

MEASURING PRODUCT QUALITY IN TURKISH INTRA-INDUSTRY TRADE

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1. Introduction

In a previous paper (Erlat, Erlat and Senoglu, 2007), we investigated the breakdown of intra-industry trade (IIT) for Turkey into its vertical (VIIT) and horizontal (HIIT) components. The vertical component was further broken down to its high quality (HQVIIT) and low quality (LQVIIT) components. We followed Greenaway, Hine and Milner (GHM) (1994)'s approach in obtaining this decomposition.

We took the 5-digit SITC Rev.3 classification to represent products and used the ratios of their import and export unit values to classify them as vertically and horizontally differentiated products. If the unit value ratio of a product fell within the interval constructed using a dispersion factor, $\alpha \in (0,1)$, then it was classified as HIIT, if it fell outside this interval, it was designated to exhibit VIIT.

In the next step, the IIT index developed by Grubel and Lloyd (GL) (1971) was calculated for each 5-digit sector and was aggregated to the 3-digit level by calculating their weighted averages based on the share of each sector in total trade. These aggregated GL values were then decomposed into their vertical and horizontal components. The focus of the analysis of that paper was these GL values.

However, the criterion used to classify the 5-digit sectors was criticized by Fontagné and Freudenberg (FF) (1997) and by Azhar and Elliott (AE) (2007). FF also use the ratio of unit values but they point out that the bounds of the interval used to classify a sector as horizontally differentiated by GHM involves an asymmetry that may lead to misclassification of that sector. They suggest a simple correction for this, but they also introduce a different measure of IIT.

AE, on the other hand, point out that using the ratio of unit values, to begin with, may lead to misclassifications of the sectors. They point out that, for any two equal but opposite values of the unit value of imports and the unit value of exports, an equal but opposite change in their ratio is not associated with an equal but opposite increase in the unit value of imports or the unit value of exports. Hence, AE suggest an alternative to the ratio of unit values by utilizing the idea underlying the GL index. As the GL index measures the share of intra-industry in total trade, their two indexes, called PQH and PQV, which are complements of each other, treat the unit values as unit costs and

measure how much the sum of the import and export unit costs are shared by exports and imports.

Thus, the focus of the present study is different than Erlat et al (2007). We compare the classification procedures of FF and AE. We do not include GHM because the FF procedure is basically the same except for the correction for asymmetry mentioned above. Such a comparison was undertaken by Azhar, Elliott and Liu (2008) using the trade data of China with three of its trading partners, namely, Malaysia, Thailand and the Philippines. They, however, do this for a single year, 2002, to be exact. We, instead, consider the same period as in Erlat et al (2007), 1987-2001, to see if the classifications obtained from these two approaches show different patterns over time.

The importance of classifying sectors as VIIT and HIIT lies in their implication regarding the smooth adjustment hypothesis. This hypothesis argues that if the share of IIT in new trade increases, then since the of production are more mobile for IIT sectors than inter-industry trading sectors, the cost of adjustment to the new production structure implied by new trade will be less. Since the mobility of factors in VIIT industries resemble the mobility in inter-industry trade sectors, it is important that products are correctly classified as VIIT and HIIT.

Hence, the next section will contain an account of the methods used, followed by a description of the data. Section 4 will contain our empirical results and Section 5, the conclusions.

2. Methodology

We have two sets of measures. One set involves measures of intra-industry trade (IIT), the other, the classification of sectors (or products) into horizontal and vertical IIT (HIIT and VIIT, respectively).

As mentioned in the Introduction, there, apparently, are two measures of IIT in the literature. The first, and the one used more commonly, is due to Grubel and Lloyd (1971). The other one is due to Fontagné and Freudenberg (1997). Both, of course, propose to measure the trade overlap in a given sector. GL does this by measuring the

share of IIT in total trade while FF does this by comparing the minimum of imports and exports to their maximum.

More formally, letting X_{it} stand for the exports of product i at time t and M_{it} stand for the imports of this good at t , the GL index for the i^{th} product is calculated as

$$(1) \quad GL_{it} = 1 - \frac{|X_{it} - M_{it}|}{X_{it} + M_{it}}, \quad i = 1, \dots, n; t = 1, \dots, T$$

and lies between 0 and 1. Values of GL_{it} close to unity indicate a high rate of IIT for product i at period t .

The FF index, on the other hand, is based on comparing the extent to which the minimum of the pair (X_{it}, M_{it}) covers the maximum. Formally

$$(2) \quad FF_{it} = \frac{\min(X_{it}, M_{it})}{\max(X_{it}, M_{it})}$$

The FF approach has an added dimension compared to the GL approach. A product is regarded as being involved in IIT if FF_{it} is greater than or equal to some threshold value, ξ , and FF suggest that ξ should be equal to 10%.

The second set of measures involves decomposing IIT into vertical and horizontal components. Both of the above approaches follow Abd-el-Rahman (1991) in using the unit values of X_{it} and M_{it} , denoted by UVX_{it} and UVM_{it} as indicators of the quality of the i^{th} product, with UVX_{it} exceeding UVM_{it} beyond a certain threshold implying high quality and the reverse implying low quality. Thus, measures used in decomposing IIT into VIIT and HIIT need to be based on some means of comparing UVX_{it} and UVM_{it} .

The first studies that did this decomposition are Greenaway, Hines and Milner (GHM) (1994, 1995) and they used the GL index. For the decomposition they form the ratios

$$(3) \quad r_{it} = \frac{UVX_{it}}{UVM_{it}}$$

and, based on a dispersion factor, α , that may take on any value between 0 and 1, decide if a product exhibits HIIT when

$$(4) \quad 1 - \alpha \leq r_{it} \leq 1 + \alpha$$

and exhibits VIIT when

$$(5) \quad r_{it} < 1 - \alpha \quad \text{or} \quad r_{it} > 1 + \alpha$$

In addition, the first inequality in (5) implies that VIIT is low-quality (LQVIIT) while the second inequality implies that it is high-quality (HQVIIT).

FF also uses r_{it} to compare the export and import unit values but the criterion they use to distinguish HIIT from VIIT is different from GHM. They point out that the distances from unity of the upper and lower bounds in (4) are not symmetrical. Suppose $\alpha = 0.15$. Then r_{it} must be, at most, 1.15 but $1/r_{it}$ must be, at most, 1.18 for a product to be classified as HIIT. This asymmetry becomes larger as α is chosen to be larger; for example, for $\alpha = 0.25$. In that case, the maximum value that r_{it} can attain must be 1.25 but $1/r_{it}$ must be 1.33. Thus, to ensure symmetry, FF modify the HIIT criterion in (4) as

$$(6) \quad \frac{1}{1 + \alpha} \leq r_{it} \leq 1 + \alpha$$

Of course, the definition of VIIT and LQVIIT will now use $1/1 + \alpha$.

But now $1/1 + \alpha > 1 - \alpha$ so that more products will be classified as VIIT in the GHM case than the FF case, as pointed out by Azhar and Elliott (2006). The difference between these two lower bounds will become larger as α gets larger. Thus, for $\alpha = 0.15$, $1/1 + \alpha = 0.87$ and $1 - \alpha = 0.85$ so that only an $r_{it} = 0.86$ will be classified as VIIT by GHM but as HIIT by FF, while for $\alpha = 0.25$ the FF lower bound goes down to 0.80 and the GHM lower bound to 0.75 so that products with r_{it} 's ranging from 0.76 to 0.79 may be classified as VIIT by GHM but as HIIT by FF.

A more serious criticism by AE is leveled at using r_{it} to compare the unit values of the i^{th} product. They demonstrate, both numerically and analytically, that the rates of change of r_{it} with respect to UVX_{it} and UVM_{it} are not the same. They show that

$$\frac{\partial r_{it}}{\partial UVM_{it}} = -\frac{UVX_{it}}{(UVM_{it})^2} \quad \text{and} \quad \frac{\partial r_{it}}{\partial UVX_{it}} = \frac{1}{UVM_{it}}$$

and it follows that

$$\frac{\partial r_{it}}{\partial UVM_{it}} \rightarrow \infty \quad \text{as} \quad UVM_{it} \rightarrow 0 \quad \text{while} \quad \frac{\partial r_{it}}{\partial UVX_{it}} = \frac{1}{UVM_{it}} \quad \text{as} \quad UVX_{it} \rightarrow 0$$

Thus, it is possible that the classification of a good may change when UVM_{it} changes, keeping UVX_{it} constant, while the classification may remain the same when UVX_{it} changes, keeping UVM_{it} constant. They call this the *proportionality* effect.

To avoid the proportionality effect and to retain the symmetry in the bounds defining HIIT, AE propose two measures that are complements of each other. The idea underlying these measures parallels the rationale of the GL index. The GL index provides us with share of IIT in total trade. If we regard the sum of the unit values of imports and exports, $UVX_{it} + UVM_{it}$, as total cost or quality, then the ratio of the difference between UVX_{it} and UVM_{it} , $UVX_{it} - UVM_{it}$, to this sum, subtracted from unity will give us the extent to which total quality is shared by exports and imports. Formally, we have the index

$$(7) \quad PQH_{it} = 1 - \frac{UVX_{it} - UVM_{it}}{UVX_{it} + UVM_{it}}$$

This index is bounded by the limits 0 and 2, which correspond to $UVM_{it} = 0$ for the lower limit of 0 and $UVX_{it} = 0$ for the upper limit of 2. When $UVX_{it} = UVM_{it}$, $PQH_{it} = 1$ so that values $0 < PQH_{it} < 1$ indicate either HIIT products or VIIT products of high quality and values of $1 < PQH_{it} < 2$ indicate either HIIT products or VIIT

products of low quality. But this way of classifying are the reverse of the procedures based on r_{it} so that AE suggest using the complement of PQH_{it} :

$$(8) \quad PQV_{it} = 1 + \frac{UVX_{it} - UVM_{it}}{UVX_{it} + UVM_{it}}$$

Note that PQV_{it} also lies between 0 and 2 but now the (0,1) portion corresponds to $UVX_{it} < UVM_{it}$ and the (1,2) portion to $UVX_{it} > UVM_{it}$.

This last fact suggests that formulating a decision rule as to how we differentiate between HIIT products and VIIT products is better done by using PQV_{it} rather than PQH_{it} . Thus, AE suggest that if the imports and exports of the i^{th} product share at least 85% of the total cost; in other words, if

$$\left| \frac{UVX_{it}}{UVX_{it} + UVM_{it}} - \frac{UVM_{it}}{UVX_{it} + UVM_{it}} \right|$$

is, at least, less than 15%, then that product should be classified as HIIT. This implies the following decision rule for PQV_{it} : Classify IIT as LQVIIT if $PQV_{it} < 0.85$ and as HQVIIT if $PQV_{it} > 1.15$. If $0.85 \leq PQV_{it} \leq 1.15$, classify it as HIIT.

That both PQH_{it} and PQV_{it} are symmetrical around unity is clear from the discussion above. That they do not suffer from a proportionality effect can again be demonstrated, using PQV_{it} , as follows:

$$\frac{\partial PQV_{it}}{\partial UVM_{it}} = \frac{2UVX_{it}}{(UVX_{it} + UVM_{it})^2} \quad \text{which equals} \quad -\frac{2}{UVX_{it}} \quad \text{as} \quad UVM_{it} \rightarrow 0 \quad \text{and}$$

$$\frac{\partial PQV_{it}}{\partial UVX_{it}} = \frac{2UVM_{it}}{(UVX_{it} + UVM_{it})^2} \quad \text{which equals} \quad \frac{2}{UVM_{it}} \quad \text{as} \quad UVX_{it} \rightarrow 0$$

Thus, the rate of change in PQV_{it} with respect to UVX_{it} is similar but in the opposite direction to that of the change in PQV_{it} with respect to UVM_{it} .

3. The Data

The data on foreign trade used in the empirical applications are the same as those used in Erlat, Erlat and Senoglu (2007). They were obtained from the TURKSTAT database, which also constitutes the basis of the Turkish trade data in the UN-COMTRADE database. They cover the period 1987-2001 and are classified in terms of SITC Rev. 3, at the 5-digit level. They include the export and import flows in terms of \$US and kilograms. Unit values are obtained as the ratio of these two flows.

4. Empirical Results

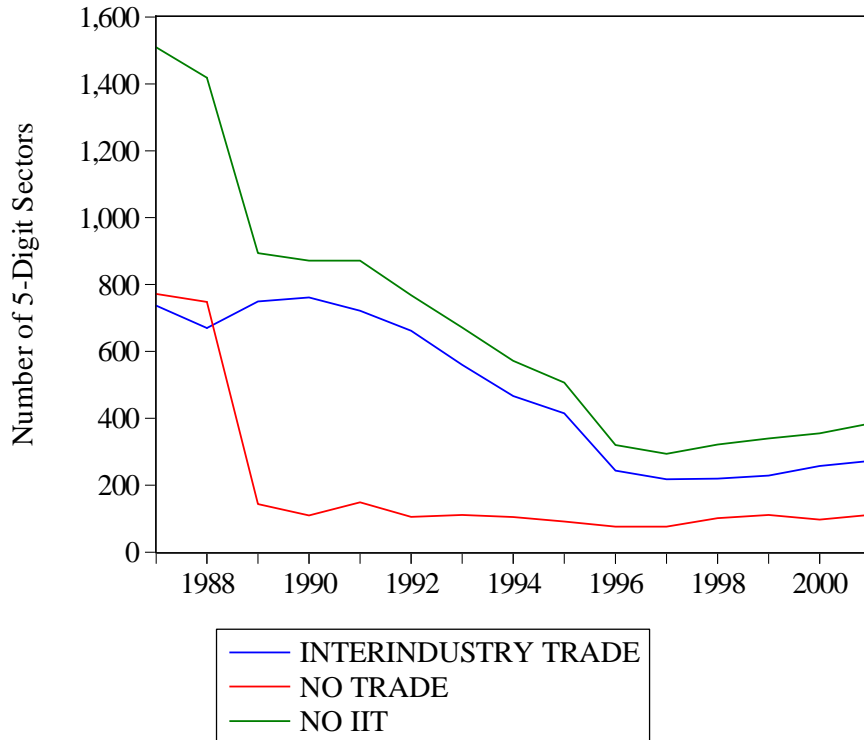
In view of the discussion in the section on methodology, the GHM approach to distributing the 5-digit sectors into the HIIT, LQVIIT and HQVIIT classifications appears to be the least desirable. So we preferred to use the FF criterion as given in (6) for this purpose but use both the GL and FF indexes to measure the rate of IIT for the 5-digit sectors. We also decided to apply the 10% cut-off point suggested by FF also to the GL index. We, however, did not regard those sectors that fell below the 10% level as exhibiting inter-industry trade, as FF do. We reserved that classification to those sectors that only had export or import figures. But, using the 10% cut-off point would avoid obtaining "... spurious levels of vertical or horizontal IIT that may vary significantly in magnitude and over time." (Azhar and Elliott, 2006, 480, fn. 7).

Also, as opposed to our previous study, (Erlat et al, 2007), we calculated the GL and FF indexes at the 5-digit level but did not aggregate them to the 3-digit level and present the results. The objective of the present paper is not to measure IIT and decompose the corresponding indexes into their vertical and horizontal components but to see how the classification of the products (represented by the 5-digit sectors) are effected by the different criteria described above. Hence, the results are presented in terms of the numbers of 5-digit sectors that one finds in each classification.

	Table 1		
	5-Digit Sectors With No Intra-Industry Trade		
	No Intra-Industry Trade	Inter-Industry Trade	No Trade
1987	1509	737	772
1988	1418	670	748
1989	894	750	144
1990	871	761	110
1991	871	722	149
1992	768	662	106
1993	671	560	111
1994	572	467	105
1995	507	415	92
1996	320	244	76
1997	294	218	76
1998	322	220	102
1999	340	229	111
2000	355	258	97
2001	385	273	112

The distribution of the sectors is done for each year of the 1987-2001 period. The total number of 5-digit sectors is 3114 for every year of this period. We first consider the sectors that do not exhibit any IIT. These are given in Table 1 where the first column contains the total numbers of such sectors and these are broken down to those sectors that exhibit only inter-industry trade and those that are not involved in any trade at all. We plotted this information in Figure 1.

Figure 1
Plot of 5-Digit Sectors With No Intra-Industry Trade



We note that there is a sharp decline in the number of 5-digit sectors not involved in IIT from a level that is almost half the number of the total sectors. This downward trend continues until 1997 after which a slight upward turn is observed. This trend appears to be largely due to the decline in the number of sectors involved inter-industry trade. After the sharp drop in 1989, the no-trade figures show some fluctuation around a 100. Thus, it may be claimed that the movement into intra-industry trade is from those sectors that had exhibited inter-industry trade; this movement appears to have stopped after 1997, reaching a steady level.

We next move on to considering the numbers of 5-digit sectors that fall below and above the 10% cut-off point, both in terms of the GL index and the FF index. These results are given in Table 2 and presented graphically in Figures 2 and 3.

The first plot in Figure 2 shows how the two groups of figures behave when the GL index is subjected to the 10% cut-off point. We note that the number of sectors with

Table 2				
Number of 5-Digit Sectors With Intra-Industry Trade Classified According To The 10% Cut-off Point				
	GL		FF	
	< 10%	> 10%	< 10%	> 10%
1987	706	898	875	729
1988	760	935	947	748
1989	1067	1158	1307	918
1990	1145	1102	1359	888
1991	1160	1087	1390	857
1992	1159	1191	1417	933
1993	1225	1222	1470	977
1994	1131	1415	1406	1140
1995	1206	1405	1474	1137
1996	1204	1592	1498	1299
1997	1212	1609	1563	1258
1998	1129	1665	1458	1336
1999	1080	1696	1410	1366
2000	1086	1673	1449	1310
2001	1002	1729	1298	1433

GL values below 10% grow until 1993 after which they decline slowly. On the other hand, those with GL values above 10% show a steady increase, particularly after 1993, with an ever increasing gap with the numbers for GL < 10%.

When we turn to the second plot in Figure 2, which gives the same information based on the FF index, we find that, as far as the behaviour of the two series over time is concerned, there does not appear to be much difference, but the number of sectors with FF below 10% is much higher than the number of FF > 10% and this gap starts widening in 1989 and only starts closing after 1994, with the FF > 10% figures exceeding the FF < 10% figures in 2001.

Figure 3 compares the number of 5-digit sectors with indexes less than 10% and those with indexes greater than 10%. The first plot in Figure 3 shows that the below-10% figures for both FF and GL indexes have similar patterns but those corresponding to FF exceed those corresponding to GL at every point. From the second plot in Figure 3, where we have sectors with FF and GL values greater than 10%, we observe that the

patterns of the two series are also similar but now the figures based on GL exceed those based on FF.

Figure 2
Plot of 5-Digit Sectors With IIT Classified According to the 10% Cut-Off Point (1)

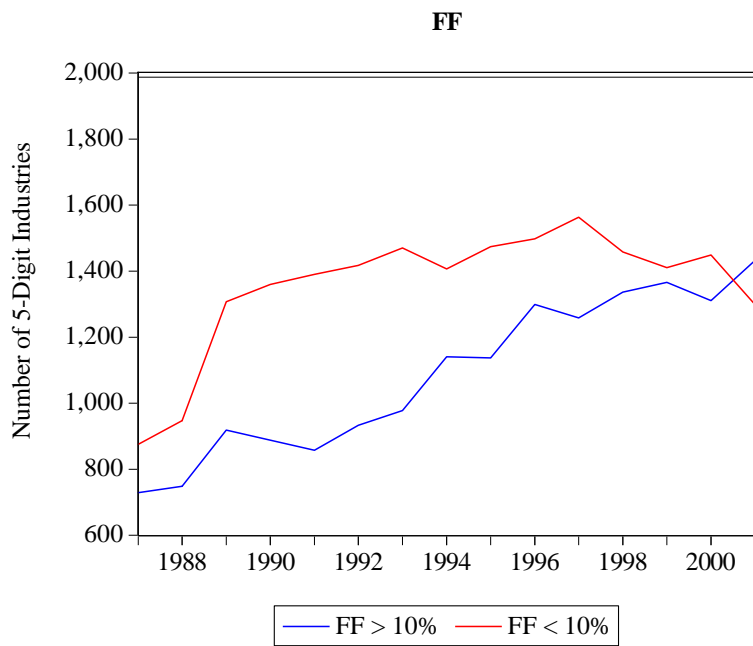
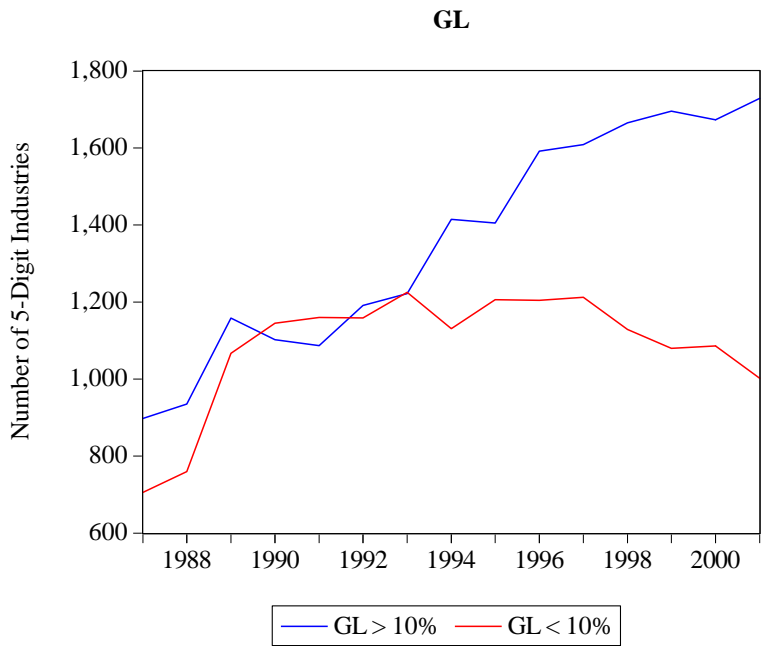
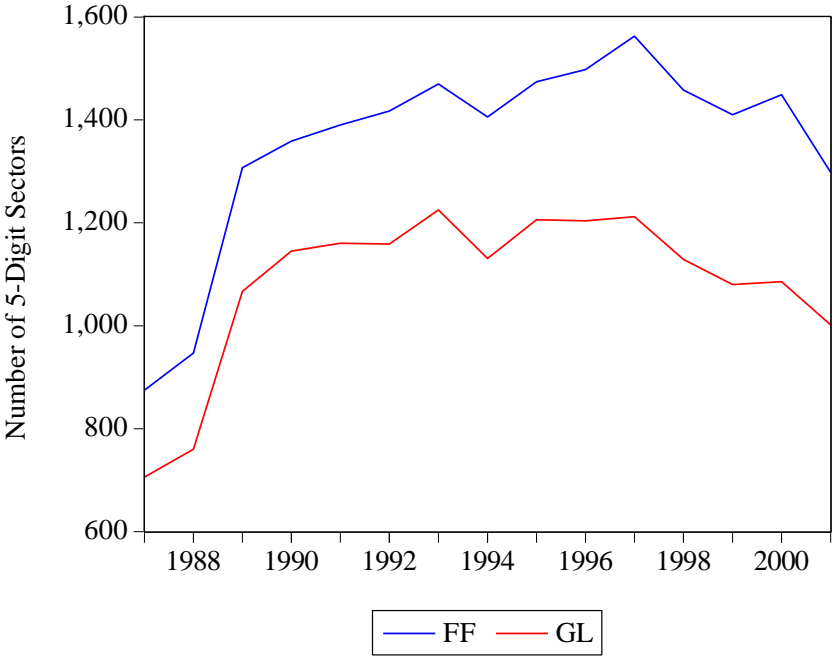


Figure 3
Plot of 5-Digit Sectors Classified According to the 10% Cut-Off Point (2)

< 10%



> 10%

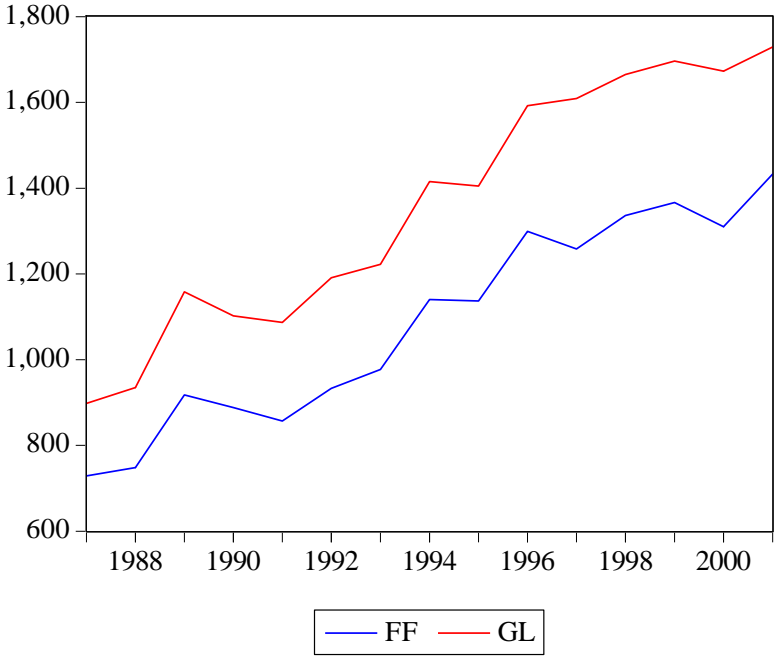
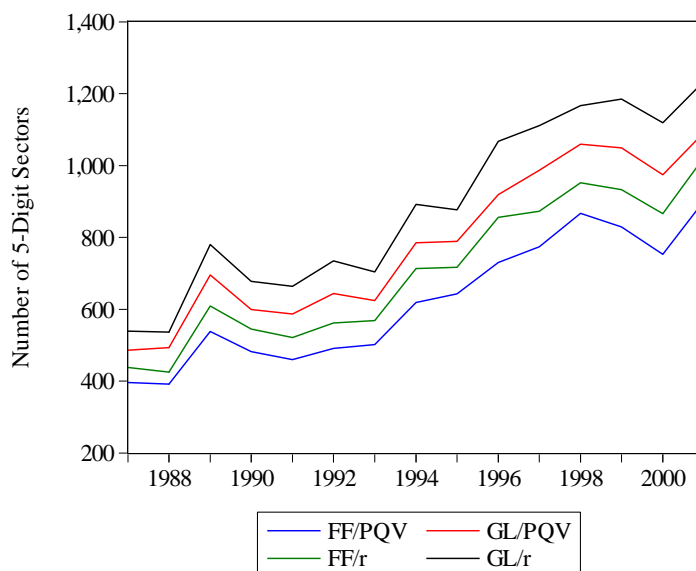


Table 3												
The Distribution of 5-Digit Sectors with GL and FF Values Greater Than 10 According To The r and PQV Criteria												
	GL						FF					
	R			PQV			r			PQV		
	LQVIIT	HQVIIT	HIIT	LQVIIT	HQVIIT	HIIT	LQVIIT	HQVIIT	HIIT	LQVIIT	HQVIIT	HIIT
1987	539	255	104	486	217	195	438	206	85	396	175	158
1988	536	268	111	493	213	229	425	227	96	392	166	190
1989	780	247	131	695	190	273	609	200	109	538	152	228
1990	678	286	138	599	227	276	545	235	108	482	185	221
1991	664	290	133	587	236	264	521	229	107	460	183	214
1992	735	323	133	644	256	291	562	256	115	491	204	238
1993	704	367	151	624	291	307	568	293	116	502	237	238
1994	892	346	177	785	295	335	713	283	144	619	244	277
1995	877	342	186	789	278	338	717	270	150	643	221	273
1996	1067	361	164	919	284	389	856	299	144	730	239	330
1997	1111	327	171	987	247	375	873	249	136	774	190	294
1998	1167	313	185	1059	231	375	952	239	145	867	174	295
1999	1185	313	198	1049	239	408	933	260	173	829	197	340
2000	1119	341	213	974	263	436	866	275	169	753	210	347
2001	1235	311	183	1092	231	406	1023	260	150	902	193	338

Figure 4
Plot of 5-Digit Sectors Exhibiting LQVIIT In terms of both GL and FF, and r and PQV



These results indicate that the 10% cut-off point acts as a stricter threshold for the FF index than for the GL index, leading to the calculation of aggregate IIT rates based on a much smaller set of 5-digit sectors than the GL index..

Since the sectors with index values greater than 10% would constitute a more reliable basis for IIT measurement and since the numbers of these sectors appear to grow in terms of both the GL and the FF index, we shall only present the foregoing results for these sectors. Thus, Table 3 contains the classification of said sectors into LQVIIT, HQVIIT and HIIT according to both r , using the criteria suggested by FF that ensures symmetry between the lower and upper bounds of the interval determining HIIT and to PQV with lower and upper bounds suggested by AE that both ensures symmetry and does not suffer from the proportionality effect.

These figures are first plotted with respect to the three IIT classifications and are presented in Figures 4 to 6. Thus, in Figure 4 we have the plot of the number of LQVIIT sectors based on GL and FF, and classified using r and PQV. We note that the resulting four series show the same growth pattern over time. This growth is steady after 1993, shows a decline in 1997 and starts to pick up again in 2000. The magnitudes are quite

Figure 5
Plot of 5-Digit Sectors Exhibiting HQVIIT In terms of both GL and FF, and r and PQV

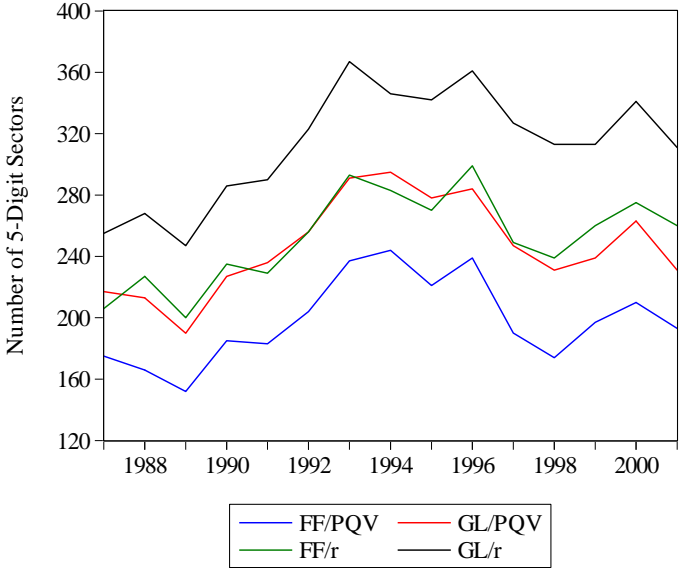


Figure 6
Plot of 5-Digit Sectors Exhibiting HIIT In terms of both GL and FF, and r and PQV

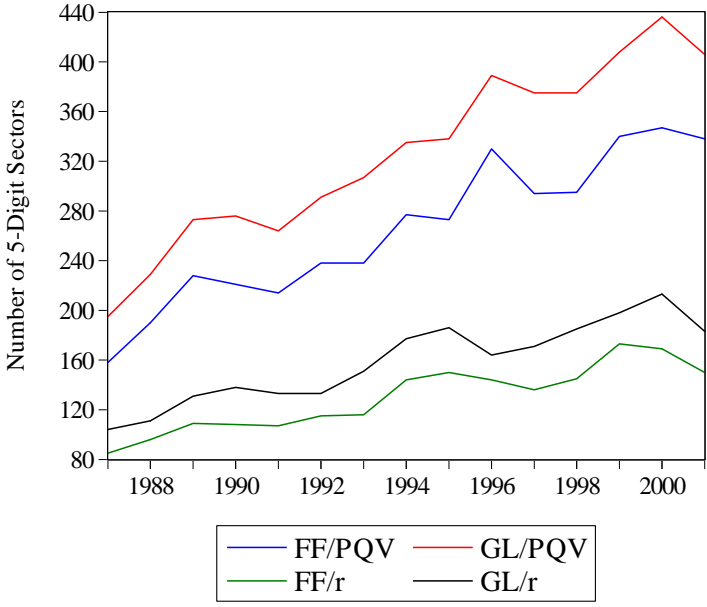
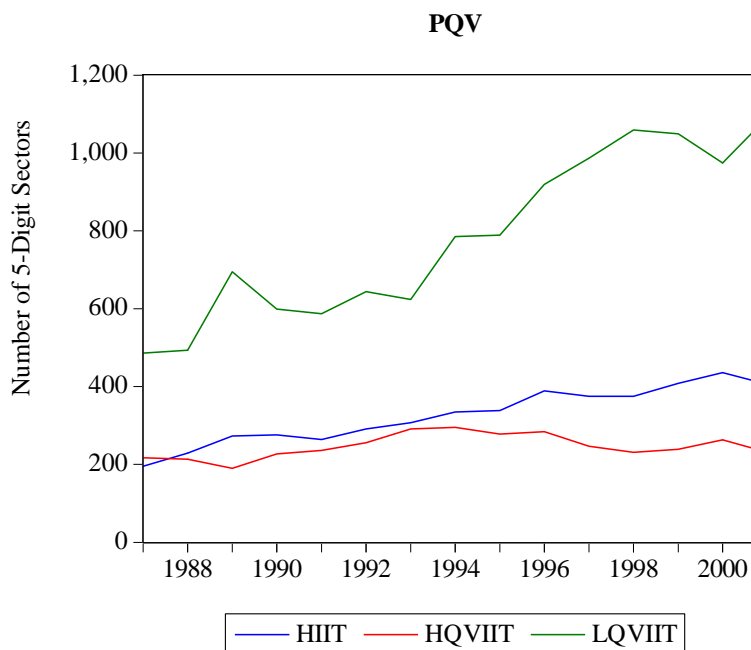
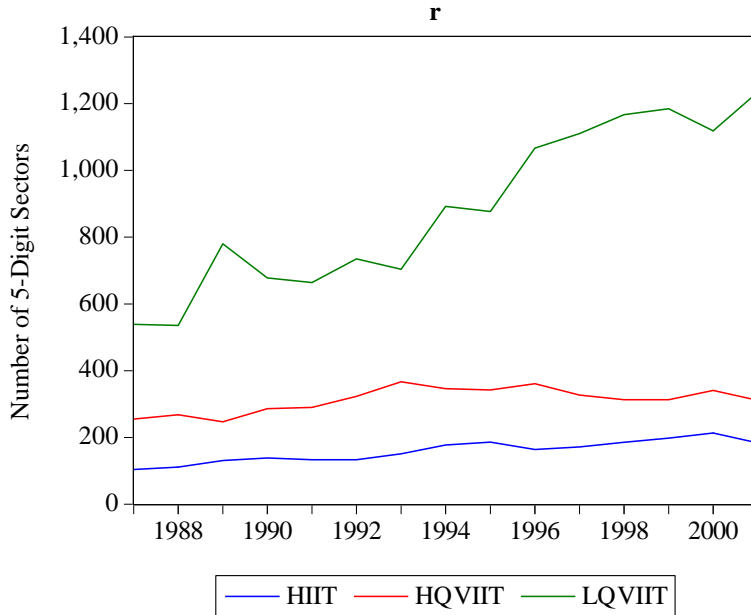
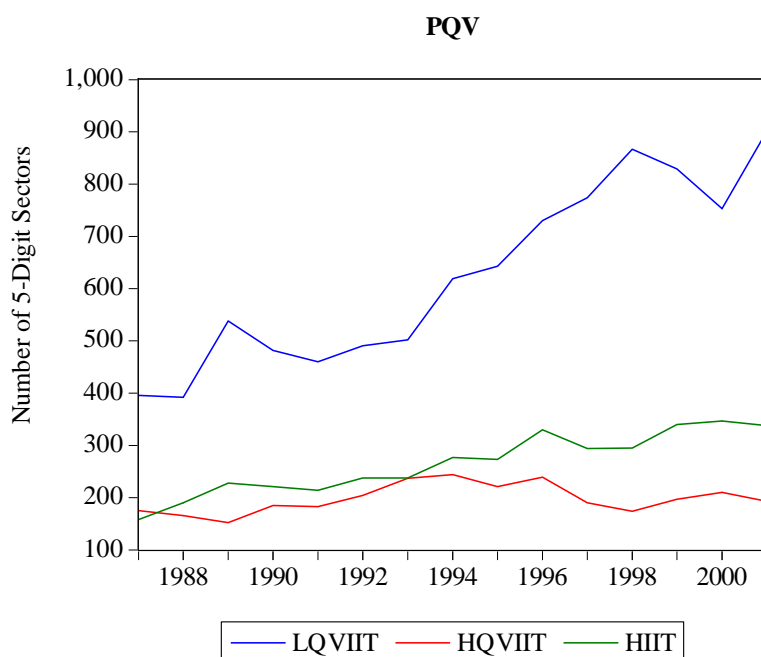
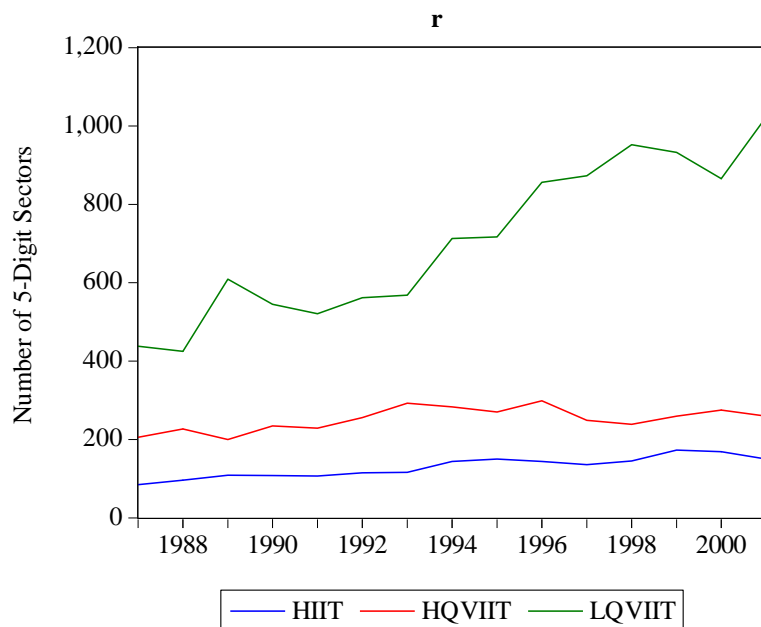


Figure 7
Plot of 5-Digit Sectors With IIT Based on GL, Classified According to r and PQV



different, however. The GL figures are larger than the FF figures, as one would expect from our previous result from Figure 3, but we now find that the figures based on the r-criterion are larger than those based on the PQV-criterion.

Figure 8
Plot of 5-Digit Sectors With IIT Based on FF, Classified According to r and PQV



We note the same thing for HQVIIT as presented in Figure 5. The patterns over time for GL/r, GL/PQV and FF/PQV are almost parallel while there are some discrepancies in the pattern for FF/r. However, the pattern, in general, indicates that the

number of HQVIIT sectors increases until 1994, then declines until 1998 after which it appears to pick up until 2001 where, again, a decline is observed. The figures based on GL are again larger than those of FF/PQV, in particular, and GL/PQV is larger than FF/r but the magnitudes of FF/r compared to those of GL/PQV vary over the period with FF/r exceeding GL/PQV for the period after 1996.

When we turn to the HIIT plots in Figure 6, we note that the PQV-based GL and FF figures constitute a pair with similar growth patterns while the r-based GL and FF figures constitute another pair. The rate of growth of the first pair appears to be greater than the growth rate of the second pair. In each pair, the GL values exceed FF values.

In the next two figures, the series are presented in terms of the GL and FF indexes, separately. In Figure 7 we have the series based on GL, presented in terms of the r-based classification in the first plot and in terms of the PQV-based classification in the second plot. The LQVIIT figures are larger than those of HQVIIT and HIIT in both classifications, but while HQVIIT exceeds HIIT at every year for the r-criterion, the reverse is true for the PQV-criterion. The HIIT figures start slightly below the HQVIIT figures and showing a steady increase, start outstripping the HQVIIT figures after 1998, with the gap between them steadily widening until 2000.

The story appears to be the same for the FF index as given in Figure 8. HQVIIT exceeds HIIT when r is used as the classification criterion but the reverse holds when PQV is used as the criterion.

Finally, we disaggregated the results to the 1-digit level. The 1-digit categories are

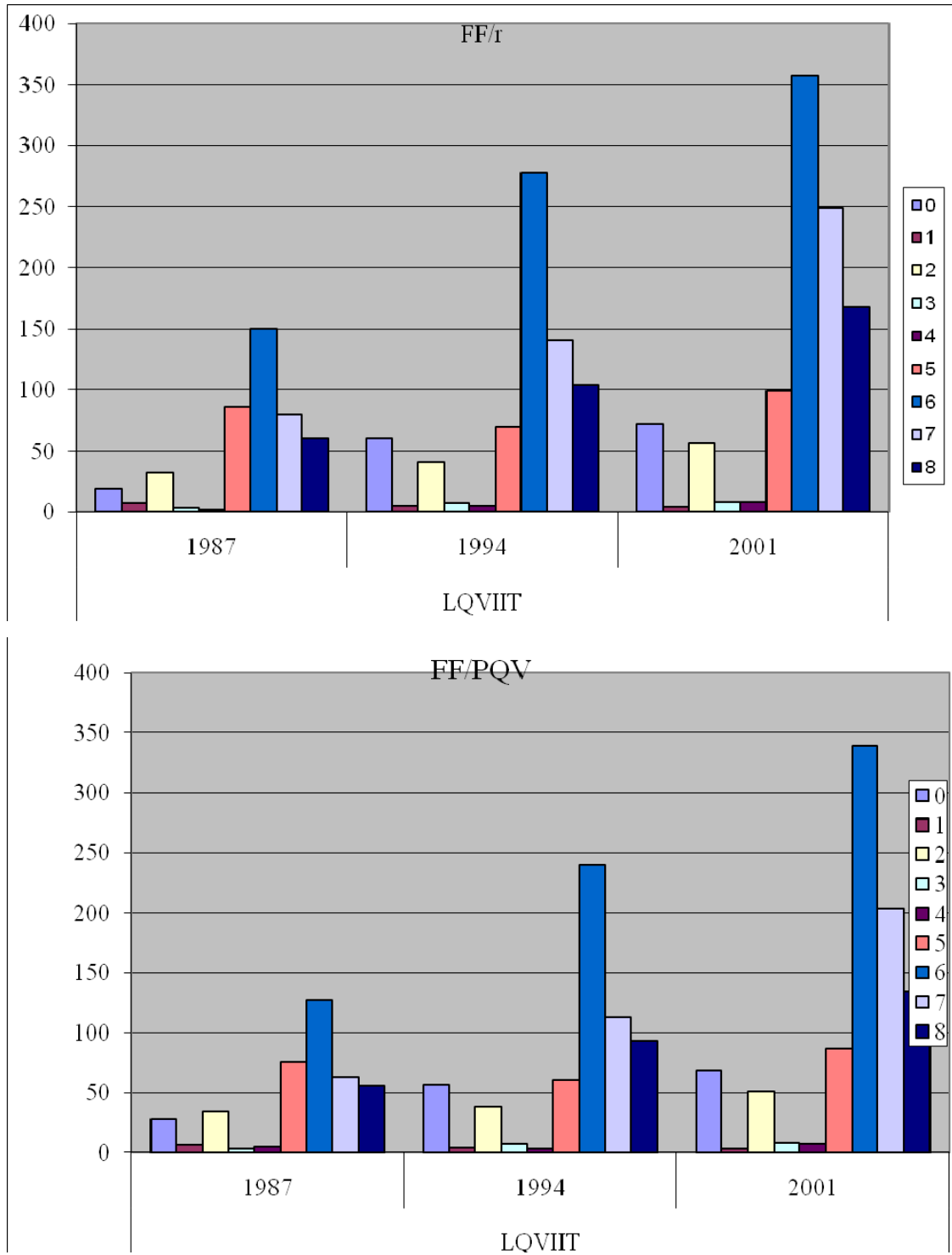
- 0 Food and Live Animals
- 1 Beverages and Tobacco
- 2 Crude Material, Inedible, Except Fuels
- 3 Mineral Fuels and Related Materials

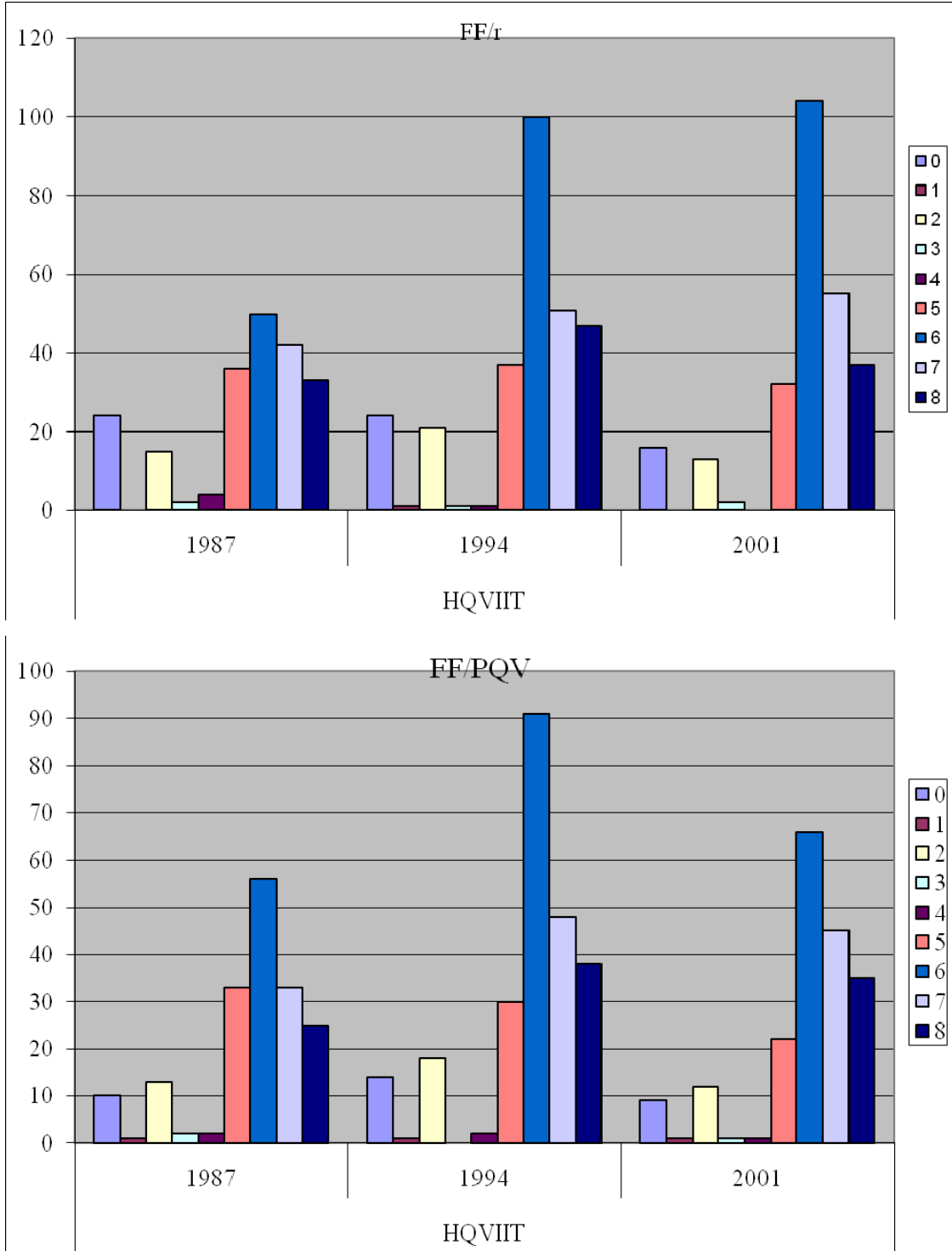
Table 4									
Distribution of 5-Digit Sectors Among 1-Digit Sectors Based on FF >0.10 and for 1987, 1994 and 2001									
r-Based									
	LQVIIT			HQVIIT			HIIT		
	1987	1994	2001	1987	1994	2001	1987	1994	2001
0	19	60	72	24	24	16	4	14	13
1	7	5	4	0	1	0	0	1	1
2	32	41	57	15	21	13	10	8	10
3	3	7	8	2	1	2	1	4	1
4	2	5	8	4	1	0	0	5	2
5	86	70	99	36	37	32	19	19	18
6	150	278	358	50	100	104	38	47	41
7	80	141	249	42	51	55	6	42	54
8	60	104	168	33	47	37	10	20	27
PQV-Based									
	LQVIIT			HQVIIT			HIIT		
	1987	1994	2001	1987	1994	2001	1987	1994	2001
0	28	57	68	10	14	9	9	25	22
1	6	4	3	1	1	1	0	2	1
2	34	38	51	13	18	12	10	14	17
3	3	7	8	2	0	1	0	4	2
4	5	3	7	2	2	1	0	5	2
5	75	61	87	33	30	22	30	35	37
6	127	240	339	56	91	66	53	85	92
7	63	113	204	33	48	45	32	72	106
8	56	93	135	25	38	35	22	35	58

- 4 Animal and Vegetable Oils, Fats and Waxes
- 5 Chemicals
- 6 Manufactured Goods Classified Chiefly by Material
- 7 Machinery and Transport Equipment
- 8 Miscellaneous Manufactured Articles

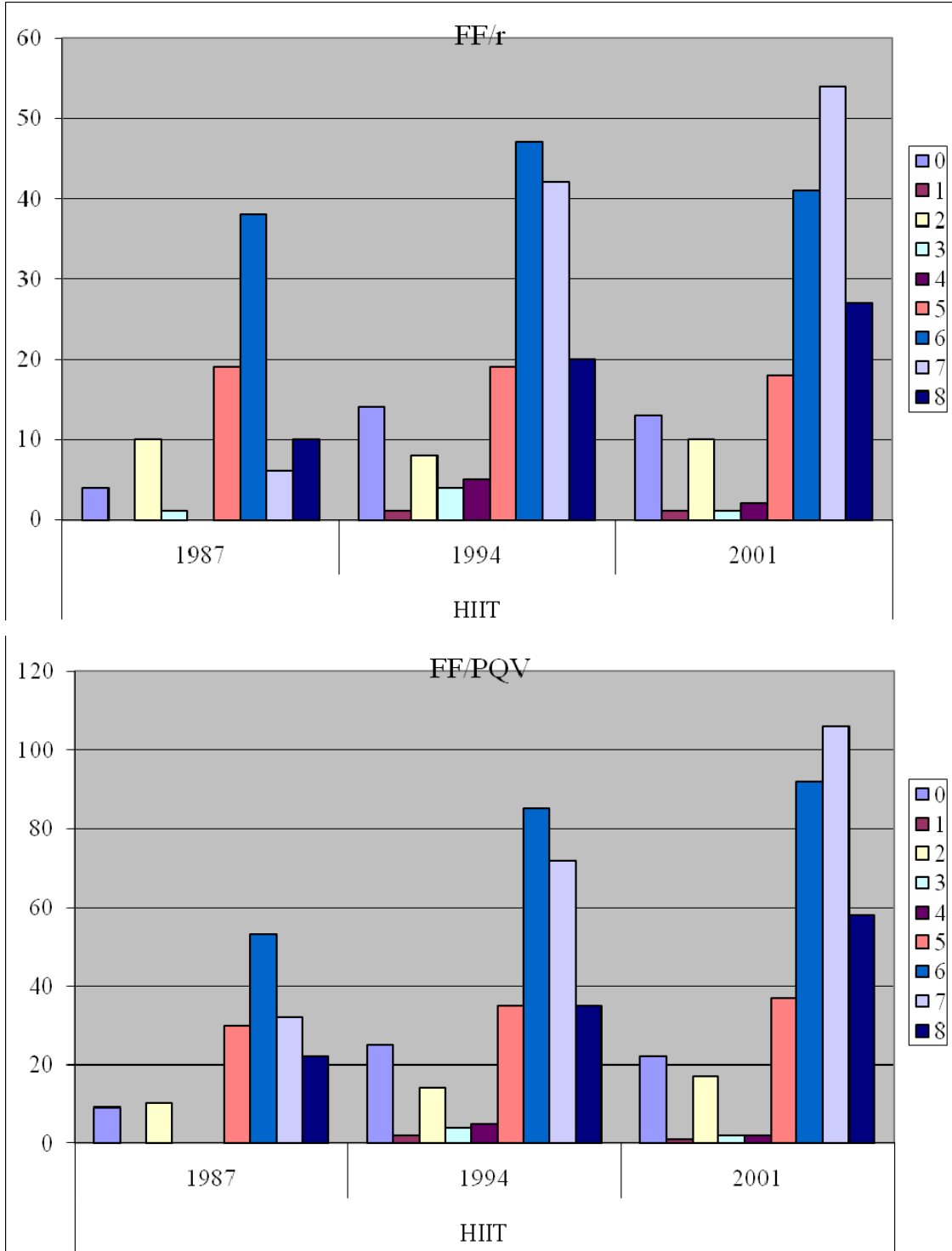
We only present the results for FF, classified with respect to r and PQV and only for three selected years; 1987, 1994 and 2001; in other words, the beginning, middle and final years. These are given in Table 4 and presented graphically in Figure 9. The first two panels show the change in LQVIIT in terms of both classifications. The pattern is quite similar in all three. The number of 5-digit sectors steadily increase in 2, 6, 7 and 8.

Figure 9
Distribution of 5-Digit Sectors Among 1-Digit Sectors Based on $FF > 0.10$





In the case of Chemicals (5) there is a decrease in 1994. The highest increase appears to be in Manufactured Goods (6) and Transport Equipment (7).



The second two panels refer to HQVIIT. We now note that the pattern given by the r and PQV based classifications are not similar. In the r case, Manufactured Goods

and Transport Equipment show increases for all three years, while the PQV classification indicates a decline for those two categories. The pattern for Miscellaneous Manufactured GOODS is similar in both cases, but this is not the case for Chemicals (5). In the PQV classification, it declines while we observe a slight increase in 1994 for the r-classification.

Finally, turning to the last two panels for HIIT, we again note variation in the panels. The one based on the r-classification indicates a steady increase in Transport Equipment and Miscellaneous Manufactured Goods but a decrease in Chemicals. The PQV based classification also shows an increase in 7 and 8, but now also in 5.

5. Conclusions

1. The sectors that do not exhibit any IIT are those where there is no trade and those where trade is of the inter-industry type. The numbers of sectors that are not involved in some level of IIT have declined considerably over the period in question and this decline is due largely to the decrease in the number of sectors that are solely involved in inter-industry trade.

2. When we apply the 10% cut-off point to the 5-digit sectors that are involved in IIT we find that the number of those with GL and FF values exceeding 10% show an increasing trend while the number of those with indexes below 10% show a decline after a point. On the other hand, the greater-than-10% group obtained from GL is larger than the group obtained from FF. In other words, 10% is a stricter cut-off point for FF than GL.

3. We consider the greater-than-10% group in investigating the patterns of the LQVIIT, HQVIIT and HIIT classified sectors. The number of sectors exhibiting LQVIIT shows an increasing pattern over time and this pattern is observed for both the FF and GL indexes and the r and PQV based classifications. The GL-based figures exceed the FF-based figures and the r-based figures exceed the PQV-based figures. The first result is consistent with the conclusion in item 2, but the second result is of more interest because it implies that the PQV-based classification favours HQVIIT or HIIT.

4. We find that, in fact, the PQV-based classification does favour HIIT. This is true for both the FF and GL indexes. The HIIT figures are above the HQVIIT figures at

every point over the time period under study and they exhibit a growing trend. This result is quite similar to the result obtained by Azhar, Elliott and Liu (2008) for China trade. The main difference is that Azhar et al (2008) find that the increase in the number of sectors classified as HIIT reduces the number classified as LQVIIT, whereas we find that the increase in HIIT sectors lead to the decrease in HQVIIT sectors.

5. Finally, when we consider 1-digit sectors, we find that all manufacturing sectors except Chemicals show an increase in LQVIIT from 1987 to 1994, then from 1994 to 2001. Chemicals show a decrease in 1994. The decrease in Chemicals is also evident for HQVIIT and for r-classified HIIT, but shows an increase for PQV-classified HIIT. Both classifications also indicate that Transport Equipment outstrips Manufactured Articles in 2001 for the HIIT classification.

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