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ABSTRACT

This study investigates export and import dynamics of Turkey in the context of the main Broad Economic Classification (BEC) sectors. Our results suggest that the trade equations do not remain stable when an endogenously estimated regime change is taken account. According to our results, consistent with the elasticity pessimism literature, real exchange rate elasticities of exports and imports are considerably low in absolute value. Exports and imports are basically determined by world real output and domestic real income, respectively, with substantially high elasticities. Consistent with the fact that Turkish integration to global value chains has substantaily increased during the post-2000 period especially in intermediate and capital goods sectors, the real exchange elasticities of exports and imports decrease (in absolute value) during the recent period. Our results suggesting that the external income elasticity of exports, for all sectors, is substantially higher than the domestic income elasticity of imports support that the Houthakker and Magee findings still remains a puzzle even under case of the higher participation in the global value chains.

Key words: current account deficits, exports, global value chains, imports, real exchange rates, trade elasticity, Turkey.

JEL Classification: F1, F4

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I. INTRODUCTION

The determinants of external trade dynamics have always been at the centre of macroeconomics literature. The conventional international trade literature maintains that products for exports and imports are imperfect substitutes and trade dynamics are mainly determined by deviations from the law of one price (real exchange rate changes) and demand conditions. Consequently, under Marshall-Lerner condition, a real depreciation of domestic currency improves international competitiveness and thus external trade balance. The recent literature, however, often finds that the Marshall-Lerner condition does not hold, real exchange rate elasticities are much lower and income elasticities are substantially higher than the theory postulations.

Another important empirical issue, which is often called as the Houthakker-Magee (1969) puzzle, is the finding that the estimated income (domestic) sensitivity of imports significantly exceeds the income (foreign) sensitivity of exports. The values of estimated income elasticities are often found to be quite high. The high domestic demand elasticity of imports may render the sustainability of trade deficits under growth whilst a high external demand elasticity of exports may lead to economic growth vulnerable to adverse global conditions. Furthermore, under the Houthakker-Magee puzzle, a real depreciation of the domestic currency may not be sufficient to improve the external trade balance even under the Marshall-Lerner condition.

There are ample explanations of the estimated low trade price elasticities and the Houthakker-Magee puzzle. Imbs and Mejean (2010) and Berman, Martin and Mayer (2012) stress the ignored role of sectoral heterogeneity in the estimated low price elasticities. Kharroubi (2011) suggests that, the higher degree of vertical specialisation and higher participation in global value chains act to reduce the price

sensitivity of trade. Amongst the many other important reasons including imperfect exchange rate pass-through, pricing to market and different production structures, the increase in the links to global value chains offer convincing explanations of the low trade price elasticities and/or the high income elasticities.

In recent decades, along with financial globalisation, the world economy has witnessed increasingly higher degree of globalisation of production and trade such that production of final product is sliced up into different stages and tasks are distributed among different countries. This process which is called global value chains (Krugman, 1995; Baldwin, 2012; Baldwin and Lopez-Gonzalez, 2013; Johnson, 2014) or vertical integration (Hummels *et al*., 2001) leads to countries more dependent on imported inputs for domestic production and exports. This process increases the complementarity of exported and imported goods leading to a decrease in the real exchange rate elasticity of trade whilst increasing the sensitivity of exports and domestic growth to global growth (demand) conditions (Jones and Kierzkowski, 2001; Arndt and Huemer, 2004; IMF, 2007; Kharroubi, 2011).

After the financial crisis of 2001, the Turkish economy has experienced some important policy regime changes, including flexible exchange rate regime under inflation targeting, higher macroeconomic stability and higher linking to global value chains (GVC). According to the recent trade in value added (TIVA) statistics[1], the domestic value-added (%) share of gross exports declined from 88.8 in 1995 to 84.7 in 2000, 79.0 % in 2005 and 73.2 in 2008. Consistent with the argument that the linking

[1] Due to the increasing importance of GVC, OECD and WTO recently published trade in value added (TIVA) statistics (http://oe.cd/tiva) based on harmonised OECD input-output tables. See Backer and Mirodot (2013), Banga (2013), Koopman, Wang and Wei (2014) and the articles in Elms and Low (2013) for the details of the TIVA database. See also, Hummels, Ishii and Yi (2001), Baldwin (2012), Johnson (2014) for the recent evaluations of global value chains.

to GVC is essentially the case for intermediate and capital goods trade, the decline in the share of domestic value added in gross exports of these sectors were much more striking. The share of domestic value added in gross imports, for instance, declined from 89.5 in 1995 to 77.1 in 2000 and to 57.0 in 2008 for chemicals industry. Similarly, compared to the 1995 values, the domestic value added shares declined from 84.3 to 61.0 for basic metals, from 86.6 to 71.0 for machinery and equipment, from 74.3 to 64.5 for electrical equipment and from 74.4 to 68.7 for transport equipment industries in 2008. The TIVA GVC participation index (Koopman, Wang and Wei, 2014), basically due to the increase in the intermediate and capital goods trade, increased by 75 % between 1995 and 2008. Consistent with the Lucas (1976) critique, the trade elasticities, may not be invariant to all these policy regime changes.

The aim of this paper is to investigate whether export and import dynamics of Turkey in the context of the main Broad Economic Classification (BEC) sectors remain stable when an endogenously estimated regime change is taken account. To this end, we employ not only the conventional procedures developed for a data generation process without a break, but also the Gregory and Hansen (1996) method which allows stationarity around an endogenously estimated structural break under the alternative hypothesis. The following section briefly reviews the studies on Turkish trade dynamics and presents the empirical procedures and results. Section III concludes and provides policy implications.

II. EMPIRICAL ANALYSIS

Figures 1 and 2, respectively, present the composition of exports and imports in Turkey during the post 1990 period. The share of intermediate goods exports fluctuating around 40 % until the early 2000's appears to increase to around 50 % during the post-2000 period. The share of exports of consumption goods decreased to 40 % from around 50 % during the last decade. Capital goods exports, albeit showing an increasing trend, increased its' share only to 10 %. The bulk of Turkish imports (around 70%) is the intermediate goods imports whilst the shares of capital and consumption goods fluctuated around 20 % and 10 %, respectively[2].

[INSERT FIGURES 1 AND 2 ABOUT HERE]

The recent studies on Turkish trade dynamics provide important contributions to the literature. Saygılı and Saygılı (2011) find that the higher integration of Turkey into GVC has led to changes in commodity composition of exports in favour of non-traditional commodities which have higher income and import but lower real exchange rate sensitivity. Consistent with these findings, the results by Saygılı and Saygılı (2011) suggest that income and import elasticities of exports continuously increased whilst the real exchange rate elasticity persistently decreased during the recent period. Saygılı (2010) and Özmen (2014) show that the trade elasticities change not only between time periods but across the sectors of the Turkish manufacturing industry. According to Saygılı (2010), due to their higher import dependency, real exchange rate appreciations lead to an increase in exports of capital intensive manufacturing industry sectors. For the main BEC sectors, Togan and Berument (2007) finds that income and exchange rate elasticities of consumption goods imports are higher compared to those

[2] Taymaz, Voyvoda and Yılmaz (2011), Saygılı and Saygılı (2011) and Özmen (2014) provide recent detailed investigations of the Turkish external trade dynamics.

of capital and non-energy intermediate goods and the income elasticity is higher than price elasticity in the long run in all categories. Aldan, Bozok and Günay (2012) employ Kalman filter procedure and find that income elasticity of exports tends to increase whilst real exchange rate elasticity tends to decrease over time.

To investigate the evolution of Turkish trade, we consider the following conventional[3] long-run real export and import equations

$$exp_t = \gamma_0 + \gamma_1 reer_t + \gamma_2 x^*_t + u_{1t} \quad (1)$$

$$imp_t = \beta_0 + \beta_1 reer_t + \beta_2 x_t + u_{2t} \quad (2)$$

where exp = ln(EXP), EXP = volume of exports, imp = ln(IMP), IMP = volume of imports, reer = ln(REER), REER = reel effective US $ exchange rate, x = ln(RGDP), RGDP= real domestic GDP and x* = ln($RGDP^W$), $RGDP^W$ = foreign (world) real GDP[4].

Considering the potential endogeneity of real exchange rates and domestic real output for the long-run evolution of the external trade dynamics, we first estimate the equations by employing fully modified OLS (FM-OLS) procedure developed by Phillips ve Hansen (1990). Table 1 reports FM-OLS results for the basic sectors according to the BEC sectors for the 1994:1-2013:4 period Turkish quarterly data. Given that all the variables are integrated of order one[5] (I(1)), the stationarity of the residuals from the equations implies a long-run equilibrium relationship (cointegration).

[3] See Goldstein and Khan (1985), Hooper *et al*. (2000) and Chinn (2004) for the derivation of the conventional model.

[4] The data for EXP, IMP and RGDP are fromTurkish Statistical Institude (TUIK), REER are from Bank of International Settlements (BIS) and RGDPW are from IMF-IFS. All the series except REER are seasonally adjusted using the X12 procedure.

[5] The results from the conventional unit root test statistics (not reported to save the space) suggested that all the variables in lvels are integrated of order 1 (I(1). Consequently, the stationarity of the residuals from the estimated equations can be interpreted as evidence supporting the presence of cointegration between the variables in the equations.

Equations (1.1) and (1.3) report the results for aggregate exports and imports, respectively. Consistent with the elasticity pessimism, the real exchange rate elasticity appears to be low especially for aggregate exports. The domestic income sensitivity of exports is greater than unity whilst the foreign income sensitivity of exports is substantially as high as 4.5. The relatively high domestic demand elasticity of imports may render the sustainability of trade deficits under growth whilst the substantially high external demand elasticity of exports may lead to economic growth severely vulnerable to adverse global conditions. The real exchange rate elasticity of exports is statistically significant only for consumption goods which indeed constitute about the half of the aggregate exports. Exports of capital, intermediate and consumption goods, as presented by equations (2.1), (3.1) and 4.1), correspondingly, all appear to be basically determined by external demand with substantially high foreign income elasticities. Imports of capital goods have the lowest real exchange rate elasticity (0.58) whilst the elasticity is close to unity for intermediate (0.93) and consumption (0.83) goods. Real domestic income elasticity of imports are all higher than unity for all sectors with the highest elasticity is estimated for capital goods. These estimates essentially do not support the Marshall-Lerner condition and indeed provides a different puzzle from that of the Houthakker-Magee puzzle, such that the estimated foreign income sensitivity of exports exceeds the domestic income sensitivity of imports. Given that growth of emerging market economies highly dependent on external financial and real conditions (Özatay, Özmen and Sahinbeyoglu, 2009; Köse, Otrok and Prasad, 2012; Erdem and Özmen, 2014), the Houthakker-Magee findings may be interpreted as a puzzle basically for advanced economies.

All these elasticity estimates, albeit theoretically plausible, maintains that there is a single policy regime during the period or the parameters are invariant to policy regime changes. Although it lies at the centre of the debate, incorporating the regime change effects to the international trade analyses is yet to be a common practice. A policy regime change, however, may lead to structural breaks either in income and/or price elasticities. In such a case, employing conventional procedures such as FM-OLS would be misleading as these are known to be biased towards not-rejecting non-stationarity if the data generation process is, in fact, stationary around a broken mean and/or trend (Gregory and Hansen, 1996).

Gregory and Hansen (1996) have developed residual-based cointegration tests that allow for an endogenously determined structural break in the cointegration relationship. We consider the regime shift model of Gregory and Hansen (GH) which takes the generic form for y and x:

$$y_t = \mu_1 + \mu_2 D_t + \beta_1 x_t + \beta_2 x_t D_t + u_t \qquad (3)$$

where $D_t = 1(t > [T\tau])$, $\tau \in (0,1)$ is an unknown parameter denoting the (relative) timing of the change point, 1(.) is the indicator function, and [] denotes the integer part. In (3), β_1 (μ_1) is the slope (intercept) term before the shift and β_2 (μ_2) is the change in the slope (intercept) term due to the shift. The Phillips-Perron statistic to test the nonstationarity of the residuals in (3), hence the null of no cointegration between the I(1) variables, at τ gives Gregory and Hansen's Z_t^* test:

$$Z_t^* = \inf_{\tau \in (N)} Z_t(\tau)$$

Following Gregory and Hansen we consider N = (0.15, 0.85) and compute the test statistic for each integer point in the interval ([0.15T], [0.85T]). We are interested in

the smallest value of $Z_t(\tau)$ across all possible break points since small values of it provide evidence against the null of no-cointegration.

Table 2 presents the results of the GH procedure applied to regression of the trade equations augmented with the endogenous regime shift variables under the null hypothesis of no regime change. The results for all the main BEC sectors, except exports of capital and consumption goods, strongly suggest the presence of regime shift after the financial crisis of 2001 which indeed corresponds to higher integration to GVC and stronger macroeconomic stability.

Table 1 presents also the estimation results of the conventional equations augmented with the interactions of the endogenously estimated regime shift dummy variables. The results from GH tests (CI(GH)) suggest that the residuals are stationary at the 10 % level when the endogoneusly estimated break points are taken into account. Consequently, the equations may be interpreted as representing long-run or cointegration relations under a regime shift. For aggregate exports, the coefficients of real exchange rate (reer) and foreign income both significantly change after the post-2002:1 period. The impact of external demand decreases from 4.9 to around 4.1 during the last period, which remains indeed still as substantially high (eq. 1.2). The reer elasticity of exports which is estimated as -0.86 for the first period, on the other hand, increases significantly in the second period and becomes statistically insignificant (eq. 1.4). The sensitivity of aggregate imports to domestic income decreases but remains elastic during the recent period.

Capital goods imports equation (2.3), consistent with the GH results presented by Table 2, remains stable across the sample period. Capital goods exports (2.2), on the other hand, exhibits a structural change both for the external demand and reer

coefficients at the endogenous break point estimate. The reer elasticity increases from 0.60 to 0.45 and becomes statistically insignificant after 2002:1. Foreign demand elasticity increase from a substantially high value (7.5) to 8.4 in the recent period.

The foreign income elasticity of intermediate goods exports, which indeed constitute around 45 % of total exports, decreases in the recent period but remains still very high with a value of 4.3 (eq. 3.4). Exports of intermediate goods appear to be sensitive reer with around a unitary elasticity before 2001:4. This elasticity, however, becomes insignificant after this period. Consequently, the results suggest that, in line with the conventional model albeit with very high income elasticity, exports of both the intermediate and capital goods were determined by reer and external demand during the pre-2002 period. Consistent with higher integration with global value chains, their price (reer) elasticity substantially decreases and exports of intermediate and capital goods become solely determined by external demand in the long run during the recent period. As for the exports, imports of intermediate goods constitute the bulk (around 70%) of Turkish imports[6]. The domestic income elasticity of intermediate goods imports remains stable whilst the reer elasticity slightly decreases after 2001:4. Another important export item, consumption goods is basically determined by external demand with relatively high elasticity (3.7) and reer, the inelastic value (0.40) of which further declines after 2002:1. The determinants of consumption goods imports, which constitute only around 10 % of the total, remained stable with elastic domestic income and approximately unitary domestic income coefficients.

[6] An important part of external trade is "processed materials incidental to industry" trade which constitute around 30 % of both aggregate imports and exports and 70 % of exports and 50 % of imports of intermediate goods. The results for this item were essentially the same with those for intermediate goods trade, therefore not reported to save the space.

III. CONCLUDING REMARKS

We investigated the trade dynamics of the main BEC sectors of Turkey. Our results suggest that most of the trade equations do not remain stable when an endogenously estimated regime change coinciding with a period of higher participation in GVC, stronger macroeconomic conditions and flexible exchange rate regime is taken account. According to our results, supporting the elasticity pessimism literature, real exchange rate elasticities of exports and imports are considerably low in absolute value. Potentially due to much higher participation in GVC during the post-2000 period, especially in intermediate and capital goods sectors, the real exchange elasticities of exports and imports decrease (in absolute value) during the recent period.

According to the TIVA GVC participation index (Koopman, Wang and Wei, 2014), basically due to the increase in the intermediate and capital goods trade, Turkish participation in GVC increased by 75 % between 1995 and 2008. The participation index, basically due to the increase in the intermediate and capital goods trade, increased by 75 % between 1995 and 2008. The TIVA database distinguishes linking to GVC as backward participation (the use of foreign inputs in exports) and forward participation (the use of domestic intermediates in third country exports). The backward participation index increased from 11.2 in 1995 to 26.3 in 2008 (134 %) whilst the forward participation index increased from 13.5 in 1995 to only 16.6 in 2008 (23 %) and consequently the 74 % in total participation (from 24.7 to 42.9) was mainly due to the increase in backward participation[7]. The higher backward participation may be interpreted as the main cause of the low exchange rate elasticities of intermediate and capital goods imports.

Exports and imports are basically determined by world real output and domestic real income, respectively, with substantially high elasticities. The relatively high domestic demand elasticity of imports may render the sustainability of trade deficits under growth whilst the substantially high external demand elasticity of exports may lead to economic growth severely vulnerable to adverse global conditions[8]. An important finding is that, opposite to the Houthakker and Magee (1969) findings, the external income elasticity of exports for all the sectors, is substantially higher than the domestic income elasticity of imports[9]. Given the low trade price elasticities, especially during the post-2001 period, real exchange rate depreciation policies may not be an effective policy option for reducing the Turkish growing external trade and current account deficits. Alternatively, industrial policies aiming to decrease backward participation along with total participation in GVC might be more effective in achieving sustainable higher growth and lower external deficits.

[7] The % change in the backward (forward) participation between 1995 and 2008 was, for instance, 350 (12.5) for chemicals and non-metallic products, 475 (60) for basic metals, 975 (300) transport equipment and 650 (200) for machinery and equipment industries.

[8] The recent experience during the peak of the global financial crisis (2009) leading sharp declines in both world and Turkish real output provides an example. During 2009, despite a substantial real exchange rate depreciation (around 8 %), the Turkish real exports declined around 7.1 % with the decline in capital and consumption goods exports were 30 % and 25 %, respectively. Aggregate imports declined 12.7 % and the decline in the major import item, intermediate goods, was 13.4 %.

[9] Compared to the conventional imperfect substitutes model, participation in GVC may be expected to increase the income elasticities of trade and thus potentially offering a plausible explanation of the high income elasticity part of the Houthakker and Magee puzzle. Given the observation that, advanced countries use more domestic inputs for production and have higher forward participation indices (Backer, and Miroudot, 2013 and Baldwin, 2012), their income elasticity of imports might be expected to be lower. For small open economies relying more on international sourcing for production with higher backward participation and substantially depending on external demand conditions, might be expected to have larger income elasticities for both exports and imports. However, neither of these explanations do not eliminate the puzzle if not make more complex.

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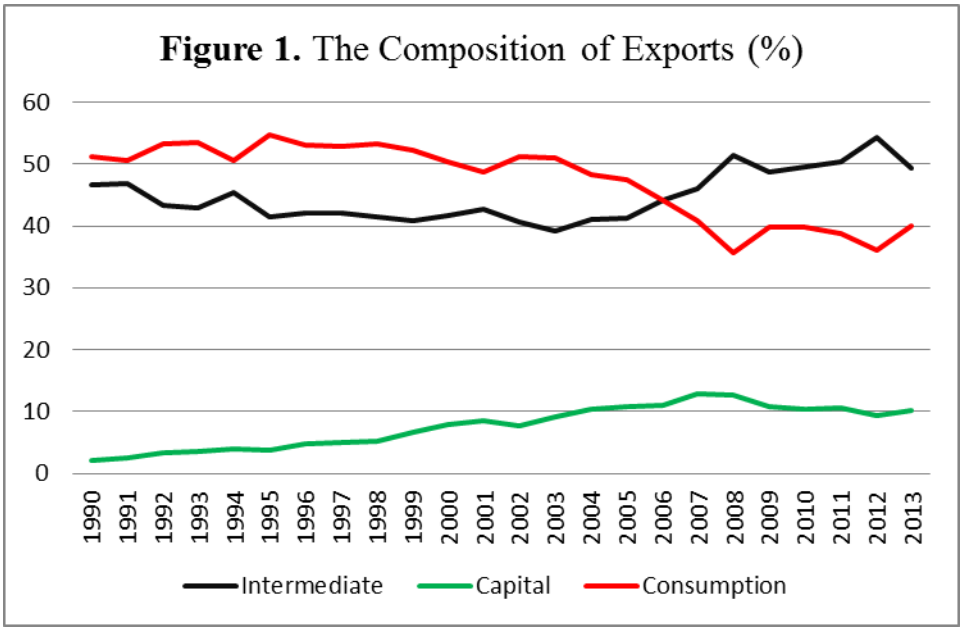
Figure 1. The Composition of Exports (%)
60
50
40
30
20
10
0
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Intermediate
Capital
Consumption

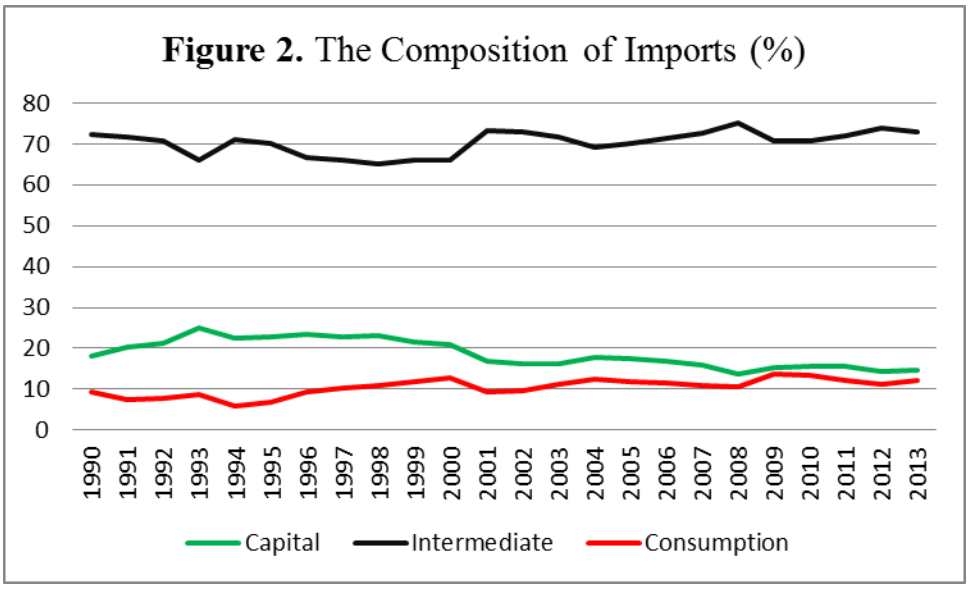
Figure 2. The Composition of Imports (%)
80
70
60
50
40
30
20
10
0
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Capital
Intermediate
Consumption

Table 1. Export and Import Equations: BEC Basic Sectors

Sector	**Total**				**Capital goods**		
	Export		**Import**		**Export**		**Import**
Equation	**(1.1)**	**(1.2)**	**(1.3)**	**(1.4)**	**(2.1)**	**(2.2)**	**(2.3)**
constant	-20.28** (1.005)	-16.278** (1.119)	-6.49** (0.377)	-6.687** (0.749)	-38.82** (1.228)	-30.13** (1.593)	-7.85** (0.612)
$reer_t$	-0.518** (0.268)	-0.856** (0.217)	0.896** (0.175)	0.380 (0.279)	-0.272 (0.328)	-0.595** (0.308)	0.578** (0.284)
x^w_t	5.492** (0.392)	4.947** (0.355)			8.207** (0.486)	7.505** (0.505)	
x_t			1.592** (0.131)	2.141** (0.361)			2.237** (0.213)
D_B*reer_t		0.986** (0.306)		0.752** (0.397)		1.049** (0.436)	
$D_B*x^w_t$		-0.827** (0.272)				0.875** (0.387)	
D_B*x_t				-0.733** (0.395)			
	R^2 = 0.97 LRV= 0.03 CI(PO)= -2.93[0.24]	R^2 = 0.99 LRV= 0.01 CI(GH)= -4.44[0.01] D_B= 2002:1	R^2 = 0.98 LRV= 0.02 CI(PO)= -3.71[0.05]	R^2 = 0.98 LRV= 0.01 CI(GH)= -5.55[0.04] D_B= 2003:1	R^2 = 0.98 LRV= 0.04 CI(PO)= -3.98[0.04]	R^2 = 0.99 LRV=0.02 CI(PO)= -5.55[0.01] CI(GH)= -5.91[0.05] D_B = 2003:1	R^2 = 0.96 LRV= 0.05 CI(PO)= -3.83[0.05]

Notes: The values in parentheses are the standard errors. (*) and (**) denote significance at the 5 % and 1% level, respectively. LRV denotes long-run variance and CI(PO) presents Phillips ve Ouliaris (1990) residuals-based for cointegration. CI(GH) are the Gregory and Hansen (1986) test results at the endogenously estimated regime change point D_B. The figures in [] are the p-values for the null of no cointegration

Tablo 1 (c). Export and Import Equations: BEC Basic Sectors							
Sector	**Intermediate goods**				**Consumption goods**		
	Export		**Import**		**Export**		**Import**
Equation	**(3.1)**	**(3.2)**	**(3.3)**	**(3.4)**	**(4.1)**	**(4.2)**	**(4.3)**
constant	-20.75** (1.480)	-17.57** (1.992)	-5.65** (0.467)	-4.14** (0.583)	-16.66** (0.783)	-12.02** (0.749)	-5.66** (0.766)
$reer_t$	-0.565 (0.395)	-1.295** (0.386)	0.926** (0.217)	0.759** (0.178)	-0.534** (0.209)	-0.402** (0.114)	0.829** (0.356)
x^w_t	5.647** (0.585)	5.621** (0.632)			4.755** (0.310)	3.669** (0.219)	
x_t			1.360** (0.163)	1.164** (0.148)			1.439* (0.267)
D_B*reer_t		1.730** (0.545)		0.041** (0.012)		0.057** (0.001)	
$D_B*x^w_t$		-1.493** (0.484)					
	R^2 = 0.95 LRV= 0.06 CI(PO)= 2.86[0.32]	R^2 = 0.97 LRV= 0.03 CI(PO)= -4.31[0.09] CI(GH)= -7.00[0.01] D_B = 2001:4	R^2 = 0.96 LRV= 0.03 CI(PO)= -3.51 [0.10]	R^2 = 0.97 LRV= 0.02 CI(PO)= -4.11[0.09] CI(EG)= -5.75[0.05] D_B = 2001:4	R^2 = 0.98 LRV= 0.02 CI(PO)= -3.10[0.21]	R^2 = 0.99 LRV=0.01 CI(PO)= -4.98[0.01] CI(GH)= -5.30[0.05] D_B = 2002:1	R^2 = 0.91 LRV= 0.07 CI(PO)= -4.40[0.03] CI(EG)= -4.29[0.04]

Table 2. Structural Break in Trade Equations: GH Test results		
Sector	Z_t*	Break date (T_B)
Exports	-6.43***	**2002:1**
Imports	-5.55**	**2003:1**
Exports: Capital goods	-5.91	**2002:1**
Imports: Capital goods	-4.85	1998:1
Exports: Consumption goods	-5.30**	**2002:1**
Imports: Consumption goods	-3.96	2001:1
Exports: Intermediate goods	-7.00***	**2001:4**
Imports: Intermediate goods	-5.75**	**2001:4**
Notes: ** and *** denote the rejection of the unit root null at the estimated break point (T_B) at the 5 % and 1 % levels, respectively. The bold faces for the T_B indicates that the equation represents a cointegration relationship with a regime shift at T_B.		