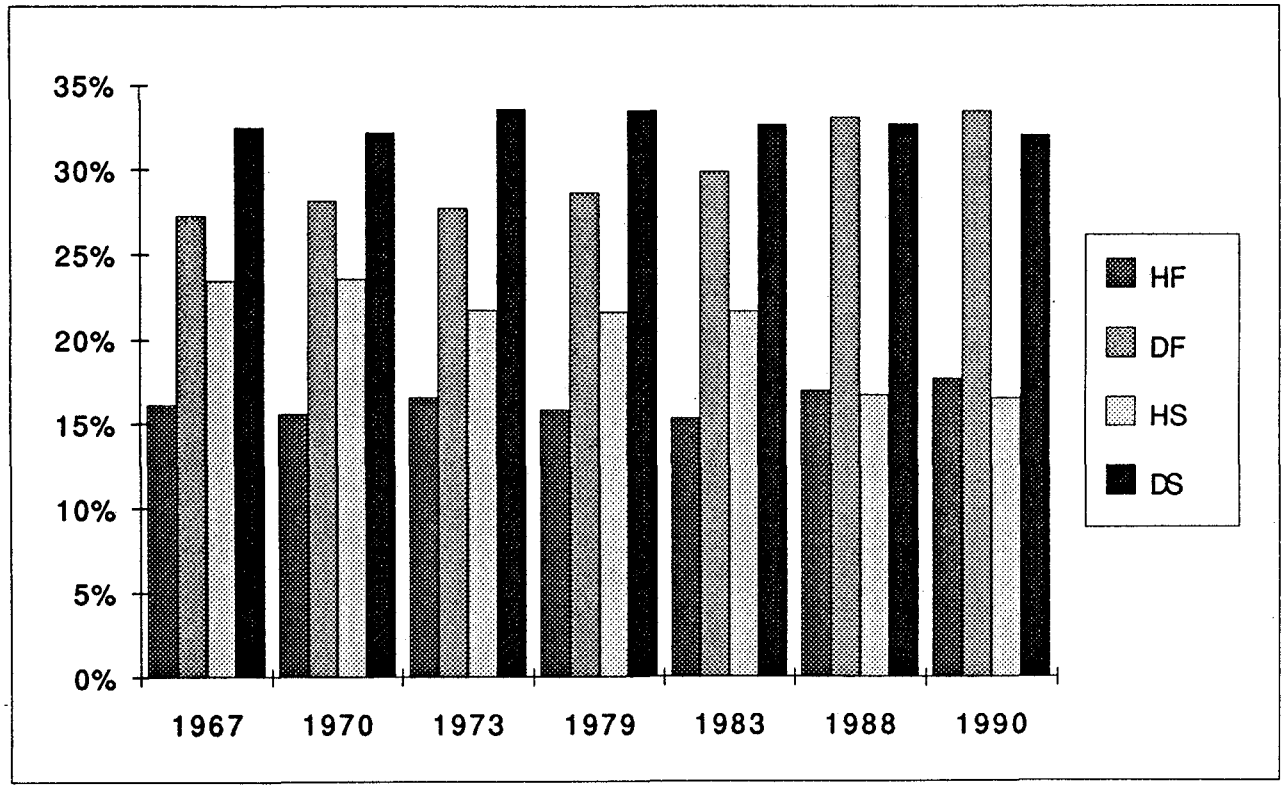
Source: OECD/DSTI Stan and CEPII/CHELEM databases.

Figure 8. Share of LDCs Exports of Manufactured Products



Source: CEPII, CHELEM Data Base.

Figure 9. Shares of world trade by type of industry grouping



Source: CEPII, Chelem data Base.

Legend:

HF: Fragmented, Low-differentiation industries

DF: Fragmented, High-differentiation dndustries

HS: Segmented, Low-differentiation industries

DS: Segmented, High-differentiation industries

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