Product Differentiation and Intra-Industry-Trade: Tests and Classification Issues on Italian Data.

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ABSTRACT

A description of IntraIndustry-Trade is provided for Italy at the finest level of disaggregation of trade flows so far performed in the literature. Some stylized facts emerge. The most striking is the almost stationarity of IIT over the last two decades. The main thrust of the paper is concerned with vertical differentiation as a determinant of trade specialization. We show that IIT can be surely be made to depend on the difference between import and export prices, which is the best representation of vertical differentiation.

1.Introduction

Literature on Intra-Industry-trade (IIT) has emphasized the role of industry and country determinants of specialization providing alternative answers (Marvel-Ray, 1987). Economies of scale, differentiation, concentration are the industry features mostly utilized to explain IIT tracing back to the contributions of Krugman (1980), Helpman (1981) and others. Some emphasis has been put also on tariffs (Brander-Krugman, 1983; Marvel-Ray, 1987) without reaching any unanimously accepted conclusion.

An aspect on which there remains some unanswered question is product differentiation. This is due to the double nature of this phenomenon which can be either horizontal or vertical. The latter version of differentiation is associated to quality and price differences. Indeed a great deal of IIT is made up of exchange of goods belonging to the same industry yet qualitatively differentiated. Quality differentiation, unlike horizontal differentiation, seems to introduce a comparative advantage where it is usually assumed away. For this reason vertical differentiation has to be better understood.

A second question relates to the evolution of IIT over time. Analysing IIT over time should help get rid of much "noise" in IIT measures since the influence of short run exchange rate adjustments and short run relative price variations will be neutralized over time. In this paper we have tried to tackle partially this problem by analysing IIT over time in some selected industries resorting to two different econometric approaches.

The purpose of this paper is twofold. On one side we wish to add some empirical test of the vertical differentiation hypothesis. On the other hand we provide a classification of industries according to their level of IIT, the time evolution of it and the difference between import and export prices. The analysis is mostly empirical and based on trade data for Italy collected at the 5-digit level of disaggregation of SITC. The analysis is conducted at both a descriptive and an interpretative tier. To this purpose we describe in the next paragraph some aspects of specialization that can be observed on Italian trade data. The descriptive empirical analysis will raise some questions which will be answered by econometric tests.

2. Description of trade specialization in Italy between 1961-1990

2.1. General remarks

Before trying to interpret trade specialization we wish to analyse trade flows in Italy during the last thirty years. The analysis is conducted on OECD data at 5-digit[1] level of disaggregation, which represents the most detailed description performed so far.

During this long period we can observe huge changes in the structure of trade flows. Unfortunately also the classification of industries at the finest level of disaggregation has changed somehow. In table 1 we can see that the number of industries (product groups) where trade is registered changes from 1404 to 3122 during the period 1972-1990, showing sharp jumps in 1978 and 1988 just after trade classification changes[2].

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1 Trade data up to 1967 are available only at 4-digit level of disaggregation. Elaborations are available upon request even though we do not report them since they are not comparable with those produced after 1967.

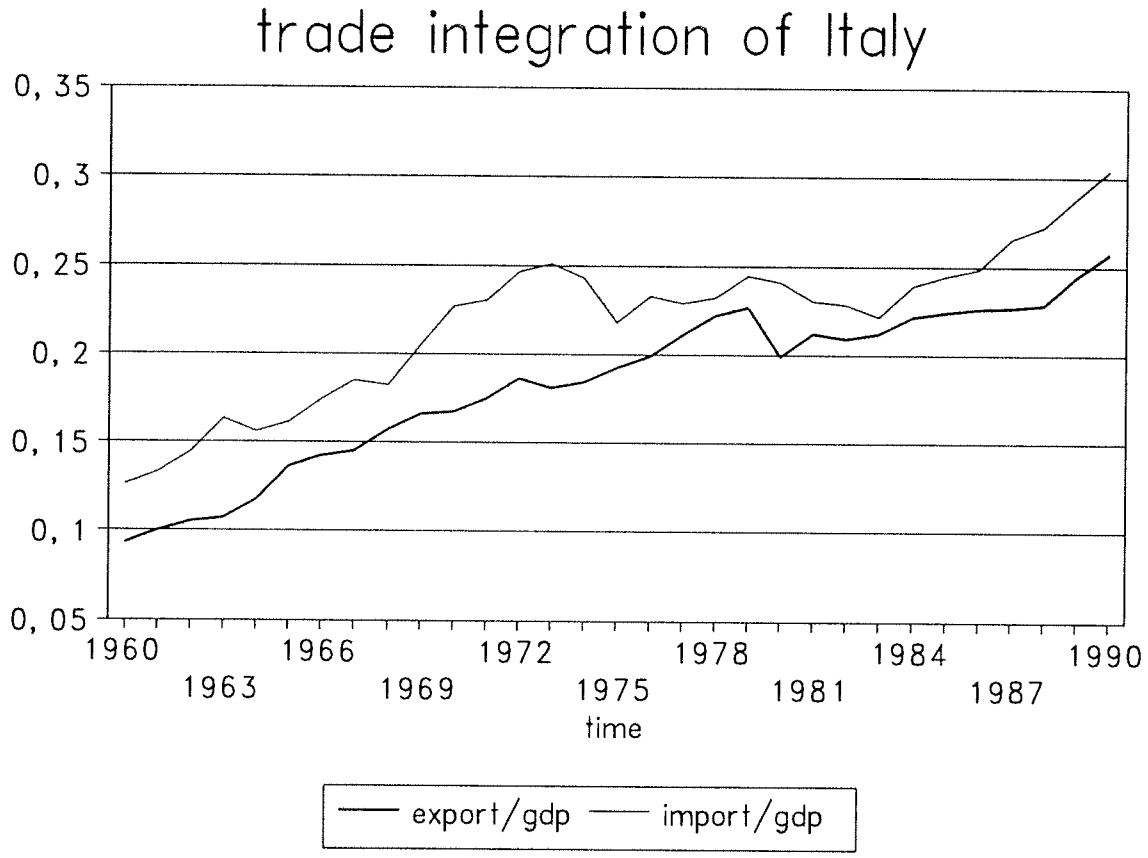
2 See S.I.T.C revision 2 (1975), S.I.T.C revision 3 (1986).

Table 1

year	number of product groups where trade is registered	zero import group	zero export group	product groups where GL index > 0.75
1972	1404	148	103	369
1976	1403	136	108	365
1977	1403	144	114	379
1978	1835	73	46	408
1979	1838	62	41	432
1985	1860	84	53	417
1987	1862	85	52	456
1988	3122	56	42	708
1990	3122	82	52	684
	in percent of total			
1972		10.54	7.34	26.28
1976		9.69	7.70	26.02
1977		10.26	8.13	27.01
1978		3.98	2.51	22.23
1979		3.37	2.23	23.50
1985		4.52	2.85	22.42
1987		4.56	2.79	24.49
1988		1.79	1.35	22.68
1990		2.63	1.67	21.91

In the same table we notice that the number of industries with no export or import decreases quite steadily during the same period, witnessing an increasing integration of Italy in international trade, which can be seen also, at the macroeconomic tier, in figure 1.

Figure 1



To describe trade specialization we use the standard Grubel-Lloyd (GL) unadjusted index od Intra-Industry Trade (IIT), calculated at the 5-digit disaggregation level and reported at 1-digit[3]. We have the choice of calculating the index either on quantity data or on value data. We are going to use both type of data since they are able to better convey different information on specialization. Before going into detailed analysis it is worth assessing how pervasive is IIT among industries. In table 1 (last column) we present the number of product groups displaying levels of GL index (in values) greater than 0.75. As it can be seen, the absolute number of industries having a very high level of IIT increases over time, while the percentage level decreases. This could be thought of as the **first** empirical finding, which points to some reversal of IIT, even tough to an extent that has to be properly assessed, mainly during the eighties. This is what is done in Figure 2.

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3 In table A1, in the Appendix we report 3-digit GL indeces in values and quantities calculated at 5-digit disaggregation for year 1990. For prevoius years indices can be obtained from the authors upon request.

Figure 2

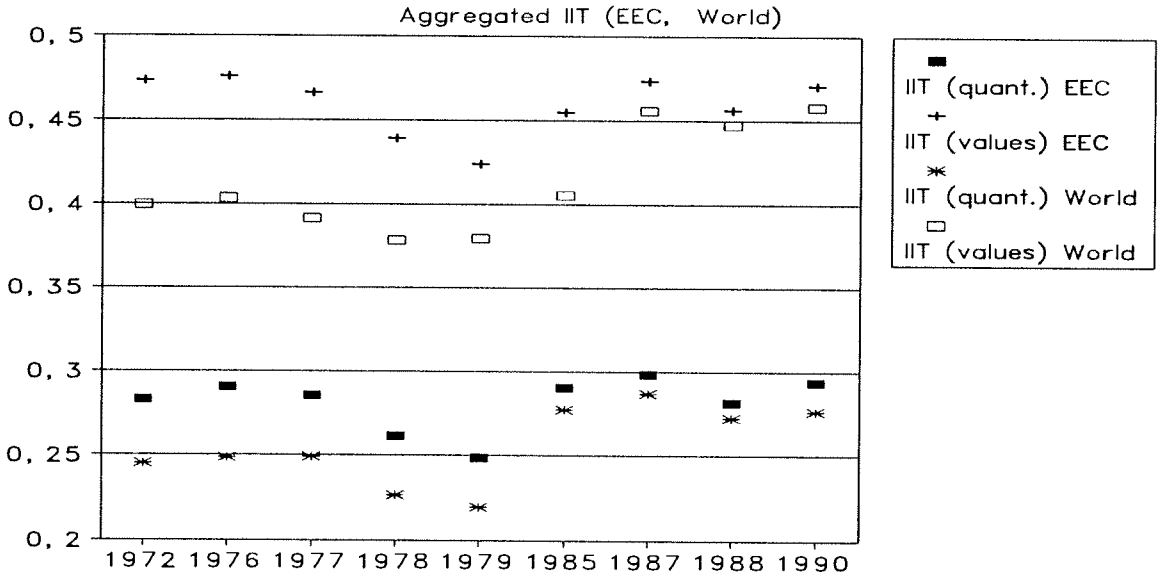

Figure 2 provides many interesting insights; some of them are surprising. First of all we see that aggregated IIT indices in values are always greater than those calculated on quantities. This could be thought of as a sort of stylized fact (**second** empirical finding) which appears when we use aggregated indices, but not when we use disaggregated indices[4]. In the same figure we notice that IIT with EEC is always greater than IIT with the entire world, confirming what has been already observed in previous literature[5] and been thought of as a sort of stylized fact: Within the EEC, IIT is larger than with outside partners. But be careful not to extend this fact, which is EEC typical. In other words we cannot say that, when countries integrate, IIT necessarily grows. It all depends on the stage of development of a country during which integration takes place[6]. If countries integrate at late stage of development they are more IIT prone than countries which integrate at early stages of development.

This observation is indirectly confirmed by the **third** empirical finding, (shown in figure 2), saying that the gap between EEC and World IIT indices narrows during the eighties and seems almost going to disappear in recent years.

What has been seen in Table 1 in terms of number of industries with high IIT index is confirmed by a seemingly stationarity of IIT indeces during the last twenty years, where no trend

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4 See Table A1 in the Appendix.

5 See Sazanami-Hamaguchi (1978), Rossini (1983).

6 See Hufbauer - Chilas (1974).

can be observed. This could be termed the **fourth** empirical finding to which we shall come back again later.

As far as the difference between IIT calculated on quantities and IIT calculated on values is concerned, there seems to be again some sort of stationarity. Still at the aggregated level we have computed the variances of IIT indices in values and quantities, reported in Table 2. We see that a larger variance is shown by IIT indices in values (**fifth** empirical finding). This fact could point to some vertical differentiation phenomenon, that will be analyzed later.

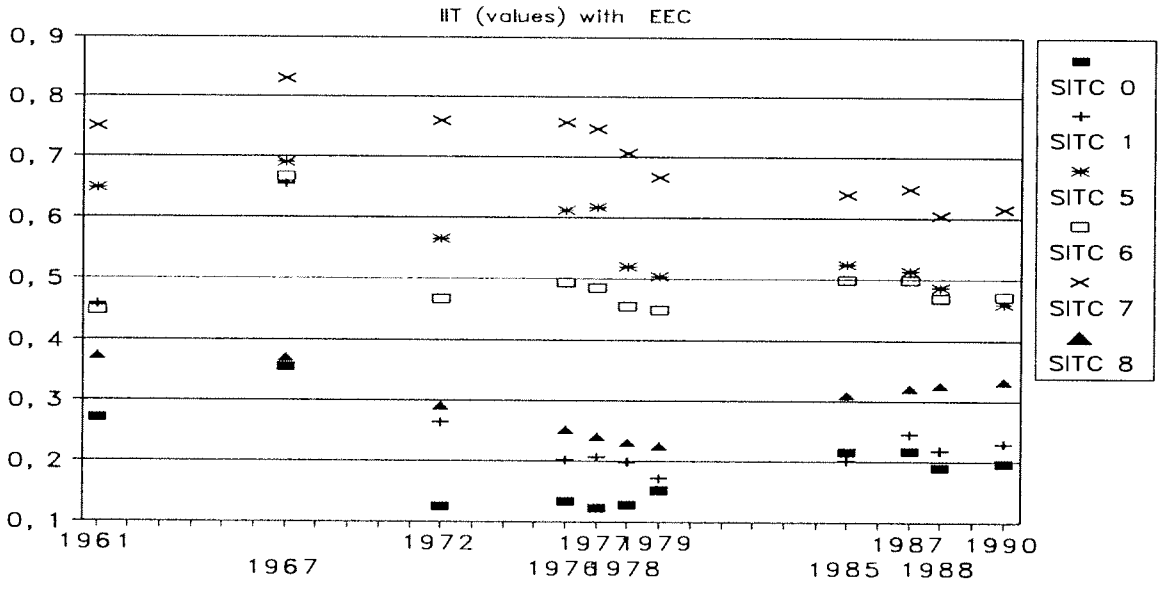
Table *2*

variance	quantities	values
EEC	0.000235	0.000282
WORLD	0.000505	0.000904

Now we wish to analyze IIT across industries at the highest aggregation level. We calculate indices at 5-digit disaggregation level and we report them at 1-digit.

In Figure 3 we have IIT indices calculated on values for trade of Italy with EEC partners.

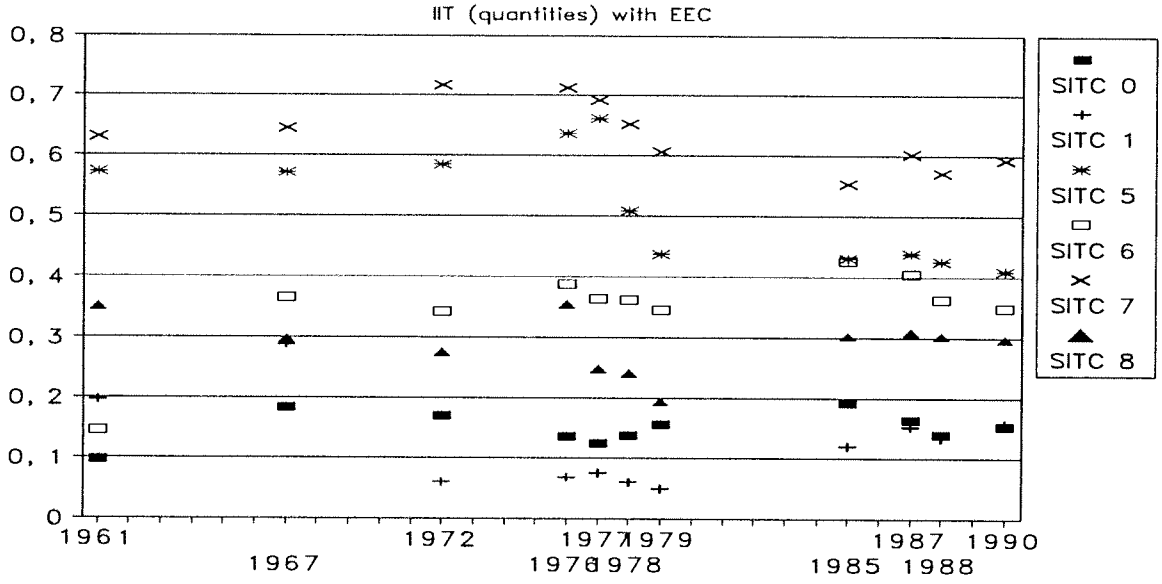
Figure 3



In Figure 3 we can observe a decreasing trend of IIT till 1980 and a sort of stabilization over the eighties. Only industry[7] 8 shows a positive trend during the same period. This can be termed the **sixth** empirical finding which points to a reemergence of Interindustry specialization, for all industries but one, over the eighties. This has been a period of fairly stable exchange rates.

If we analyze the same indices calculated on quantities (Figure 4) we find more difficult to see any trend, whereas there seems to be some sort of stationarity. This means that trends can be attributed only to a change in relative prices of imports vis à vis exports but not to quantities. At the basis of this phenomenon there could be either some vertical differentiation, which was not there before the eighties, or a different inflation rate between Italy and the rest of EEC during a period of almost fixed exchange rates.

Figure 4



In Figure 5 and 6 we report the same IIT indices calculated for total trade (world). In Figure 5 (values) we observe a sort of convergence, i.e. industries with low levels of IIT increase it, while industries with high level of IIT (7,5) decrease it. When we go to quantities it is quite akward to find any local regularity. The **stationarity** issue comes back as the most suitable description even though we observe a large variance.

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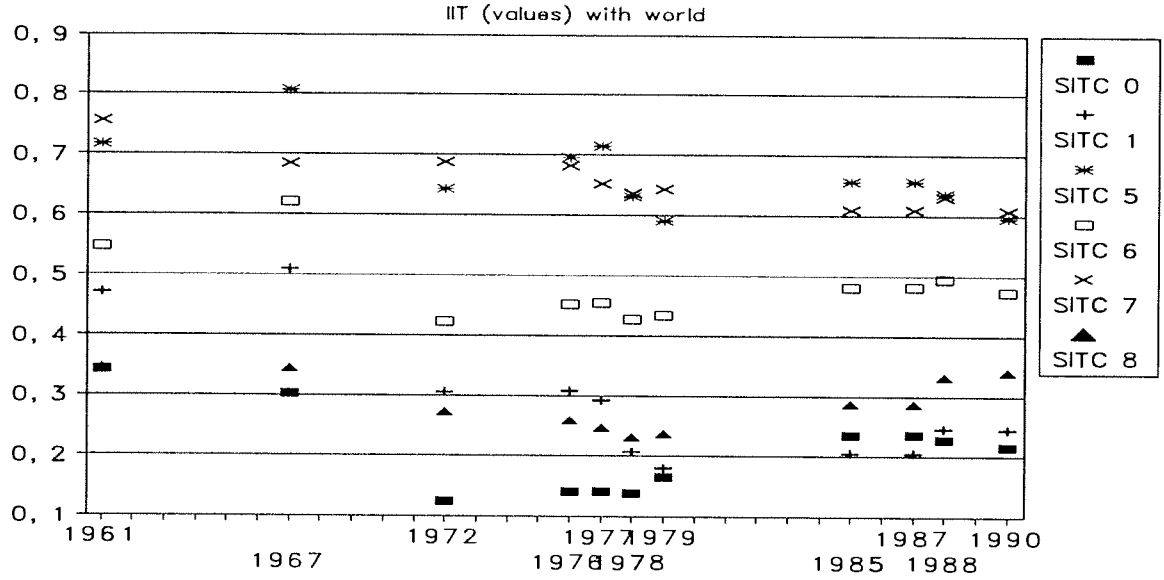
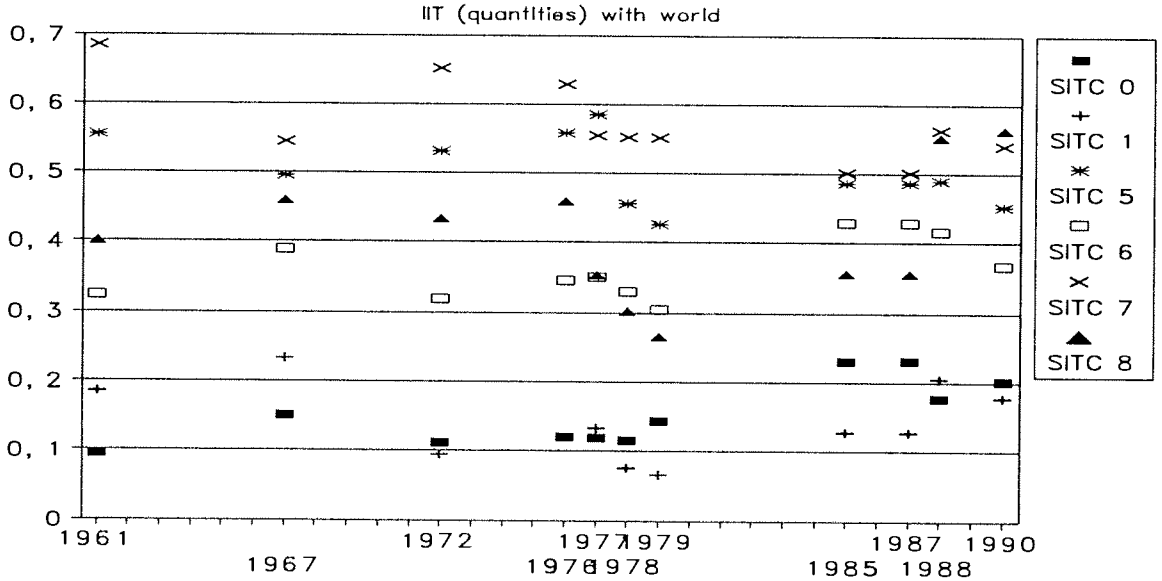
7 According to SITC industry 0 corresponds to Food and Live animals chiefly for food, 1 to Beverages and Tobacco, 2 to Crude materials, Inedibles except Fuels, 3 to Mineral Fuels, Lubrificants and Related Materials, 4 to Animal and Vegetable Oils, Fats and Waxes, 5 to Chemicals and Related Products, 6 to Manufactured Goods Classified chiefly by Material, 7 to Machinery and Transport Equipment, 8 to Miscellaneous Manufactured Articles, 9 Non Classified Commodities.

Figures 5, 6



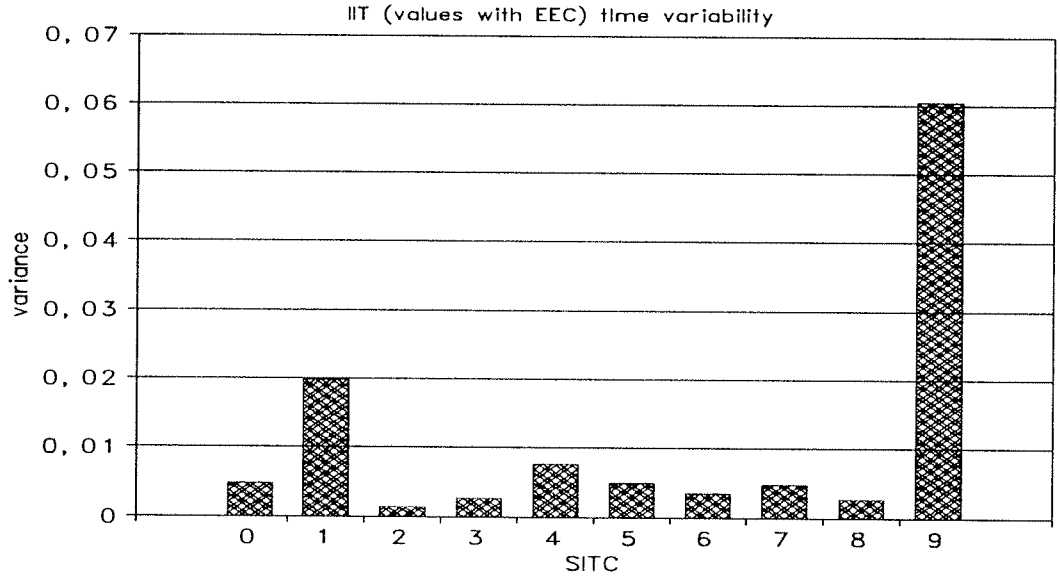


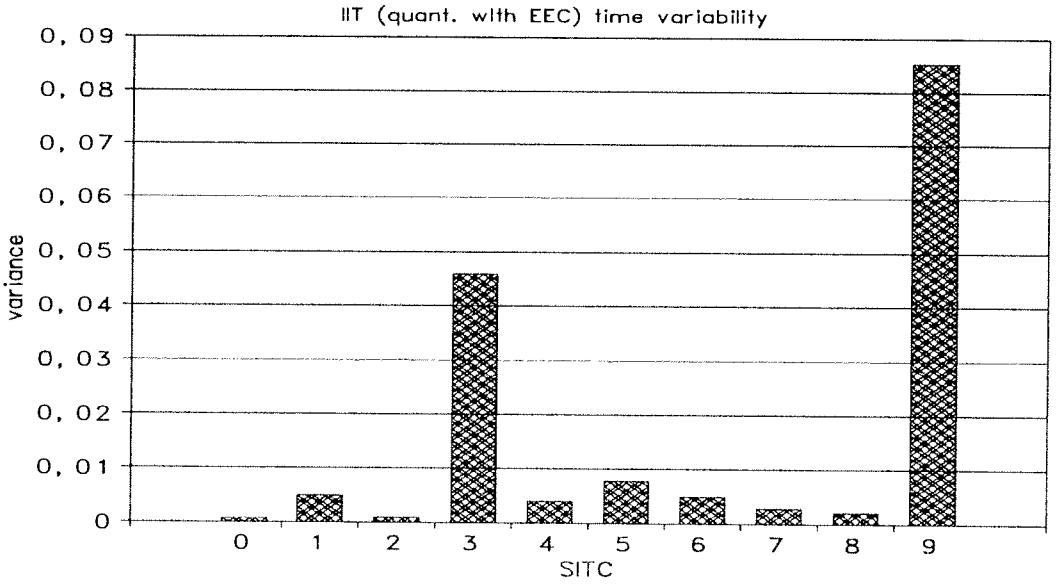
2.2. The time variability of IIT indices

An aspect which seems to be of great interest is the time variability of specialization. A rough measure of it could be the variance of IIT indices over time. To this purpose we have computed for each industry the variance of IIT both for quantity indices and for value indices, shown in Figures

7, 8. If we do not consider industry 9 because it is statistically treated as a residual basket, we see that IIT indices in quantity are less variable over time than IIT indices in values. Going into some detail, it can be observed that only industry 3 shows a greater variability which can be attributed to the kind of products concerned, i.e. oil and derivatives. For most of the industries we definitely observe a high price variability that might again be due to vertical differentiation. This issue will be tackled in the next paragraphs by resorting to both discriminant analysis and regression analysis.

Figures 7, 8

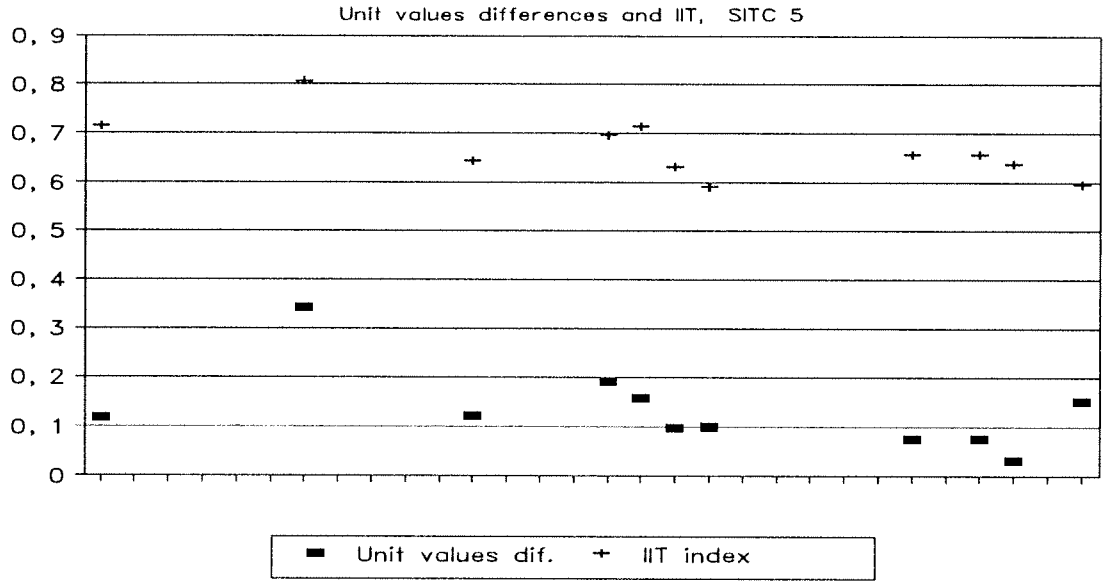


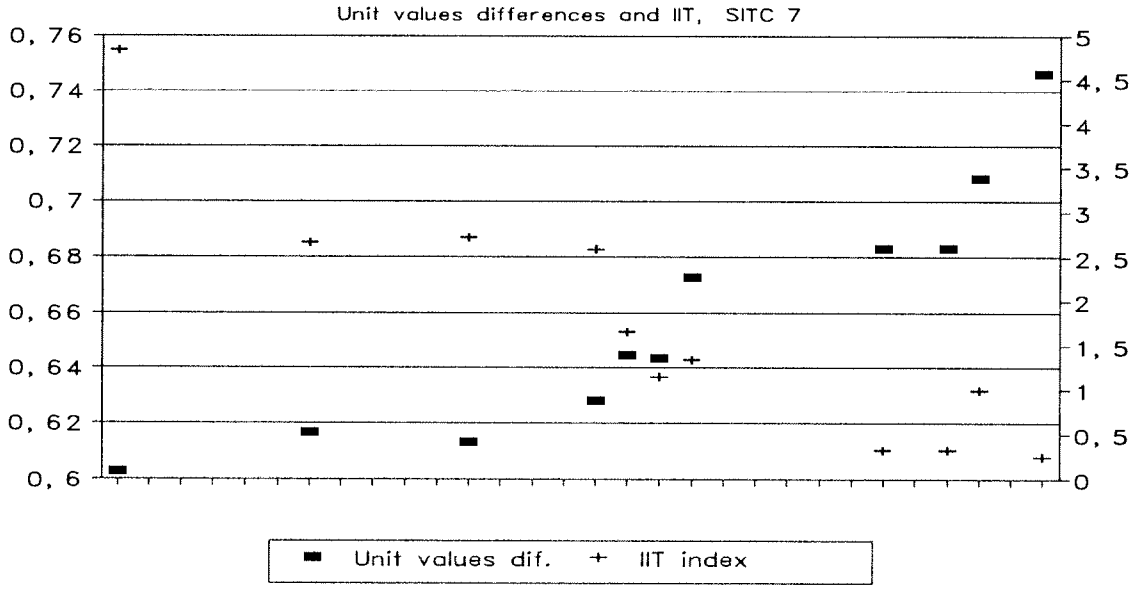


2.3 IIT as a function of differences between import and export unit values

We have plotted in diagrams (Figures 9, 10) IIT indices and the absolute difference between export and import unit values for industries 5 and 7. In the first case (figure 9) there seems to be a direct relation, while in the second case there seems to be an inverse relation. Since IIT is largely coupled to vertical differentiation which can be explained by price differences between export and import (Linder trade), in the next paragraph we shall try to regress IIT indices over the price difference between imports and exports; in other words we wish to find a relation between the two series plotted in Figures 9 and 10.

Figures 9, 10


Unit values differences and IIT, SITC 5
0, 9
0, 8
0, 7
0, 6
0, 5
0, 4
0, 3
0, 2
0, 1
0
Unit values dif.
IIT index


Unit values differences and IIT, SITC 7
0, 76
0, 74
0, 72
0, 7
0, 68
0, 66
0, 64
0, 62
0, 6
5
4, 5
4
3, 5
3
2, 5
2
1, 5
1
0, 5
0
Unit values dif.
IIT index

3. Vertical differentiation and IIT: some tests

Trade in vertically differentiated goods or *Linder-trade* means that the quality of imported goods is different from the quality of exported goods. This is reflected in different prices. One way to assess the importance of this phenomenon is by using trade data expressed both in quantities and in values as we have already seen in the previous paragraph.

The usual measure of specialization adopted is the GL index, which can be computed either on quantities or on values. A quantity IIT index can be written as:

$$IIT_{qij} = 1 - \frac{| x_{qij} - m_{qij} |}{(x_{qij} + m_{qij})}$$

where x and m are respectively quantities of exports and imports, and IIT_q is the GL index calculated on quantities for industry i, for country j in a particular period of time.
We now introduce prices and have

$$IIT_{vqij} = 1 - \frac{| p_x x - p_m m |}{(p_x x + p_m m)}$$

that is the GL index calculated on values for the same industry i of country j (subscripts are abandoned to make it readable), with p_x and p_m representing respectively the price of exports and the price of imports.
To see what happens when we have vertical differentiation between imports and exports we may calculate the partial derivative of IIT_v with respect to p_x and p_m. The derivative is

$$\frac{\partial IIT_v}{\partial p_x} = -\frac{x(p_x x + p_m m) - x \mid p_x x - p_m m \mid}{(p_x x + p_m m)^2}$$

The sign of this derivative is negative, yet at the same time we have that:

$$\frac{\partial IIT_v}{\partial p_m} < 0$$

Therefore each time we face a change of price either of imports or of exports we know that the index of IIT will move the opposite way.

3.1 Some classification issues

Before conducting econometric tests we wish to classify and group industries according to some common behaviour. To this purpose we have chosen a limited number of products at the 5-digit classification of SITC. Some of these products are not vertically differentiable, like chemicals whose formula is the same all over the world. Other products are among those where vertical differentiation is supposed to be the greatest. Our prior is that these two groups of industries should reveal different behaviour as far as international specialization is concerned. To see whether this distinction is correct we have used cluster analysis. Before proceeding we wish to say something on cluster analysis. Consider an index of IIT in value. We can think of this as a feature of each industry. Cluster analysis allows us to group industries according to this feature by using an

algorithm[8] which collects industries in clusters by minimizing the differences among them as far as the character analysed is concerned. Clusters can be formed also on the basis of more than one character. The second character we have chosen to form clusters is the difference between the import and the export price. Industries will be grouped according to two characters and the clusters we shall get will show similar GL indices and similar patterns of price differentials. We use a GL index of IIT computed on values. Clusters will then reflect the similarity of behaviour of industries across the two characters.

In Table 3 we can see the composition of the two clusters in which the sample of 5-digit products has been divided. Our prior is that products belonging to the chemical sector are not vertically differentiated and should have lower levels of IIT (sectors whose first digit in column 1 of table 3 is 5). Products belonging to sector 7 (machinery and transport equipment) should display the opposite behaviour since liable to be strongly vertically differentiated. In our classification attempt we have separeted the products in two clusters. As we can see in cluster 2 we find only products of the verticaly differentiated sort. In cluster 1 we find all products belonging to the chemicals and some belonging to the sector 7. Even though this result is not conclusive it gives some confirmation of our prior.

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8 We have used the algorithm of Ward. For furhter details on cluster analysis see Anderberg (1970).

Table 3

Clusters on GL and δ p

sector	cluster	sector	cluster
51112	1	78520	2
51222	1	78535	2
51135	1	78433	2
51212	1	78511	2
78432	1	78311	2
78516	1	78513	2
51217	1	78537	2
51223	1	78622	2
51122	1	78120	2
78435	1	78431	2
51124	1		
51126	1		
78219	1		
78685	1		
51132	1		
51215	1		
51214	1		
51211	1		
51235	1		
51241	1		
78630	1		
51131	1		
78225	1		
51113	1		
51138	1		
78211	1		
78320	1		
78227	1		
78621	1		
51125	1		
51133	1		
51111	1		
51123	1		
51221	1		
78536	1		
51231	1		
78425	1		
51121	1		
51216	1		
78410	1		
78517	1		
51243	1		
51244	1		
51127	1		
51224	1		
78434	1		
51140	1		
51213	1		
78110	1		
51114	1		
78531	1		
51137	1		
78223	1		
78221	1		
78610	1		
78683	1		
51225	1		
78421	1		
78515	1		
78436	1		
51242	1		

The grouping just derived is a picture of what happened in only one year (1990) in some finely disaggregated 5-digits groups.

Now we wish to see whether there is some stability of grouping according only to IIT indeces over time. On the trace of the received literature we might think of IIT as a peculiar feature of some industries while other industries are less IIT prone. This would imply that some industries preserve over time a higher level of IIT respect to other industries. This is the hypothesis that we wish to test using a cluster over two years. The test we perform is conducted on IIT indeces over all sectors, calculated at 5-digit and reported at 3-digit classification. In table A2, in the appendix, we report the clusters inferred on value data of 1985-1990. We have now ten clusters. Cluster 1 is composed of 154 industries. It can be checked which industries keep their cluster in two different years (1985-1990) by looking at the second column in table A2. It appears that there is a high number of industries which maintain their position in cluster 1, i.e.: there is some stability of IIT for a relevant number of industries. This indirectly confirms the intuition of Marvel-Ray (1987) that IIT leads to a decrease of protection, provided it stays fairly stable. We can indeed observe that the stability of IIT along the past decade has been accompanied by reduction of many non tariff barriers within the EEC.

Yet it is difficult to identify industries with stable IIT within a particular category. There are manufacturing industries sometimes identifiable with those with predominant economies of scale, yet there are also agricultural products.

We have to recognize that there is not yet a theory about the evolution over time of specialization and hence IIT. Therefore it becomes pretty akward to classify industries according to the stability of IIT over time. Our purpose has been only to identify those industries even though we are not able to group them in a systematic way.

As far as the remaining clusters are concerned there is no stability whatsover making specialization a phenomenon which shows some volatility on the majority of sectors.

3.2. Two econometric tests

If vertical differentiation is a cause of IIT we should be able to find some relation between IIT and a variable which proxies at best the phenomenon of vertical differentiation. This relation is what we are trying to find and to this purpose we resort to regression analysis. We have done two groups of tests, paralleling the ones with cluster analysis. One has been done on industries at 1-digit disaggregation level, while the other has been performed on disaggregated data.

The first test:

We have used time series of GL indeces for the 8 industries (1 digit) and we have used as explanatory variable the difference between import and export prices. The results are reported in table 4 below.

Table 4

Dependent variable IIT GL index for sector 8

Regressor	coefficient	Std. Error	T-Ratio	Prob.
CONST	0.26348	0.014525	18.1397	0.000
DVMU8	0.02492	0.009561	2.6069	0.028

R-squared 0.43023

Dependent variable IIT GL index for sector 7

Regressor	coefficient	Std. Error	T-Ratio	Prob.
CONST	0.70325	0.013485	52.1491	0.000
DVMU7	-0.026474	0.005967	-4.4365	0.002

R-squared 0.68622

Dependent variable IIT GL index for sector 6

Regressor	coefficient	Std. Error	T-Ratio	Prob.
CONST	0.45727	0.022891	19.9762	0.000
DVMU6	0.15822	0.10557	1.4986	0.168

R-squared 0.19971

Dependent variable IIT GL index for sector 5

Regressor	coefficient	Std. Error	T-Ratio	Prob.
CONST	0.59250	0.025735	23.0255	0.000
DVMU5	0.56560	0.16692	3.3885	0.008

R-squared 0.56059

Dependent variable IIT GL index for sector 4

Regressor	coefficient	Std. Error	T-Ratio	Prob.
CONST	0.36997	0.047734	7.7506	0.000
DVMU4	-0.16730	0.17506	-0.95564	0.364

R-squared 0.092124

Dependent variable IIT GL index for sector 3

Regressor	coefficient	Std. Error	T-Ratio	Prob.
CONST	0.13569	0.033732	4.0225	0.003
DVMU3	0.0053191	0.0040253	1.3214	0.219

R-squared 0.16249

Dependent variable IIT GL index for sector 2

Regressor	coefficient	Std. Error	T-Ratio	Prob.
CONST	0.15984	0.013554	11.7930	0.000
DVMU2	0.20182	0.21940	0.91988	0.382

R-squared 0.085939

Dependent variable IIT GL index for sector 1

Regressor	coefficient	Std. Error	T-Ratio	Prob.
CONST	0.49941	0.12900	3.8713	0.004
DVMU1	-0.12573	0.074782	-1.6813	0.127

R-squared 0.23902

Dependent variable IIT GL index for sector 0

Regressor	coefficient	Std. Error	T-Ratio	Prob.
CONST	0.19039	0.032072	5.9364	0.000
DVMU0	0.26325	0.38894	0.67685	0.67685

R-squared 0.048438

Industry 8: there is a positive and significant relationship between the level of IIT and the gap between import and export prices. This industry contains products which are highly differentiated and our prior, that IIT is partly caused by vertical differentiation, is supported by evidence.

Industry 7: there is a significant negative coefficient, which means that IIT decreases when vertical differentiation increases. In this case the price difference might conceal some comparative advantage.

Industry 6: a positive coefficient, but the relation is less reliable. IIT is positively linked to price differences but this is less explicative.

Industry 5: a positive and significant link. Since this sector is made up mostly by products where vertical differentiation is absent (chemicals) we think that this positive relation needs a more disaggregated analysis, which will be conducted in the next test.

Industry 4: a negative but scarcely reliable relation. In this industry we think that price differences are the sign of a comparative advantage leading to a greater Interindustry specialization.

Industry 3: a positive but not much reliable relation. In this case IIT might be due to goods which are either horizontally differentiated or fairly homogeneous.

Industry 2: positive but unreliable relation. We cannot attach any meaning to it since the coefficient is not significantly different from zero.

Industry 1: negative and fairly significant coefficient. There is definitely a comparative advantage coming out of price differences.

Industry 0: a positive but not significantly different from zero coefficient. We would expect a negative one since this sector does not include many vertically differentiated goods and is probably one of the most oriented towards interindustry specialization.

The above results are partly confirming our hypothesis that IIT is linked to vertical differntiation. However the test has been conducted at a very aggregated level, even though both GL indices and price differentials have been computed at 5-digit disaggregation. We thought that a more detailed analysis could provide some more precise answers. To this purpose we chose some industries belonging to groups which seem to be fairly similar in term of the degree of differentiation. We considered 3 groups at 5-digit disaggregation level to capture quite precisely an industry wherein composition fallacies are almost absent.

The **first** group is made up by industries 04841 (bread, biscuits and ordinary bakers not containing added sugar, honey, eggs, fats, cheese or fruit) and 04842 (Pastry, biscuits, cakes and fine bakers wares).

The **second** group is made up by industries 51211 (methanol), 51212 (propanol), 51213 (butanol), 54161 (Glycosides, natural or reproduced by synthesis, and their salts, ethers, esthers and other derivatives), 54191 (Wadding, gauze, bandages and similar articles), 61120 (Composition leather or leather fibre in slabs, sheets or rolls).

The **third** group is made up of industries 89410 (Baby carriages), 89421 (Wheeled toys designed to be ridden by children), 89422 (Dolls), 89423 (Toys for particular purposes), 89424 (Equipment for parlour, billard tables, pintables, table tennis), 89425 (Carnival articles and entertainement articles, tricks, jockes).

We have selected these 3 groups to perform the same test as before but with a different technique on better empirical basis. We have constructed panels[9] of data (time series and cross sections) for each group for GL indeces and differences of Import vis à vis Export prices. We then have estimated the time-cross relations for each group.

Table 5 Regression panel

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9 The output of panel regressions is tied to different underlying models. In the *Total* regression we estimate a model where both slopes and intercepts are equal over different industries. In the *fixed* effect (*within*) model we assume that intercepts may vary among industries and in the *byid* model we allow both slopes and intercepts to vary among industries.
The *between* model represents a regression using individual means and finally the *random* effect (*varcomp*) model is similar to the *fixed effect* model but assumes that slopes are drawn from a common distribution with mean α and variance σ^2.

The dipendent variable is always the GL index calculated on values.
The indipendent variables are either DIFVMU (the absolute value of the difference between export unit values and import unit values) or DIFREL (the same but weighted with the sum of the two unit values).

Groups: 04841, 04842

TOTAL (plain OLS) Estimates:
R-squared = .216475

Variable	Estimated Coefficient	Standard Error	t-statistic
DIFVMU	.147632	.070217	2.10251
C	.735975	.053887	13.6578

BYID: F-stat for A,B=Ai,Bi: F(2,14) = 1.0695 , P-value = [.3696]

WITHIN (fixed effects) Estimates:
R-squared = .248503

Variable	Estimated Coefficient	Standard Error	t-statistic
DIFVMU	.153261	.068815	2.22714

F-stat for Ai,B=Ai,Bi: F(1,14) = 0.47575, P-value = [.5016]

F-stat for A,B=Ai,B : F(1,15) = 1.7235, P-value = [.2090]

Groups: 51211, 51212, 51213, 54161, 54191, 61120.

TOTAL (plain OLS) Estimates:
R-squared = .191188

Variable	Estimated Coefficient	Standard Error	t-statistic
DIFREL	-.663931	.189372	-3.50597
C	.581403	.064801	8.97212

BYID: F-stat for A,B=Ai,Bi: F(10,42) =4.8856, P-value = [.0001]

BETWEEN (OLS on means) Estimates:
R-squared = .321885

Variable	Estimated Coefficient	Standard Error	t-statistic
DIFREL	-.881326	.639599	-1.37794
C	.637513	.190735	3.34241

WITHIN (fixed effects) Estimates:
R-squared = .108888

Variable	Estimated Coefficient	Standard Error	t-statistic
DIFREL	-.491715	.205182	-2.39648

F-stat for Ai,B=Ai,Bi: F(5,42) = 2.3584, P-value = [.0565]

F-stat for A,B=Ai,B : F(5,47) = 6.4769, P-value = [.0001]

Groups: 89410,89421,89422,89423,89424,89425.

TOTAL (plain OLS) Estimates:
R-squared = .137154

Variable	Estimated Coefficient	Standard Error	t-statistic
DIFVMU	.061167	.021275	2.87500
C	.297161	.058430	5.08573

BYID: F-stat for A,B=Ai,Bi: F(10,42) = 4.5206, P-value = [.0002]

BETWEEN (OLS on means) Estimates:
R-squared = .210059

Variable	Estimated Coefficient	Standard Error	t-statistic
DIFVMU	.108824	.105516	1.03134
C	.190586	.249571	.763652

WITHIN (fixed effects) Estimates:
R-squared = .118182

Variable	Estimated Coefficient	Standard Error	t-statistic
DIFVMU	.046655	.018589	2.50977

F-stat for Ai,B=Ai,Bi: F(5,42) = 0.82540, P-value = [.5388]

F-stat for A,B=Ai,B : F(5,47) = 8.3713, P-value = [.0000]

The results obtained make it clear that the 3 groups display different behavoiur. We chose the groups trying to capture 3 phenomena: horizontal differentiation (0), no differentiation (5), vertical differentiation (8).

The panel data test gives us a definite answer on two groups. In the chemicals differentiation is almost impossible. Therefore IIT is not determined by price differences. These might just be the sign of Interindustry specialization or comparative advantage.

The toys (8) is a group where there is a lot of vertical differentiation and we see that price differentials have an influence on the level of IIT, as we expected.

Group (0) gives a less definite answer. In this group there seems to be a considerable amount of horizontal differentiation. We have no prior, even though we expect that horizontal differentiation should not be linked to price differences; yet the result says that there are price differences and that they cause IIT. Horizontal differentiation probably deserves more careful analysis because we theoretically exclude price differentials but we always find them when we look at the data on horizontally differentiated goods.

6. Conclusions

We have presented a description of IIT in Italy during the last two decades. We have classified some empirical findings which change somehow the received description of IIT. When we start calculation at very disaggregated levels (5-digits) we see that IIT is a more complex phenomenon to be explained and it is almost impossible to find any trend since a stationarity feature emerges.

We have tried to better understand the relationship between IIT and vertical differentiation going into a very detailed analysis of some sectors selected for their behaviour. These sectors are very typical and can be thought of as a sort of paradigm.

When vertical differentiation is there IIT can be surely be made to depend on the difference between import and export prices, which is the best proxy for vertical differentiation.

When goods are almost homogeneous, price differentials do not make IIT grow. Just the opposite, they make it decrease increasing interindustry specialization.

A cloudy picture comes out when we analyse horizontally differentiated goods. In some cases we find a positive, often insignificant, influence of price differentials on IIT but we are not able to say why, unless we believe that horizontal differentiation has been turned into vertical differentiation.

5. References

Anderberg M. (1973) *Cluster Analysis for Applications*, Academic Press, New York

Brander J.- P.Krugman (1983) A Reciprocal Dumping Model of International Trade. *Journal of International Economics*, **15**, 313-321.

Greenaway D.- R.Hine-C.Milner-R.Elliott (1993) Adjustment and the Measurement of Marginal IIT. *SPES Paper n.8*, Nottingham.

Hamaguchi N. - Sazanami V. (1978) Intra-Industry Trade in EEC: 1962-1972. *Keio Economic Studies*, Vol.XV, p.53-68.

Hamilton C. - P.Kniest (1991) Trade liberalization, Structural Adjustment and Intraindustry Trade: a Note, *Weltwirtschaftliches Archiv*, **127**, 356-367.

Helpman E. (1981) International Trade in the Presence of Product Differentiation, Economies of Scale and Monopolistic Competition: a Chamberlin-Heckscher-Ohlin Approach. *Journal of International Economics*, **11**, 305-340.

Hufbauer G. - J.Chilas (1974), Specialization by Industrial Countries: Extent and Consequences. In H.Giersch (ed.) "*The International Division of Labour: Problems and Perspectives*". p.3-38. Tuebingen.

Krugman P.(1980) Scale Economies, Product Differentiation and the Pattern of Trade. *American Economic Review*, **70**, 950-959.

Marvel H. - E.Ray (1987) Intraindustry Trade: Sources and Effects on Protection. *Journal of Political Economy,* **95,** 1278-1291.

Matyas L. - Sevestre P. eds.(1992) *The Econometrics of Panel Data. Handbook of Theory and Applications.* Kluwer Academ ic Publishers, Dordrecht.

A.Rizzi (1985) *Analisi dei dati*, Nuova Italia Scientifica, Roma.

Rossini G. (1983) Intraindustry Trade in Two Areas: Some Aspects of Trade Within and Outside a Custom Union. *Keio Economic Studies*, vol.XX, p.1-26.

United Nations (1975) Standard International Trade Classification: Revision 2, *Statistical Papers Series M No.34 /Rev.2*, Department of Economic and Social Affairs, Statistical Office, New York.

United Nations (1986) SITC: Revision 3 *Statistical Papers Series,* Department of Economic and Social Affairs, Statistical Office, New York.

6. Appendix

TABLE **A1**

IIT indices, Italy 1990, calculated at 5-digit SITC reported at 3-digit: total trade

	IIT3QN	IIT3VAL		IIT3QN	IIT3VAL		IIT3QN	IIT3VAL		IIT3QN	IIT3VAL		IIT3QN	IIT3VAL
001	0.0176	0.0203	265	0.1155	0.1708	579	0.2535	0.4185	699	0.4486	0.4968	845	0.3430	0.2682
009	0.0000	0.0000	266	0.2319	0.3103	581	0.7071	0.7610	711	0.2206	0.3064	846	0.1043	0.1401
00B	0.0000	0.0000	267	0.1268	0.2003	582	0.5718	0.6829	712	0.5796	0.5953	848	0.2546	0.3728
011	0.1692	0.1334	266	0.0829	0.0825	583	0.7681	0.9100	713	0.6406	0.6889	851	0.2528	0.1880
012	0.1074	0.0955	269	0.6178	0.6521	591	0.7775	0.7565	714	0.6828	0.9172	871	0.4177	0.2409
016	0.1355	0.0997	272	0.0315	0.1507	592	0.4072	0.4768	716	0.7940	0.8518	872	0.8069	0.7285
017	0.3941	0.3616	273	0.3130	0.3768	593	0.4284	0.6254	718	0.6310	0.5640	873	0.6316	0.5016
022	0.0344	0.0465	274	0.2199	0.4040	597	0.7812	0.6765	721	0.4246	0.4916	874	0.7278	0.6580
023	0.4420	0.4923	277	0.3090	0.1021	598	0.5175	0.5778	722	0.3096	0.2837	881	0.6420	0.5674
024	0.3417	0.4223	278	0.2268	0.3031	611	0.5165	0.5762	723	0.7799	0.8248	882	0.5858	0.4614
025	0.0938	0.1416	281	0.0000	0.0004	612	0.3760	0.3174	724	0.4595	0.5660	883	0.2086	0.6446
034	0.0991	0.1106	282	0.0067	0.0430	613	0.2333	0.3403	725	0.6777	0.7371	884	0.5301	0.4011
035	0.0422	0.0328	283	0.6166	0.5630	621	0.5359	0.5644	726	0.5833	0.6532	885	0.5960	0.3043
036	0.2163	0.1548	284	0.0098	0.0028	625	0.8134	0.8684	727	0.2409	0.2640	891	0.2675	0.3861
037	0.3005	0.2995	285	0.1948	0.7270	629	0.5835	0.5503	728	0.2649	0.3601	892	0.3534	0.5067
03B	0.0000	0.0000	286	0.0000	0.0426	633	0.4407	0.5456	731	0.6672	0.6218	893	0.4057	0.5496
041	0.0570	0.0482	287	0.0867	0.1484	634	0.3944	0.6317	733	0.5848	0.4939	894	0.7304	0.7244
042	0.1608	0.1233	288	0.2955	0.2259	635	0.6738	0.5666	735	0.6994	0.5913	895	0.6148	0.8302
043	0.0023	0.0024	289	0.0638	0.1562	641	0.3501	0.4610	737	0.6091	0.5260	896	0.4019	0.6385
044	0.1308	0.1144	291	0.2513	0.2734	642	0.4647	0.5349	741	0.3506	0.4617	897	0.8672	0.0932
045	0.0085	0.0401	292	0.6468	0.6467	651	0.5041	0.5277	742	0.5039	0.6029	898	0.4099	0.3964
046	0.0455	0.0532	321	0.0031	0.0087	652	0.3514	0.4946	743	0.5251	0.8839	899	0.3636	0.4847
047	0.0803	0.1339	322	0.0000	0.0081	653	0.5150	0.5190	744	0.4982	0.5723	911	0.0000	0.0000
048	0.1749	0.3649	325	0.6058	0.6884	654	0.2723	0.2781	745	0.3889	0.4216	931	0.1065	0.6412
054	0.4186	0.4758	333	0.0222	0.0110	655	0.4133	0.4607	746	0.6039	0.8391	961	1.0000	0.3141
056	0.1545	0.1910	334	0.4413	0.4467	656	0.6121	0.4331	747	0.4351	0.5066			
057	0.2353	0.2760	335	0.6782	0.3095	657	0.6477	0.6556	748	0.5898	0.7401			
058	0.2740	0.3428	342	0.0215	0.0381	658	0.3894	0.6709	749	0.5932	0.5330			
059	0.5220	0.4542	343	0.5364	0.4672	659	0.6242	0.5135	751	0.5940	0.5586			
081	0.5227	0.5437	344	0.3137	0.3957	661	0.1492	0.0770	752	0.6546	0.6636			
062	0.5959	0.6395	345	0.0250	0.0532	662	0.1355	0.1605	759	0.6116	0.8176			
071	0.0245	0.0495	351	0.0000	0.0000	663	0.3457	0.5224	761	0.6018	0.4939			
072	0.1485	0.1530	411	0.5363	0.5305	664	0.5890	0.5761	762	0.0314	0.0383			
073	0.6230	0.5539	421	0.1983	0.2159	665	0.5813	0.6207	783	0.1621	0.1247			
074	0.2307	0.2645	422	0.1671	0.3672	668	0.2511	0.2806	764	0.5581	0.6404			
075	0.1730	0.2243	431	0.3884	0.4069	667	0.0670	0.0738	771	0.6022	0.7667			
081	0.2358	0.2094	511	0.4960	0.5813	671	0.1222	0.2674	772	0.7647	0.7412			
08B	0.7994	0.7885	512	0.1641	0.3670	672	0.4222	0.4943	773	0.4997	0.6183			
091	0.0838	0.0803	513	0.5114	0.4999	673	0.5168	0.5238	774	0.8214	0.6509			
098	0.3377	0.4591	514	0.3900	0.5438	674	0.4935	0.5398	775	0.2282	0.3161			
111	0.2507	0.8568	515	0.3296	0.4307	675	0.5695	0.5357	776	0.6094	0.5502			
112	0.1332	0.2685	516	0.3671	0.4782	676	0.4100	0.4317	778	0.4691	0.6086			
121	0.4625	0.8254	522	0.4524	0.4529	677	0.3102	0.5807	781	0.7374	0.6507			
122	0.0275	0.0175	523	0.3414	0.4603	678	0.5005	0.5419	782	0.9552	0.6882			
211	0.0915	0.1078	524	0.3214	0.6012	679	0.5207	0.5302	783	0.8489	0.8849			
212	0.3167	0.0758	525	0.1638	0.3351	681	0.4574	0.4266	784	0.5223	0.6921			
222	0.0835	0.0670	531	0.5899	0.3526	682	0.3664	0.4321	785	0.5168	0.5729			
223	0.1501	0.4173	532	0.5062	0.6259	683	0.2268	0.2285	786	0.5062	0.4730			
231	0.0337	0.0666	533	0.7214	0.6935	684	0.3453	0.4452	791	0.6944	0.6989			
232	0.3674	0.3308	541	0.4629	0.5597	685	0.1927	0.2135	792	0.6894	0.6815			
244	0.1835	0.1591	542	0.5237	0.6354	686	0.7333	0.6903	793	0.5241	0.4695			
245	0.0052	0.0318	551	0.4657	0.3962	687	0.2559	0.1884	811	0.2602	0.3438			
246	0.0109	0.0476	553	0.7522	0.7045	689	0.5256	0.4274	812	0.3768	0.5547			
247	0.0025	0.0107	554	0.6860	0.7505	691	0.2996	0.3568	813	0.3300	0.3117			
248	0.0229	0.1128	562	0.4476	0.4977	692	0.4044	0.4557	821	0.2113	0.1572			
251	0.0520	0.0629	571	0.0000	0.0000	693	0.4523	0.5955	831	0.3978	0.2960			
261	0.0240	0.0205	572	0.6016	0.6509	694	0.4397	0.5006	841	0.6236	0.5062			
263	0.0254	0.0531	573	0.2772	0.3813	695	0.5171	0.7526	842	0.4578	0.3176			
264	0.1992	0.5833	574	0.6077	0.6062	696	0.4261	0.4577	843	0.4234	0.3794			
			575	0.4596	0.5675	697	0.3402	0.3755	844	0.3014	0.2659			

TABLE A2

	V85	V90	85-9
001	1	1	1
009		1	.
00B		1	.
011	4	4	2
012	1	4	1
014	1		.
016		1	.
017		1	.
022	1	1	1
023	1	1	1
024	4	3	4
025	1	1	1
034	5	1	1
035	1	1	1
036	1	1	1
037	5	1	1
03B		1	.
041	2	1	1
042	5	1	1
043	1	1	1
044	2	1	1
045	1	1	1
046	1	1	1
047	1	1	1
048	2	4	2
054	2	3	4
056	2	4	2
057	4	3	4
058	5	1	1
059		1	.
061	5	4	1
062	5	1	1
071	1	1	1
072	1	1	1
073	2	4	2
074	1	1	1
075	1	1	1
081	2	4	2
08B	1	4	1
091	1	1	1
098	5	4	2
111	1	1	1
112	2	3	2
121	5	4	2
122	1	1	1
211	5	1	1
212	1	1	1
222	1	1	1
223	1	1	1
231		1	.
232	1	1	1
233	2		.
244	1	1	1
245	1	1	1
246	1	1	1
247	1	1	1
248	1	4	1
251	1	1	1
261	1	1	1
263	1	1	1
264	1	1	1
265	1	1	1
266	2	4	2
267	1	1	1
268	5	1	1
269	1	1	1
271	1		.
272		1	.
273	5	4	2
274	1	1	1
277	1	1	1
278	5	4	1
281	1	1	1
282	1	1	1
283		1	.
284		1	.
285		4	.
286	1	1	1
287	5	1	1
288	5	1	1
289	1	1	1
291	1	1	1
292	2	3	4
321		1	.
322	1	1	1
323	1		.
325		1	.
333	5	1	1
334	9	9	9
335	5	1	1
341	5		.
342		1	.
343		1	.
344		1	.
345		1	.
351	1	1	1
411	1	1	1
421		4	.
422		1	.
423	4		.
424	1		.
431	1	1	1
511	2	3	4
512	2	4	2
513	4	3	4
514	3	5	4
515	3	5	4
516	2	4	2
522	2	4	2
523	2	4	2
524	5	1	1
525		1	.
531	4	4	2
532	1	1	1
533	4	3	4
541	7	2	6
542		2	.
551	1	1	1
553	2	3	4
554	2	3	2
562	5	4	2
571		1	.
572	1	3	2
573		4	.
574		3	.
575		6	.
579		1	.
581		4	.
582	3	6	3
583	8	1	6
584	5		.
585	1		.
591	2	4	2
592	5	4	1
593		1	.
597		4	.
598	3	2	4
611	6	7	5
612	1	1	1
613	5	1	1
621	5	4	2
625	3	6	3
628	2		.
629		4	.
633	1	1	1
834	5	3	2
635	5	4	2
641	6	6	3
642	2	3	2
651	6	7	5
652	3	5	4
653	4	6	3
654	2	3	4
655	5	4	2
656	5	1	1
857	4	5	4
658	2	4	2
659	5	4	1
661	1	1	1
662	5	4	2
663	2	3	2
664	2	3	2
665	2	3	4
666	5	4	1
667	1	1	1
66B	1		.
671	5	4	1
672	3	4	2
673	3	6	3
674	7	3	6
675	2	3	2
676	1	2	4
677	5	1	1
678	4	4	2
679	1	2	4
681	5	1	1
682	3	2	4
683	1	1	1
684	3	2	4
685	1	1	1
686	5	4	1
687	1	1	1
688	1		.
689	1	1	1
691	5	4	2
692	5	4	1
693	5	4	2
694	5	4	2
695	4	5	4
696	1	1	1
697	2	3	2
699	3	6	3
711	1	1	1
712	1	1	1
713	3	6	3
714	3	5	4
716	4	2	4
718	1	1	1
721	2	3	2
722	5	4	2
723	3	6	3
724	6	7	5
725	5	3	2
726	2	3	4
727	5	4	2
728	3	7	5
731		5	.
733		3	.
735		4	.
736	4		.
737	2	3	2
741	4	6	3
742	4	5	4
743	3	6	3
744	4	5	4
745	4	2	4
746		5	.
747		2	.
748		3	.
749	7	3	6
751	2	3	2
752	10	9	7
759	7	7	5
761	2	5	4
762	1	1	1
763	1	1	1
764	6	7	5
771	5	3	2
772	6	7	5
773	2	3	2
774	5	4	2
775	4	2	4
776	6	7	5
778	3	7	5
781	9	10	10
782	6	9	5
783	2	3	2
784	8	8	7
785	2	5	4
786	1	4	1
791	5	1	1
792	7	8	7
793	2	3	2
811		1	.
812	2	4	2
813		4	.
821	2	5	4
831	5	4	2
841		2	.
842	4	3	4
843	4	1	2
844	5	1	1
845	2	6	3
846	5	4	2
847	5		.
848	5	4	2
851	4	6	3
85B	1		.
871	1	1	1
872	2	5	4
873	1	1	1
874	6	7	5
881	5	4	2
882	2	3	2
883	1	1	1
884	5	4	2
885	5	4	2
891		1	.
892	2	3	4
893	3	6	3
894	3	2	4
895	2	4	2
896	1	1	1
897	5	4	2
898	2	3	2
899	2	3	2
911	1	1	1
931	5	9	8
941	1		.
951	4		.
961	1	1	1