

# Labor Market Adjustment and Intra-Industry Trade: Evidence from Turkish Manufacturing Sector

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## Abstract

*Smooth-adjustment hypothesis (SAH) is frequently tested for various country cases in which it argues that the labor market adjustment costs in terms of unemployed resources are lower with the expansion of intra-industry trade (IIT) than inter-industry trade. This paper aims to investigate and test empirically whether the SAH is valid or not for the case of Turkey. To this end, following panel data analysis and using two-digit International Standard Industry Classification (ISIC) Rev.3 data of Turkish Statistical Institute for the period between 2005 and 2008, this study analyzes the impact of trade and in particular of marginal intra-industry trade (MIIT) on the employment changes for the Turkish manufacturing industry by decomposing IIT into its vertical and horizontal components. The results show that the employment change is sensitive to the nature of IIT which is vertical or horizontal. Given the results and comparing them with other empirical studies, it can be difficult to say that the results do not support the SAH. Some variables strongly support the SAH while some of them give insignificant results.*

**Keywords:** Intra-Industry Trade, Smooth Adjustment Hypothesis, Marginal Intra-Industry Trade

## 1. Introduction

Adjustment implications of trade expansion can be analysed by examining the patterns of intra-industry trade (IIT). Recent literature concentrates on the relationship between IIT and the costs of adjustment associated with changes in trade patterns. Trade-induced adjustment costs experienced by developing countries are a matter of growing concern. While the long-term benefits of trade liberalization are well-accepted, the process of transition and associated costs are not well-understood.

The paper is organised as follows: Section 2 presents the theoretical background. In Section 3, we explain the SAH and how it is affected by considering the nature of IIT. Section 4 presents the main empirical works on labor market responses to trade structure. 5<sup>th</sup> section introduces the different indices to measure MIIT. Section 6 presents the IIT pattern of Turkish manufacturing industry. In Section 7, data and the econometric model are presented and the relationship between IIT and adjustment costs is econometrically explored. Then, estimation results are analysed in Section 8. The last section concludes.

## 2. Theoretical Background

In the neoclassical trade theory, there is a positive sum game because there are long-term gains from trade and it always outweighs the short term labor adjustment costs. In other words, the gains are large enough to compensate the losers. The labour market theorists suggest that in the long-run the economy returns to the equilibrium although there is a temporary unemployment at the beginning.

Krugman (1979, 1981), Lancaster (1980), Helpman and Krugman (1985) assume the horizontal differentiation of products and their models are based on monopolistic competition. On the other hand, Falvey (1981), Falvey and Kierskowski (1987) and Motto (1994) assume vertical differentiation of products.

The Heckscher-Ohlin (HO) framework is based on the traditional HO theory and specific factors theory that considers that labor is not specific. The free trade has a consequence of the redistribution of employment from the import substitute industry to the export industry in the HO model.

This model assumes that inter-industry labor movements are free and that there is no cost adjustment. The labor economists do not agree with this idea and consider that there are short-run adjustment costs, in terms of lost production, unemployment and reduced wages. Faustino and Leitão (2009) claim that in the short-run there are labor adjustment costs due to heterogeneity and product specificity of some factors, downward rigidity of nominal wages, market imperfections and trade induced adjustment costs. Furthermore, the trade-off between the gains of trade liberalization and short-term labor adjustment costs depend on the labor skills. Every industry requires a workforce equipped with specific skills and the inter-industry labor reallocation implies a loss of these skills and a short-term adjustment cost.

If import and export changes are unmatched, inter-industry trade is seen. On the other hand, intra-industry trade (IIT) is the simultaneous import and export of goods from the same industry and it is seen in perfectly matching trade. Azhar and Elliot (2003) claims that there will be a requirement for resources to be transferred between industries most commonly from those contracting to those expanding. It means that the more geographically dispersed the production and the greater the factor requirement differences between industries, the more severe the adjustment implications.

Cordoba et.al.(2007) define adjustment costs as the short-term costs of transition from one state to another. In other words, they are the costs of transferring resources from one sector to another. More specifically, they define labor adjustment costs include opportunity costs of unemployed labor, obsolescence of skill specificity, lower wage levels, re-training costs, personal costs (such as psychological suffering) and other costs (rent seeking). Consequently, they emphasize that since labor markets bear the highest costs and have considerable political influence, they receive the most attention and they are especially important in developing countries that are specialized in labor intensive manufacturing.

The IIT explanations given by new trade theory are different. IIT is not homogeneous. HIIT is mainly determined by scale economies, product differentiation and market structure. In other words, HIIT is explained by new trade theory whereas VIIT is explained by traditional trade theory.

### **3. Smooth Adjustment Hypothesis**

Although many authors (such as Krugman (1981), Cadot et al. (1995)) touched the concept of smooth adjustment hypothesis (SAH) directly or indirectly<sup>1</sup>, it was first mentioned by Balassa (1966)<sup>2</sup>. After Balassa opened this debate, many economists agree on the hypothesis that trade liberalization entails low-trade induced adjustment costs.

The basis of the SAH is the re-allocation. Intra-industry adjustments cause workers to move within industries rather than between industries. Since workers and managerial skills are more similar within industries than between industries, within the same industry re-allocation will be easy. Therefore, the SAH states that a higher share of IIT will be associated with relatively low labor market disruption. This is because resource transfers, as a result of sectorally matched increases in imports and exports, can be contained within individual industries or possibly firms. In other words, productive factors do not switch from one industry to another, but only within industries. Faustino and Leitão (2009) call this situation “low-distance assumption”. Azhar and Elliot (2008) state that IIT changes are however likely to require resources to be transferred between industries, most commonly from those contracting to those expanding. Lewis (2008) also states that IIT is more beneficial than inter-industry trade because it stimulates innovation and exploits economies of scale.

The SAH embodies two linked aspects of adjustment. These are the relative ease or costliness of adjustment within or between industries and the relative amounts of adjustment, namely reallocation of labour within and between industries associated with intra- and inter-industry trade expansion (Greenaway et al., 2002). It is generally accepted that adjustment costs will be less if there is an intra-industry trade. Azhar and Elliot (2003) explain this situation by resource transfers. They claim that resource transfers as a result of sectorally matched increases in imports and exports can be contained within individual industries or possibly firms.

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<sup>1</sup> Empirical studies of the SAH include Brülhart (2000), Brülhart and Elliot (2002), Erlat and Erlat (2006), Elliot and Lindley (2006), Brülhart et al. (2006) and Cabral and Silva (2006), etc.

<sup>2</sup> Balassa has observed the integration in Western Europe and has seen that this integration has taken place smoothly. So, he has concluded that most of this trade expansion is in the form of intra-industry trade.

On the other hand, Greenaway and Hine (1991) claim that the empirical support for SAH is only suggestive, not conclusive. They say that if trade expansion is intra-industry, adjustment costs are possibly lower but not higher. Faustino and Leitão (2009) claim that if labor is assumed not to be a homogeneous factor and has some degree of industry specificity, the adjustment cost will be less for IIT labor reallocation than for inter-industry one or the labor-market adjustment costs in the form of unemployed labor will be lower if trade expansion is intra-industry rather than inter-industry in nature.

Brühlhart (1999) says that there is not a theoretical model that supports the SAH yet. Although, there is a theoretical consensus which considers that the trade and specialization patterns are linked and that changes of industry specialization motivated by increasing IIT implies low adjustment costs. In this respect, Faustino and Leitão (2009) say that there are no general equilibrium model that integrates labor adjustment costs, specific industry factors and IIT theory.

#### 4. Literature Review

A lot of studies have been presented about the measurement of IIT. Most of them are country cases and they suffer from serious limitations of the measurement of adjustment cost to the econometric methodology used. The table below shows some of the econometric studies that investigates the simple correlation between employment changes and the measures of IIT and MIIT.

**Table 4.1: Literature of SAH**

Author(s)	Year	Country	SAH
Tharakan and Calfat	1999	Belgium	not valid
Sarris et al.	1999	Greece	valid
Brühlhart	2000	Ireland	valid
Brühlhart and Thorpe	2000	Malaysia	not valid
Cristóbal	2001	Spain	not valid
Brühlhart and Elliot	2002	UK	valid
Greenaway et al.	2002	UK	not valid
Devadason	2005	Malaysia	not valid
Faustino and Leitão	2009	Portugal	not valid

Here it is important to note that empirical studies are generally about developed nations and there is a scarce literature about the significance of trade patterns in developing countries. All studies investigate the relationship between employment changes and IIT- which is related to the concept of SAH- of developed countries, except for Malaysia.

In this study, the main references are the followings: In a study of Cristóbal (2001) which is about the Spanish manufacturing industry for the period 1988-1995, the relationship between MIIT, VIIT, HIIT and adjustment for employment is examined. In this study, Cristóbal (2001) does not believe the positive effect of IIT on employment which Brühlhart and Hine (1999) defend. According to the SAH, changes in industry employment (positive or negative) would be lower if trade expands by the simultaneous increase/decrease in exports and imports in the same industry (higher A index) rather than by increases and decreases of trade in different industries. Devadason (2005) examines the nature of IIT on labor market adjustments in Malaysian manufacturing sector between 1983 and 2000. From the findings of this study on adjustment, it is concluded that the time interval, the nature of IIT and the type of inter-industry adjustment proxy are all important for one to accept or reject the SAH. In their study, Faustino and Leitão (2009) test the SAH by using dynamic panel data analysis for the period 1996-2003 and for the bilateral trade between Portugal and EU-15 for 22 industries. Their results do not support SAH. Their results suggest that the validity of SAH depends on the variable choose as adjustment labor cost index, the time lag structure and the set of control variables. In other words, they conclude that the selection of the adjustment cost indicator and the model specification are crucial to accept or refuse the SAH. In another study (2010), again, they stress the importance of lagged trade indicators in affecting labor re-allocation outcomes and thus adjustment costs.

The existing empirical evidence of the relationship between trade-induced adjustment costs and IIT in Turkey is scarce. The study by Erlat and Erlat (2006) is the only existing research for Turkey. They use a model developed by Brühlhart and Thorpe (2000) for Malaysia. Their results show a lack of support for the SAH.

### **5. MIIT Index versus GL Index**

More recent developments concentrate on specific aspects of the measurement of IIT. Brülhart and Hine (1999) have published a set of papers about the measurement of IIT. They express that there are serious limitations about the econometric methodology used when they try to measure adjustment costs. Since the adjustment costs are dynamic phenomena, the static Grubel Lloyd index (GL) is not a suitable measure in this instance. An increase in the GL index between two periods can hide a change in trade flows related more with an inter-industry specialisation than with an intra-industry specialisation. Moreover, an increase in the GL index can be related either to a reduction in the trade surplus of an industry or to a reduction on its trade deficit.

Various proposals<sup>3</sup> have been made for a dynamic measure of intra-industry trade. In recent years MIIT has become a topical issue in the empirical trade literature. In this respect, studies show that the SAH is related to the measures of MIIT. In other words, the concept of MIIT is a central concept in the analysis of labor market adjustment costs and trade patterns.

There are two important issues which matter for the measurement of MIIT. The first one is the requirement of a choice of the most appropriate time period. The second one in empirical studies is the inter-temporal sequencing of trade adjustment.

MIIT denotes parallel increases or decreases of imports and exports in an industry. In other words MIIT measures have been developed to quantify the “matchedness” of trade changes. Such matched changes of sectoral trade volumes can be associated with a neutral effect on employment. For instance, if industry *i*'s imports expand, domestic jobs may be threatened in that industry, but if industry *i*'s exports expand by a comparable amount, this may offset lost market share in the domestic market and yield a zero net change in the industry's domestic employment (Brülhart 2008).

In the context of MIIT, matched trade changes can be accommodated without inter-industry factor movement in a particular sector. The intuition is that an increase in exports over a given period matched by a proportional rise in imports of the same industry does not require factors to move into or out of the domestic industry (Menon and Dixon, 1997).

Azhar and Elliot (2003) suggest four simple criteria that a measure of trade-induced adjustment should satisfy to be considered an appropriate index for testing the SAH. These four criteria are as follows:

- An index should be an increasing function of the net change in trade. This means that the greater the sectoral disparity in trade flows the greater the factor market disruption.
- The factor reallocation requirements associated with a given level of inter-industry trade changes are equal and opposite for bilateral trade partners so that the adjustment costs associated with an industry expansion are equal to those associated with an industry contraction.
- The index can be able to recognize if a country is specializing into or out of an industry.
- IIT changes will have no resource reallocation costs if firms have identical factor requirements. Since matched increases or decreases in exports and imports mean that total demand of an industry is not affected, no resource reallocation is required.

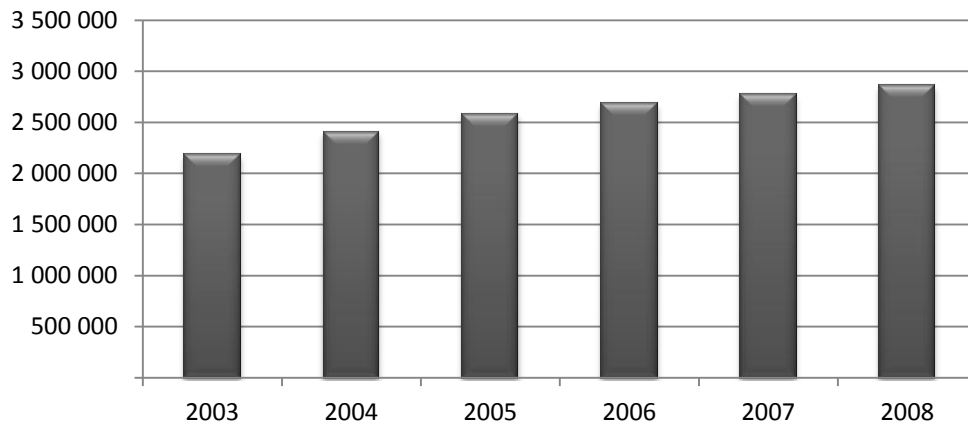
### **6. Turkish IIT Pattern at a Glance**

Since only manufacturing industry is analysed in this study, we need to look closer at the labor market and trade pattern of this industry.

Figure 6.2 presents the pattern of real exports and imports for the period 2004-2009. As seen in table imports are always above the exports, but they move together. Between 2004 and 2005, they follow a smooth pattern and then they both increase until 2008. In 2009, they show a declining pattern together.

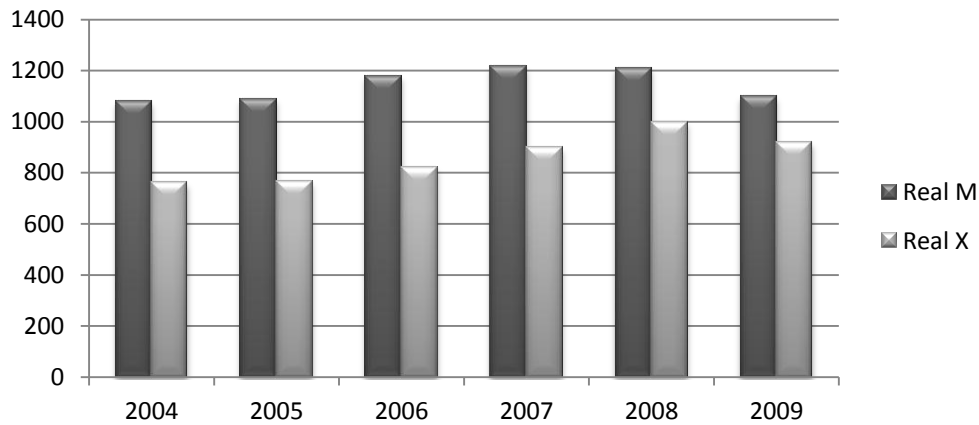
<sup>3</sup> See Hamilton and Kniest (1991), Greenaway et al. (1994), Brülhart (1994), Menon and Dixon (1997) and Azhar and Elliot (2003).

**Figure 6.1: Number of Workers in the Manufacturing Industry (2003-2008)**



Source: TURKSTAT (Annual Industry and Service Statistics)

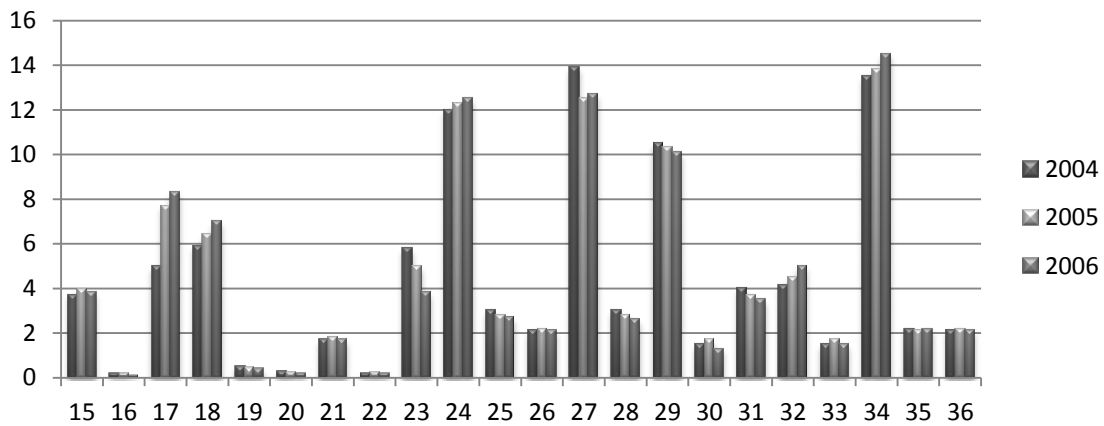
**Figure 6.2: Pattern of Real Imports and Exports (2004-2009)**



Source: TURKSTAT (Foreign Trade Statistics)

Note: The figures are in million Turkish Liras

**Figure 6.3: Trade Volumes of Sub-Sectors in Manufacturing Sector (2004-2006)**

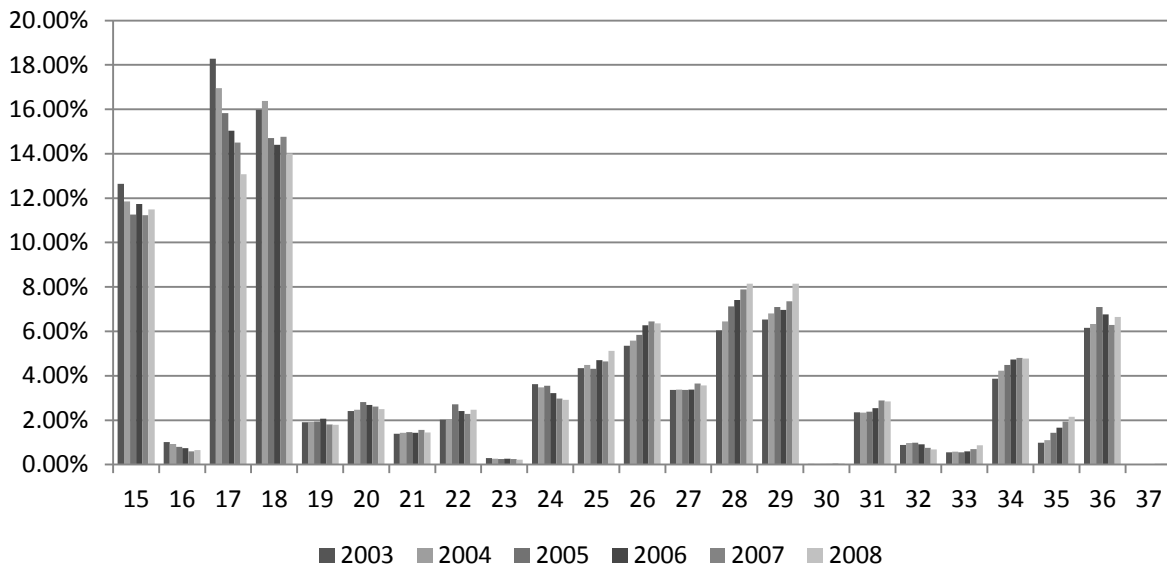


Source: TURKSTAT (Foreign Trade Statistics)

Trade volumes (imports plus exports) of sub-sectors in manufacturing sector is shown in Figure 6.3. As seen from the figure, the share of sector 34 (manufacture of motor vehicles, trailers and semi-trailers) is the highest one.

The other sectors that have high shares in manufacturing sector are 27 (manufacture of basic metals), 24 (manufacture of chemicals and chemical products) and 29 (manufacture of machinery and equipment n.e.c.), respectively.

**Figure 6.4: Sub-Sector Shares of Employment in Manufacturing Sector (2003-2008)**



Source: TURKSTAT (Annual Industry and Service Statistics)

Figure 6.4 shows the percentage of employed people in sub-sectors between the period 2003 and 2008 for manufacturing sector. As seen from the figure, the shares of employed people in sub-sectors 17 (manufacture of textiles) and 18 (manufacture of wearing apparel; dressing and dyeing of fur) are the highest ones following by sector 15 (manufacture of food products and beverages). Although they have the highest shares, they show a declining pattern from 2003 to 2008. On the other contrary, sub-sectors 28 (manufacture of fabricated metal products, except machinery and equipment) and 29 (manufacture of machinery and equipment n.e.c.) shows an increasing pattern from 2003 to 2008.

Table 6.1 shows the manufacturing trade of Turkey at the 2-digit level by using ISIC Rev.3 trade data. The last two columns show the growth of real imports and exports. As seen in table, in some sectors there is a great increase in imports that is higher than 100 % (for ex; sectors 18 (manufacture of wearing apparel; dressing and dyeing of fur) and 23 (manufacture of coke, refined petroleum products and nuclear fuel)). In sectors 16 (manufacture of tobacco products), 23 (manufacture of coke, refined petroleum products and nuclear fuel), 27 (manufacture of basic metals) and 31 (manufacture of electrical machinery and apparatus n.e.c.), there is a more than 100 % increase in real exports. In the 18<sup>th</sup> (manufacture of wearing apparel; dressing and dyeing of fur) sector, real imports increase while real exports shrink. On the contrary, in sectors 16 (manufacture of tobacco products ) and 34 (manufacture of motor vehicles, trailers and semi-trailers ) real imports shrink while real exports expand. In sectors 17 (manufacture of textiles), 32 (manufacture of radio, television and communication equipment and apparatus), 35 (manufacture of other transport equipment) and 36 (manufacture of furniture; manufacturing n.e.c.) both of real imports and real exports are declining.

**Table 6.1: Manufacturing Trade of Turkey at the 2-Digit Level (ISIC Rev.3) 2004-2008**

Sector Code	Name of Sector	Growth of M	Growth of X
15	Manufacture of food products and beverages	29,5	26,7
16	Manufacture of tobacco products	-7,1	132,4
17	Manufacture of textiles	-11,9	-7,2
18	Manufacture of wearing apparel; dressing and dyeing of fur	107,2	-19,3
19	Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear	46,5	21,2
20	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	51,1	72,0
21	Manufacture of paper and paper products	15,3	50,7
22	Publishing, printing and reproduction of recorded media	39,3	15,8
23	Manufacture of coke, refined petroleum products and nuclear fuel	138,6	251,7
24	Manufacture of chemicals and chemical products	16,9	28,0
25	Manufacture of rubber and plastics products	16,5	58,9
26	Manufacture of other non-metallic mineral products	41,5	22,2
27	Manufacture of basic metals	56,7	117,0
28	Manufacture of fabricated metal products, except machinery and equipment	45,2	64,7
29	Manufacture of machinery and equipment n.e.c.	7,6	63,5
30	Manufacture of office, accounting and computing machinery	5,1	69,9
31	Manufacture of electrical machinery and apparatus n.e.c.	51,8	106,9
32	Manufacture of radio, television and communication equipment and apparatus	-22,7	-48,3
33	Manufacture of medical, precision and optical instruments, watches and clocks	23,5	53,9
34	Manufacture of motor vehicles, trailers and semi-trailers	-13,8	43,9
35	Manufacture of other transport equipment	-1,2	-29,6
36	Manufacture of furniture; manufacturing n.e.c.	-99,8	-99,6

Source: TUIK (Foreign Trade Statistics) and author's own calculations.

The well-known way of looking at the dynamics of IIT is to calculate its change between two periods. From Table 6.2 it can be concluded that IIT has decreased in 7 sectors. This table presents the comparison of GL indices between 2004 and 2008. The last column shows that how GL index has changed from 2004 to 2008. As seen in table, in sectors 16 (manufacture of tobacco products), 32 (manufacture of radio, television and communication equipment and apparatus) and 35 (manufacture of other transport equipment) intra-industry trade has decreased more than 20 %. In sector 18 (manufacture of wearing apparel; dressing and dyeing of fur) IIT has increased more than 100 %.

However, there is not any study –according to the literature survey- about the classification of GL and MIIT indices, in this study the values of GL and MIIT indices are classified according to their magnitude from lowest to the biggest. Therefore, all remaining errors are, of course, author's responsibility.

The empirical evidence about a negative relationship between IIT and trade-induced adjustment costs is very scarce. Cristóbal (2001) claims that all the literature about IIT and trade-induced adjustment cost has been forgotten until now. He adds that recent empirical work on the nature of IIT has revealed that IIT on vertically differentiated products is significant.

There is a growing empirical evidence for the importance of VIIT<sup>4</sup>. In the vertical differentiation models, varieties differ in quality and in their factoral intensity. In these models, the differences between countries' relative factor endowments determine the international pattern of trade.

<sup>4</sup> See Blanes and Martin (2000) for evidence about Spain; Greenaway, Hine and Milner (1994, 1995) for UK and Brühlhart and Hine (1999) for the other European countries.

In her study, Devadason (2005) claims that in identifying the consequences of the IIT for the labor market, quality are important. IIT in vertically differentiated products (VIIT) has different consequences for labor adjustments than IIT in horizontal products which means the specialization in varieties (HIIT). Therefore, not only inter-industry trade is responsible for the painful or more costly adjustments but also VIIT. Cristóbal (2001) claims that, further research focused on VIIT instead of total IIT can be fruitful, since several papers have found that VIIT is the prevailing king of IIT in most European countries.

**Table 6.2: Change in GL Index between 2004 and 2008**

Sector Code	$\Delta$ GL (2004-2008)	Sector Code	$\Delta$ GL (2004-2008)
15	1,41%	26	11,66%
16	-43,62%	27	20,78%
17	-3,44%	28	-7,28%
18	134,49%	29	33,01%
19	-11,99%	30	58,93%
20	8,74%	31	21,63%
21	22,72%	32	-23,21%
22	-13,62%	33	22,25%
23	30,99%	34	4,02%
24	8,05%	35	-21,95%
25	-15,46%	36	1,72%

Source: TUIK and author's own calculations.

**Table 6.3: Classification of GL and MIIT Indices**

	Value of GL Index	Type of Trade
GL	0	Perfect Inter-Industry Trade
	0.01-0.29	Low IIT
	0.30-0.59	Moderate IIT
	0.60-0.99	High IIT
	1	Perfect IIT
	Value of MIIT Index	Type of Adjustment Cost
MIIT	0	Very High
	0.01-0.29	High
	0.30-0.59	Moderate
	0.60-0.89	Low
	0.90-1	Very Low

VIIT is more significant than HIIT in most of the Turkish manufacturing sectors. Moreover, Turkey seems to be specialize in varieties of lower quality in most of the sectors. Labor would be the most sensible factors to the nature of IIT. Changes will be greater as bigger the inter-industry component of trade expansion. Contrary, changes will be lower as bigger the intra-industry component of trade expansion.

In this study, IIT is classified into five sub-groups according to the value that GL and MIIT indices taken. This classification is shown in Table 6.4. Then, Table 6.5 is prepared by using this classification for the period 1990-2009. In this period, Turkish manufacturing industry shows a high intra-industry trade which means that the value of GL indices from 1990 to 2009 are between 0,60 and 0,99. The nature of IIT is shown in the 4<sup>th</sup> column. As seen in table, low-quality VIIT highly dominates the manufacturing industry. In 1990-2009 period, only in one year (1993) shows HIIT. Therefore, it can be concluded that IIT dominates Turkish manufacturing industry and this IIT is determined by low-quality products.

In order to see at a first glance whether there is a relationship between the nature of IIT and MIIT, 4<sup>th</sup> and 5<sup>th</sup> columns of Table 6.4 can be used. In the literature, it is expected that high IIT means low adjustment costs. Therefore, with a more detailed analysis, we see that the type of IIT shows a slight change on the share of low-quality VIIT in Turkish manufacturing industry.



Even if the nature of IIT, which means whether IIT is vertical or horizontal, has shown a smooth pattern, type of adjustment costs have changed in this period. So, at a first glance, it can be inferred that there is not a consistent relationship between IIT and adjustment costs as the literature supports.

**Table 6.4: Relationship between the Nature of IIT and MIIT**

Year	GL	IIT or Inter-Industry	GHM (%15)	MIIT	Adjustment Costs
1990	0,79	High IIT	IIT(L)	*	*
1991	0,81	High IIT	VIIT(L)	0,00	Very High
1992	0,84	High IIT	VIIT(L)	0,87	Low
1993	0,74	High IIT	HIIT	0,21	High
1994	0,96	High IIT	VIIT(L)	0,00	Very High
1995	0,84	High IIT	VIIT(L)	0,55	Moderate
1996	0,74	High IIT	VIIT(L)	0,28	High
1997	0,74	High IIT	VIIT(L)	0,74	Low
1998	0,76	High IIT	VIIT(L)	0,00	Very High
1999	0,83	High IIT	VIIT(L)	0,05	Very High
2000	0,73	High IIT	VIIT(L)	0,27	High
2001	0,94	High IIT	VIIT(L)	0,00	Very High
2002	0,90	High IIT	VIIT(L)	0,71	Low
2003	0,88	High IIT	VIIT(L)	0,84	Low
2004	0,85	High IIT	VIIT(L)	0,76	Low
2005	0,4	High IIT	VIIT(L)	0,80	Low
2006	0,84	High IIT	VIIT(L)	0,80	Low
2007	0,85	High IIT	HIIT	0,94	Very Low
2008	0,90	High IIT	VIIT(L)	82	Low
2009	0,92	High IIT	VIIT(L)	0,85	Low

Year	GHM (%15)	MIIT (A)	Adjustment Cost
2004-2009	VIIT(L)	0,923	Very Low
2004-2006	VIIT(L)	0,832	Low
2007-2009	VIIT(L)	0,389	Moderate

Source: Author's own calculations.

In order to discover the direction and strength of the link between the sets of GL index data and MIIT index (A) data, Spearman's Rank Correlation Test is used<sup>5</sup>. The hypothesis tested is that rank GL and rank MIIT are independent.

We might expect to find that the Spearman's rank correlation coefficient (rho) is going to be high and significant. When GL index is high IIT is seen in that industries. On the other hand, when MIIT index (Brülhart's A index) is high it means that adjustment costs are very low as seen in the industries that show an IIT trade pattern.

$$[1] \quad r_s = 1 - \frac{6 \sum d_i^2}{n(n^2 - 1)}$$

<sup>5</sup> At first the two data sets are ranked from the biggest to the lowest data. In other words, ranking is achieved by giving the rank '1' to the biggest number and '2' to the second biggest value and so on. The smallest value will get the lowest ranking. This is done for both sets of GL and MIIT indices. Then, the difference between these ranks is found by subtracting MIIT values from the GL values. Then, in order to remove the negative values the square of the difference is calculated and then they are summed. After multiplying these value by 6, it is divided by  $n^3 - n$  (n is equal to the number of observations which is equal to 22 in our cases). Then, the rank correlation coefficient is calculated according the Spearman's rank correlation formula. The rank coefficients are calculated in STATA version 10.

As a result Spearman rank correlation coefficients are very low and smaller than the test statistics for all years (2005, 2006, 2007 and 2008). It means that our null hypothesis is accepted. Therefore, it can be said that if an industry has a high GL index value (a high intra-industry trade) does not need to have a high MIIT index value (low adjustment cost). This result supports our findings that are shown in Table 6.4.

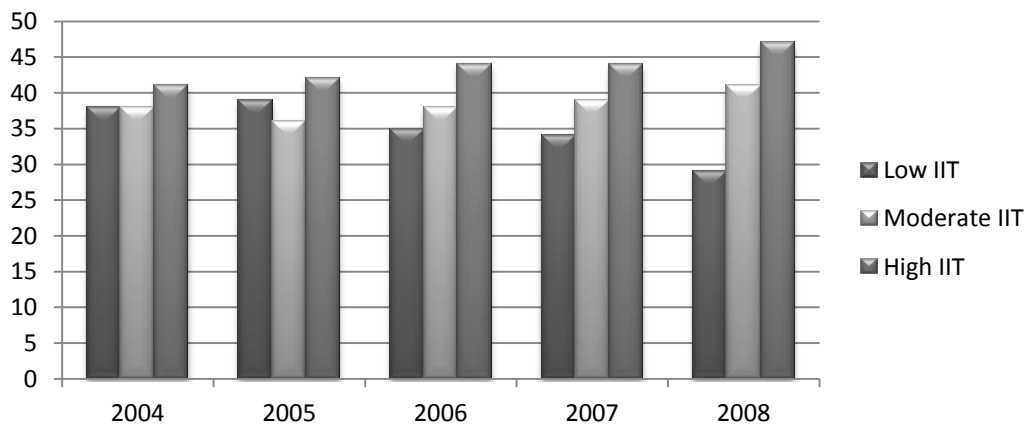
It can be said that, when we relate the MIIT index and the nature of IIT, the effect of MIIT on changes in employment does not differ according to the nature of IIT. The nature of IIT is vertical (specially low-quality vertical intra-industry trade-VIIT(L)) for the period 1990-2009, but the values of MIIT indices are very different at this period.

Greenaway and Milner (1986) claim that the growth of the GL index is not adequate to capture the dynamics of IIT. Since GL index is a static measure, it captures IIT for a particular year. Since our aim is to correctly explore trade-induced adjustment costs, we need to calculate IIT changes in the margin.

As seen from Figure 6.5 the number of sectors that have high IIT which means GL index is greater than 0,60 are much more than the other types of IIT. From 2004 to 2008, the number of sectors that show high IIT has increased.

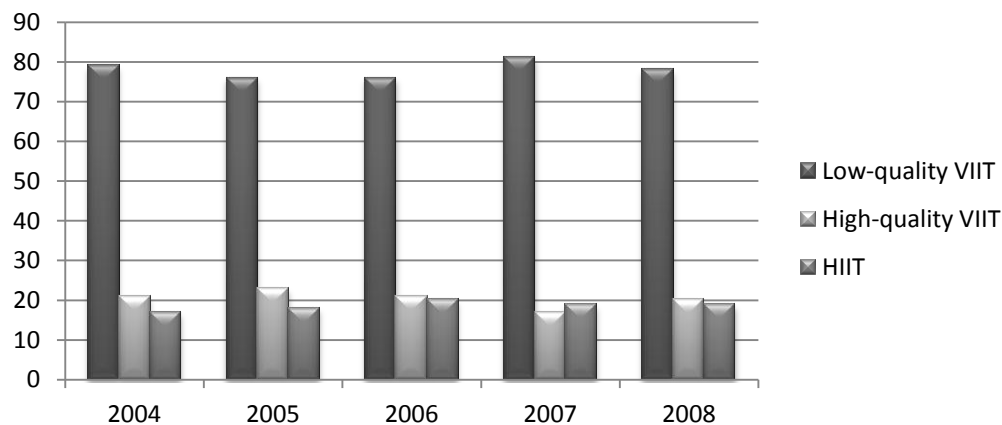
After noticing that Turkish manufacturing trade shows IIT, then the nature of IIT is examined. Figure 6.6 represents that the sectors in manufacturing industry mostly show low-quality IIT from 2004 to 2008.

**Figure 6.5: IIT (Number of Industries at 4-digit level) (2004-2008)**



Source: Author's own calculations.

**Figure 6.6: Nature of IIT (Number of Industries at 4-digit level) (2004-2008)**



Source: Author's own calculations.

## 7. Data and Econometric Model

In this study, the IIT structure of Turkish international trade is tried to examine based on 2-digit ISIC (Rev.3) data. The data were obtained from Turkish Statistical Institute (TURKSTAT) database. The study covers a period between 2005 to 2008. The availability of the 2-digit data on employment in manufacturing sector is the only restriction in this research. The compiled trade data is available for a long period but the data on 2-digit manufacturing employment is available only for a short period. Moreover, instead of starting or finishing in a year of economic crisis, 2005-2008 period is chosen for the analysis. Therefore, a possible bias is tried to be eliminated. All calculations are made for the manufacturing sector. There are 22 manufacturing sectors and their sector codes lie between 15 and 36. All quantities are measured in kilograms.

Since all trade data are obtained in \$US, we convert them in TL by using exchange rate series for the period 2005-2008. Also, the literature of MIIT stresses the need of use inflation-adjusted trade flows to avoid capturing not real increases. Therefore, all variables are converted into real variables by using producer price index (PPI) based on 2003.

Cristóbal (2001) claims that theory does not equip us with a model indicating with control variables to include in a fully specified model of market adjustment. Therefore, as a conclusion, it can be said that research carried in that paper suffers for relevant methodological shortcomings because the non-existence of a theoretical model. But the following basic specification is generally used in the literature.

The model is shown below.

$$[2] \quad \text{lavec} = f(\text{lcc}, \text{lcprod}, \text{lte}, \text{iit} * \text{lte}, \text{iit})$$

*lavec* is the natural logarithm of the absolute value of industry employment changes. It is used as a proxy to adjustment costs. This change in industry employment can be used as an indirect indicator to trade-induced adjustment costs. This choice is motivated by the other studies in the SAH literature.

*lcc* is the natural logarithm of the absolute value of change in consumption. It is calculated as follows:

$$[3] \quad C = Y + M - X$$

In the above equation *Y* represents output, *M* represents imports and *X* represents exports.

*lcprod* is the natural logarithm of the absolute value of change in productivity. In other words, it is equal to output per worker in the manufacturing industry. It is calculated as follows:

$$[4] \quad \text{prod} = \frac{Y}{\text{worker}}$$

*lte* represents the natural logarithm of the absolute value of trade exposure. It presents the openness to trade of the manufacturing sector and is calculated as follows:

$$[5] \quad \text{te} = \frac{[(M + X)]}{Y}$$

In this study, Brülhart's A index is used in order to calculate the MIIT. According to Brülhart, the A index reveals the structure of the change in export and import flows. *iit* represents the GL and MIIT indices. The value of GL and MIIT indices are shown as *gl* and *a* in the regressions, respectively. According to the targeted contribution of this study, vertical and horizontal intra-industry trade has been added to the model under the *iit* variable with the notation of *v\_h*.

*iit\*te* is an interaction between GL index (or MIIT index) and trade exposure.

## 8. Empirical Results

In order to determine whether to use fixed-effect or random-effect model, Hausman test has been performed. According to the results, the null hypothesis which says the difference in coefficients is not systematic has been rejected. In other words, the parameters that these models have estimated are systematically different from each other. Also, the data set covers the entire manufacturing sector. Therefore, in this study, a fixed-effect panel data model has been used. In other words, the model has been estimated employing fixed-effect estimator since the various manufacturing industries that make up the panel have not been randomly chosen.

At the previous part, it is found that GL and MIIT indices are distinct from each other according to the Spearman's rank correlation. This result is supported by the low correlation between GL (*gl*) and MIIT (*miit*) in the Table 8.1. Also, as seen in table, change in productivity (*lcprod*) and the nature of IIT (*v\_h*) show a stronger expected result confirming the SAH. The results of the estimations are presented in Table 8.2. As seen in table, the general performance of the model is not satisfactory across all specifications.

Previous studies emphasize that results are sensitive to the choice of length of the period. In his study, Brühlhart (2000) found that A index based on yearly changes give the best results. On the contrary, in Brühlhart and Thorpe (2000), Devadason (2005), Erlat and Erlat (2006) etc. three-yearly changes are concerned. Since the time period is short, in this study, only yearly changes are concerned.

A positive relation between change in consumption and change in employment is found as expected but the coefficients of change in consumption are insignificant not confirming the SAH.

Among the parameter estimates the coefficient of change in productivity is invariably negative and significant at the 1 % significance level. In other words, in all equations change in productivity is statistically significant and has the predicted negative sign.

Since the reallocation of resources will be lower if trade expansion is intra-industry, the sign of the IIT coefficient is expected to be negative.

When trade exposure increases, the sum of export and import in total output increases which increases the competitiveness of that sector. Then, the share of IIT labor turnover increases and change in employment in that sector decreases. Therefore, trade exposure (*te*) are expected to be positive. In only one regression specification, trade exposure (without natural logarithm) has expected sign and is significant.

A index (*a*) has the expected sign. This confirms that when MIIT index (*A*) increases adjustment costs decrease and low employment change is seen. Therefore, there is a negative relationship between A index and employment change.

The interaction effects between GL index-trade exposure (*gl\*lte*) and MIIT index-trade exposure (*a\*lte*) are insignificant.

While the impacts of A index on employment changes are relatively strong, these effects of GL index are insignificant. On the other hand, the change in GL index, that is represented by *cgl*, has a negative sign and is significant.

The nature of IIT, whether being VIIT or HIIT, appears to have an impact on employment changes. In this study, it has been explored whether IIT have different effects on adjustment costs depending on the nature of IIT. Therefore, the variable *v\_h* has been added to the model under the *iit* variable. The results show that the employment change is sensitive to the nature of IIT which is seen by the coefficient of *v\_h*.

The evidence strong for the nature of IIT as vertical and horizontal and the results show that changes in employment has been positively affected by VIIT. It means that, when VIIT increases the costs of adjustment has increased more relative to HIIT.

**Table 8.1: The Correlation Matrix**

. correlate lavec gl v\_h cgl a miit lcc lcprod te gl\_te a\_te  
(obs=88)

	lavec	gl	v_h	cgl	a	miit	lcc	lcprod	te	gl_te	a_te
lavec	1.0000										
gl	0.2871	1.0000									
v_h	0.4533	0.1962	1.0000								
cgl	-0.0367	0.0860	0.0477	1.0000							
a	-0.0543	0.1983	0.0613	0.1969	1.0000						
miit	0.2117	0.1028	-0.1234	-0.2030	-0.7065	1.0000					
lcc	0.0912	-0.0192	0.0850	-0.0424	0.1363	-0.1512	1.0000				
lcprod	-0.4831	-0.3963	-0.3726	-0.0785	-0.0114	-0.2025	0.0679	1.0000			
te	0.0080	0.0577	0.0365	-0.0342	0.1300	-0.0708	0.2504	-0.1082	1.0000		
gl_te	0.0099	0.0896	0.0404	-0.0301	0.1295	-0.0680	0.2437	-0.1133	0.9990	1.0000	
a_te	-0.0037	0.0485	0.0330	-0.0402	0.1714	-0.1046	0.2617	-0.0820	0.9969	0.9953	1.0000

. correlate lavec gl v\_h cgl a miit lcc lcprod lte gl\_lte a\_lte  
(obs=88)

	lavec	gl	v_h	cgl	a	miit	lcc	lcprod	lte	gl_lte	a_lte
lavec	1.0000										
gl	0.2871	1.0000									
v_h	0.4533	0.1962	1.0000								
cgl	-0.0367	0.0860	0.0477	1.0000							
a	-0.0543	0.1983	0.0613	0.1969	1.0000						
miit	0.2117	0.1028	-0.1234	-0.2030	-0.7065	1.0000					
lcc	0.0912	-0.0192	0.0850	-0.0424	0.1363	-0.1512	1.0000				
lcprod	-0.4831	-0.3963	-0.3726	-0.0785	-0.0114	-0.2025	0.0679	1.0000			
lte	0.1508	0.1723	-0.0398	0.2014	0.1268	0.0174	0.0795	-0.4546	1.0000		
gl_lte	-0.1815	-0.7484	-0.2067	0.0640	-0.1161	-0.0880	0.0428	0.0822	0.4963	1.0000	
a_lte	0.0709	-0.1660	-0.0904	-0.1565	-0.9035	0.6536	-0.0766	-0.1107	0.2114	0.3131	1.0000

**Table 8.2: The Fixed Effect Panel Data Results**

R <sup>2</sup>	Constant	lcc	lcprod	te	lte	gl*te	gl	gl*lte	v_h	cgl	a	a*te	a*lte	miit
0.563 1	13.6658 (5.723627)**	.2029157 (.2852421) (.0853358)***	-.8235564 (.9.062867)							-1.366778 (1.33391)**		-1.275773 (11.30821)		
0.590 1	11.1406 (5.68932)**	.2370276 (.2784539) *	-.736578 (.0916019)**	1.0118 (8.848993) *					.9584334 (.4226905)**	-1.430464 (1.300568)*		-2.709533 (11.0411)		
0.582 4	14.34098 (4.978172)**	.0704128 (.2433496) *	-.7690047 (.0970579)**		-.0963165 (.093393)				.8527099 (.4352507)**	-1.087791 (1.332182)*				
0.554 3	16.23555 (5.073737)**	.0668716 (.2541631) *	-.812345 (.082654)***							-1.061546 (1.367169)*	-2.943934 (.324249)**			
0.579 0	13.25598 (5.005518)*	.1240536 (.245448)	-.7220994 (.0883607)**						.9759706 (.4228082)**		-3.837981 (.3085415)*			
0.585 5	12.43862 (5.019744)*	.122492 (.2411233) *	-.6821154 (.0910082)**						1.102408 (.4287939)**					.4187813 (.2490129)
0.576 7	14.80764 (4.959533)**	.0404938 (.2417102) *	-.7283454 (.0887251)**						.9572844 (.4234424)**	-1.376799 (1.302891)*				
0.582 5	13.77046 (5.055503)**	.0986544 (.2479253) *	-.7263233 (.0886972)**						.978755 (.4237086)**	-1.086324 (1.331603)*	-3.29867 (.3161769)*			
0.594 9	10.7406 (5.382739)*	.2659213 (.2686253) *	-.7397858 (.0883635)**	-1.120881 (.7263535)					.9727045 (.4200704)**	-1.140306 (1.320575)*	-3.085128 (.3137536)*			

0.587 4	13.40287 (5.072537)*	.122766 (.2493199 )	-.7643904 (.0972076)**		-.0898627 (.0936611 )			.8797839 (.4362918)**	-.8356735 (1.357646)*	-.3082999 (.3171337)*			
0.591 9	10.67222 (5.40775)*	.2689692 (.2696061 )	-.7535586 (.0972802)**		-.0473285 (.1032849 )	-1.343142 (1.204376 )		.9212977 (.4361695)**		-.3503383 (.3096198)*			
0.586 7	10.63412 (5.703923)*	.2595324 (.2805017 )	-.7571108 (.0978661)**		-.0796582 (.1099655 )	4.678579 (11.31677 )		.8634701 (.4392558)**				-5.054102 (9.473174 )	
0.585 8	11.33207 (5.41969)*	.2288168 (.2690603 )	-.7586376 (.0972819)**		-.0620945 (.1008939 )			.8811213 (.4348758)**				-1.160226 (1.009131 )	
0.590 1	11.90297 (5.354427)**	.2023919 (.265879)	-.7548978 (.0974642)**		-.0344046 (.1061723 )		-1.477177 (1.217109 )	.9181107 (.4372864)**	-1.298332 (1.339492)*				
0.583 1	14.61237 (5.060792)**	.0649864 (.2451487 )	-.7843831 (.1063239)**		-.1212898 (.1162458 )		.0407205 (.1117147 )	.8543003 (.437681)***	-1.064341 (1.341098)*				
0.558 2	13.12607 (5.422819)**	.2285981 (.2744412 )	-.8183685 (.0826311)**	-6.920744 (14.70261)		8.450019 (21.50336 )							
0.563 6	13.98869 (5.322173)**	.1760796 (.2700122 )	-.8530952 (.0873703)**		-.1118853 (.1015342 )	-1.045499 (1.221627 )							
0.560 3	15.97581 (5.022424)**	.07426 (.2472198 )	-.8742932 (.0975562)**		-.1770846 (.1137951 )		.0421726 (.1131368 )						
0.557 3	13.33882 (5.716506)	.2171807 (.284991)	-.8187026 (.0852308)**	-6.285402 (9.053407)								-6.536499 (11.29542 )	
0.259 5	1.684674 (7.155007)	.5009961 (.3676194)	-.376075 (.0781883)**			2.215357 (14.22969 )						-3.15328 (12.11829 )	
0.263 6	2.328646 (6.807921)	.4717034 (.3536478)	-.3843177 (.0738489)**						-1.176057 (1.720353)*			-1.296203 (1.206922 )	
0.271 0	1.057984 (6.812534)	.4973991 (.3514301)	-.344426 (.0796757)**				.7501745 (.6608056 )					-1.308014 (1.20078)	
0.262 7	4.023711 (6.181069)	.3372637 (.3161653)	-.3294451 (.0813989)**				.8146159 (.6827803 )					.0439519 (.0850629 )	
0.279 2	3.397291 (6.233943)	.3798661 (.3187439)	-.35757 (.0744624)**				-2.076651 (.1229557 )		-6.666759 (1.754879)*			.0657887 (.089456)	
0.354 1	1.687949 (5.966144)	.3649314 (.3037039)	-.2702165 (.0766574)**				-1.151185 (.1186383 )	1.599559 (.5319618)*	-.7467424 (1.672063)*			.0840906 (.0854407 )	
0.340 6	3.037184 (5.894448)	.3105546 (.301871)	-.2769047 (.0767781)**					1.706966 (.5273015)*	-1.052377 (1.661264)*			.0469943 (.0806399 )	

- ✓ Notes: Dependent variable is the natural logarithm of absolute change in employment.
- ✓ The figures in parentheses are standart errors.
- ✓ \*, \*\*, \*\*\* denote significance levels at the 10 %, 5 % and 1 % level, respectively.

### 9. Conclusion

In this paper, we estimate the effects of intra-industry trade on labor market changes in Turkish manufacturing industries during the period 2005-2008. If more disaggregated employment data were available, the period of analysis would be longer and would give better results. Also, this would permit the computation of a more sophisticated measure of adjustment costs.

Only the study of Erlat and Erlat (2006) has been carried out to explore the link between IIT and adjustment costs in the Turkish case. Given these results and comparing them with other empirical studies, it can be difficult to say that the results do not support the SAH. Some variables strongly support the SAH while some of them give insignificant results. In other words, the results appear to be closer to what Erlat and Erlat (2006) find for Turkey that used a similar model.

The model in this study is static and it is estimated using a fixed-effect estimator.

The expected contribution of this paper is the inclusion of the nature of the IIT variable ( $v_h$ ) to the similar model that used in the SAH literature. For further research, it can be better to focus on the nature of IIT, especially VIIT.

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