Marginal Intra-Industry Trade and Adjustment Costs in the Hungarian Food Industry

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1. Introduction

Recent developments in intra-industry trade (IIT) literature focus on the relationships between IIT and adjustment costs associated with changes in trade pattern. The effects of trade liberalisation depend, inter alia, on whether trade is of an inter-industry or intra-industry nature. Whereas the former is associated with a reallocation of resources between industries, the latter suggests a reallocation within industries. The belief that intra-industry trade (IIT) leads to lower costs of factor market adjustment, particularly for labour, gives rise to the smooth-adjustment hypothesis (Brülhart, 1999, 2000). Direct empirical support for the smooth adjustment hypothesis is not extensive and focuses exclusively on Western European countries in manufactural industries. Moreover, there are only few studies that focus on the intra-industry nature of agri-food trade, despite its growing importance. Hungarian agricultural trade was liberalised via WTO agreement and some regional trade integration agreement (Assocation Agreement, CEFTA). It is reasonable assume that these partial trade liberalisation should have an effect on trade pattern and employment changes. The aim of the paper is to identify the effects of partial trade liberalisation on adjustment costs in Hungarian food industry employing recent developments in the IIT literature.

The remainder of the paper is organised as follows. Section 2 briefly reviews the theoretical background on intra-industry trade and adjustment costs. Section 3 describes different measures of marginal IIT. Empirical results are presented, in section 4. The last section summarises and offers some conclusions on the implications for the costs of Hungarian food industry's economic integration with the world market.

2. Theoretical background

The proposition, that IIT entails lower costs of factor market adjustment than inter-industry trade, originally made by Balassa (1966). Adjustment costs arise from termporary inefficiences when markets fail to clear instantaneously in the changes of demand or supply conditions. More specifically, the adjustment costs in the context of trade expansion are those welfare losses that arise in labour markets from temporary unemployment due to factor price rigidity or from costs incurred through job search, re-location and re-training.

Adjustment affects all production factors. The analysis of IIT has been implicitly concerned with adjustment in the labour market. The usual framework for a discussion of adjustment issues is the specific-factors model (Brülhart and Elliott, 2002). This model assumes a small open economy which produces and consumes an exportable and an importable good facing perfect competition in all markets and given world prices. Labour can move between two sectors (but not between countries), all factors are fixed (the "specific" factors), and there are diminishing returns to factor inputs. Suppose an export boom, which is equivalent to a fall in the relative demand for importables, triggered by some measure of trade liberalisation. If adjustment were perfectly smooth, the economy would instantly attain a new equilibrium where the unique economy-wide wage in terms of the exportable fallen, and some workers have switched from contracting importing sector to growing export sector. In reality, this transition is likely to be costly. The specific-factor model suggest two sources of adjustment costs: factor price rigidity and factor specificity with the empirical manifestation being unemployment and factor price disparities, respectively (Neary, 1985). In practice, we are likely find both phenomena simultaneously.

3. Measuring of marginal intra-industry trade

The adjustment costs are dynamic phenomena, thus the static Grubel Lloyd index (GL) is not a suitable measure in this instance. Consequently, recent theoretical developments stress the importance of marginal IIT (MIIT) in the context of trade liberalisation interpretálásában (Hamilton and Kniest, 1991; Greenaway et al., 1994; Brülhart, 1994, 1999 and 2000; Thom–McDowell, 1999). Thus, „…it is the structure of the change in flows of goods (MIIT) which affects adjustment rather than trading pattern in any given time period (IIT)". Several indices of MIIT have been developed. The most popular measure used in recent empirical studies is that proposed by Brülhart (1994), which is a transposition of the GL index to trade changes:

(1) $$A_i = 1 - \frac{|\Delta X_i - \Delta M_i|}{|\Delta X_i| + |\Delta M_i|},$$

where Xj and Mj have the same meaning as in the case of the GL index and __ is the change in trade flows between two years. The A index varies between 0 and 1, where the extreme values correspond to changes in trade flows that are attributable to being entirely of an inter-industry (0) or intra-industry (1) nature. The A index is defined in all cases, can be aggregated over a number of product groups using appropriate weights.

Brülhart (1994) also propose other index:

(2) $$C = \left(|\Delta X| + |\Delta M|\right) - |\Delta X - \Delta M|,$$

which can be scaled by variables as production, net trade, sales or employment. Menon and Dixon (1997) criticise the C index, because it does not provide information about the extent of changes in trade pat tern relating to fac tor adjustment. Therefore they offer an index, wh ich focus on inter-industry trade.

3) $$\text{UMCIT} = \left|\Delta X - \Delta M\right| .$$

Azhar and Elliott [2003] propose the following index for measuring of trade induced adjustment:

(4) $$S = \frac{\Delta X - \Delta M}{\mathbf{2}(\max\left\{\left|\Delta X\right|_t, \left|\Delta M\right|_t\right\})},$$

where $t \in N$, $N=\{1, 2, 3, \ldots n\}$. The S index ranges bet ween –1 and 1, its value negative, if sectoral trade balance is det eriorated, and it ta kes a positive value if sectoral trade balance is improved. There are t wo important issues, which matter for MIIT measures. First, measurements of MIIT indices requi re a choice of the most appropriate time period. However, there is no guide for the empirical work to indentify the relevant time interval. Oliveras and Terra (1997) investigate statistical properties of t he A index and poin out that there is no general re lationship between the A index of a certain pe riod and corresponding indices of any subperiods. They als find that there is no general relationship between the A index of a given industry and the corresponding indices of any subindustries. Consequently, re sults based on the A index are very sensitivy to choice of period and industry aggregation. However, Oliveras an d Terra (1997) note, this inconsistency may provide additional information about the adjustment process. Moreover, Fertő and Hubbard (2001) confirmed th e sensitivity of results on period choice analysing trade in agri -food products between Hungary and the EU. Brülhart argue that choice of period should be investigated carefully in empirical analysis. Second problem in empirical analysis is the intertemporal sequencing of trade adjustment. Namely, changes in firms' payr oll follow changes in sales only with a certain time lag. Since there are no theoretical or empirical priors on the size of time lag, thus this issue should be investigated more in depth.

4. Empirical results

The data are supplied by the OECD at the five-digit level of the Standard International Trade Classification (SITC) in U.S. dollars. Trade data are transformed in ISIC four-digit level, the full sample contains 18 industries between 1992 and 2002. The panel is balanced with observations on 18 industries for eleven years Production and employment data are from Hungarian Statistical Office. Production data are calculated at the real exchange rate in U.S. dollar.

Following Brülhart and Elliott (1998) we analyse the relationship between MIIT and the adjustment costs. Testable hypotheses are following. First, an improvement in productivity changes has a negative effect on the employment growth. Second, the increase in domestic consumption positively influences the rise of employment. Third, good sectoral trade performance is positively related to employment growth. Finally, there is a positive link between MIIT and employment growth. Following Brülhart and Elliott (1998) two models of employment changes are estimated. The first model assumes that productivity changes are exogenous and independent from changes in domestic demand.

(5) $$\Delta Empl_{it}=\beta_1+\beta_2\Delta PROD_{it}+\beta_3\Delta CONS_{it}+\beta_4 TPER_{it}+\beta_5 MIIT_{it}+v_i+\varepsilon_{it},$$

where $\Delta Empl_{it}$ is the change in employment in the i^{th} industry in t^{th} time period, PROD is labour productivity (output per worker) and CONS is domestic consumption. TPER is a dummy variable of trade performance based on the B index. It takes the value one, if the sectoral trade balance has improved; otherwise its value is zero. MIIT stands for matched trade changes as measured by various MIIT indices defined above. Because there is no agreement between scholars which measure is the best for MIIT, therefore our results may sensitive on the choice of a particular index. Consequently we apply four different indices and we estimate the model employing each of them separately. In the second model we assume that productivity changes to be determined endogenously be changes in domestic demand and trade pattern. Therefore, we drop the PROD variables from equation and re-estimate the reduced equation.

4.1. Year-on-year regression results

The results of fixed effects panel data model are reported in Table 1. In the first model, the coefficients of productivity and domestic consumption are significant and they have expected signs. In other words, an increase in domestic consumption leads to employment growth and productivity increases relate negatively to employment growth. The variable of sectoral trade performance and MIIT indices are not significant with unexpected signs. In short, different specifications lead to the nearly results.

In the second model, the signs of variables remain the same, however only coefficients of domestic consumption are significant (Table 2). The explanatiory power of model reduced drastically indenpendently from a particular specification.

4.2. The length of period

The values of MIIT indices are sensitive on the length of period. However, except Brülhart (2000), there is no paper, which explicitly focuses on the problem of time interval. Thus, following Brülhart's (2000) strategy we investigate carefully this issue. More specifically, we test how affect on the results if we extend the length of time period.

Our dataset covers ten years (1992-2002). Thus, the lower and upper bound on possible time periods are two and ten years. Defining of time intervals should be based on the choice of an appropriate base of start and end period. Therefore, two subintervals should be no overlapping and of the same length. Following Brülhart (2000) we choose the average over years 1-5 as the base period and the average over years 6-10 as the end period, due to eliminate the short-term volatility of data as interval is extended. To express formally

$$A_{\overline{BE}} = 1 - \frac{\left|(X_E - X_B) - (M_E - M_B)\right|}{\left|(X_E - X_B)\right| + \left|(M_E - M_B)\right|}, \qquad (6)$$

where B and E denote the base and end period respectively. We define the first year of interval as t and number of years in total period as I.

$$X_B = \frac{\sum_{y=t}^{t+\mathrm{int}(I/2)} X_y}{\mathrm{int}(I/2)} \text{ and } X_E = \frac{\sum_{y=t+I\,\mathrm{int}(I/2)}^{t+I} X_y}{\mathrm{int}(I/2)}, \qquad (7)$$

assuming downward rounding in the integer function. We calculate similarly the start and end period for imports.

We re-estimate the model (equation 5) for two-, five- and eight-year periods (Table 3). The productivity variables (ΔPROD) are robust for all specifications and time intervals. The coefficients of domestic consumption (ΔCONS) are significant for two years intervals, but they are significant for five and eight years period with expected signs. The estimated coefficients of TPER variable are significant only twice from twelve possible cases, and they change their signs for the A, C and UMCIT specifications. The signs of MIIT indices also change, except the S index. The coefficients on the A index are significant when the size of the interval exceeds one year with expected signs for two and five years periods. Note there is explanatory power of models increasing with growth of time intervals. In short, our results are sensitive for the length of time period and the choice of MIIT indices.

4.3. The lag structure

For the reasons mentioned in section 3, the sequencing problem also requires detailed scrutiny. Therefore we re-estimated the model with three different lag structures on the regressand with two-year lag, three-year lag and four-year lag. Table 4 reports our results for various MIIT indices. The coefficients of ΔPROD and ΔCONS variables are significant with expected signs, except for four-year lag of domestic consumption variable. The signs of TPER variable change for the A, C and UMCIT specifications, while for S index it has expected signs without significance. MIIT variables are not significant, but the A index has expected sign for all lags. In short, the sensitivity analyses confirm that trade related variables have no significant effects on employment changes if lags are extended.

5. Conclusions

This paper focuses on some dynamic aspects of the smooth adjustment hypothesis associating to the intra-industry trade. More specifically, the paper investigated how trade liberalisation affects on employment changes in Hungarian food industry between 1992 and 2002. Our results suggest that the growth in domestic consumption have positive effect on employment changes, while the increase of productivity is negatively related to employment growth. However, we do not find significant relationships between good sectoral performance and employment changes. Similarly, our results suggest there is no connection between MIIT and employment changes. In addition, two specific questions were investigated. First, we focused on the appropriate size of time intervals for MIIT and corresponding labour market adjustment. The data are rather favour to the longer time period comparing to year-on-year intervals. Second, we investigated the relative timing of trade and labour market changes assuming different lag structures. The calculations suggest that labour market effects may follow changes in medium term. To summarise, our results suggest that trade liberalisation has not influenced significantly the employment changes in Hungarian food industry. In other words, we do not find clear evidence to support smooth adjustment hypothesis. However, our results should be interpreted only with care due to sensitivity on the choice of period and lag structure.

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Table 1 Employment Changes and Marginal IIT: Year on Year Fixed Effects Panel Estimates

	Aj	C	UMCIT	S
	ΔEMPL			
ΔPROD	-0.291***	-0.293***	-0.293***	-0.291***
ΔCONS	0.004**	0.004***	0.004**	0.004***
TPER	-0.021	-0.023	-0.022	0.002
MIIT	-0.016	1.304e-07	-2.005e-09	-0.026
constant	-0.101	0.006	-0.007	0.006
N	180	180	180	180
R^2	0.255	0.254	0.253	0.255

Note: significance level s are* 10 per ce nt, ** 5 per ce nt, ***1 per ce nt

Table 2 Employment Changes and Marginal IIT: Year on Year Fixed Effects Panel Estimates (restricted model)

	Aj	C	UMCIT	S
	ΔEMPL			
ΔCONS	0.003*	0.003*	0.003*	0.003*
TPER	-0.032	-0.034	-0.034	0.0154
MIIT	-0.031	1.007e-07	1.038e-07	-0.0542
constant	0.002	-0.005	-0.006	-0.031
N	180	180	180	180
R^2	0.035	0.032	0.032	0.038

Note: significance level s are* 10 per ce nt, ** 5 per ce nt, ***1 per ce nt

Table 3 Fixed Effects Panel Estimates with Varying Time Intervals

	Aj			C			UMCIT			S		
	2 year	5 year	8 year	2 year	5 year	8 year	2 year	5 year	8 year	2 year	5 year	8 year
ΔPROD	-0.341***	-0.603***	-0.658***	-0.333***	-0.581***	-0.625***	-0.343***	-0.577***	-0.700***	-0.341***	-0.566***	-0.695***
ΔCONS	0.015	0.068***	0.348***	0.014	0.067***	0.349***	0.015	0.069***	0.346***	0.013	0.066***	0.347***
TPER	-0.061	-0.002	0.055	-0.072*	-0.003	0.028	-0.048	-0.004	0.034	0.09	0.191*	0.041
MIIT	0.110*	0.207***	-0.158*	2.32e-06***	1.858e-06	-2.146e-06	-2.356e-07	-9.595e-07	1.732e-07	-0.148	-0.218*	-0.009
constant	-0.005	-0.082**	-0.088**	-0.002	-0.053*	-0.093**	0.022	-0.008	-0.115**	-0.058	-0.129**	-0.115**
N	162	108	54	162	108	54	162	108	54	162	108	54
R^2	0.229	0.479	0.484	0.216	0.462	0.498	0.219	0.453	0.530	0.224	0.494	0.533

Note: significance levels are* 10 per cent, ** 5 per cent, ***1 per cent

Table 3 Fixed Effects Panel Esti mates with Varying Lags

	Aj			C			UMCIT			S		
	2 year	3 year	4 year	2 year	3 year	4 year	2 year	3 year	4 year	2 year	3 year	4 year
ΔPROD	-0.309***	-0.266***	-0.202***	-0.295***	-0.270***	-0.206***	-0.306***	-0.268***	-0.205***	-0.305***	-0.271***	-0.203***
ΔCONS	0.004**	0.004**	0.004	0.004**	0.004**	0.002	0.004**	0.004**	0.003	0.004**	0.004**	0.002
TPER	0.015	-0.010	0.044	0.019	-0.003	0.062*	0.016	-0.003	0.053	0.044	0.005	0.082
MIIT	0.015	0.059	0.059	-1.058e-06	-3.069e-07	-1.270e-06	-1.542e-07	-6.002e-07	8.667e-08	-0.032	-0.012	-0.035
constant	-0.022	-0.028	-0.062**	-0.013	-0.012	-0.042**	-0.016	-0.005	-0.049*	-0.034	-0.020	-0.065*
N	144	126	108	144	126	108	144	126	108	144	126	108
R^2	0.258	0.248	0.177	0.264	0.246	0.195	0.258	0.251	0.170	0.263	0.244	0.172

Note: significance level s are* 10 per ce nt, ** 5 per ce nt, ***1 per ce nt