Determinants of Sectoral Import in Manufacturing Industry: A Panel Data Analysis

İmalat Sanayinde Sektörel İthalatın Belirleyicileri: Panel Veri Analizi

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ABSTRACT

This paper investigates determinants of sectoral import in Turkey's manufacturing industry over a sample from 1998Q1 to 2012Q2 by using Augmented Mean Group analysis which is introduced by Eberhardt and Teal (2008) and developed by Eberhardt and Bond (2009). The model takes into account parameter heterogeneity and cross-sectional dependence. Cross-sectional dependence is tested by CD-Bias test of Pesaran (2008), while Cross-Sectionally Augmented Dickey-Fuller (CADF) test proposed by Pesaran (2007) is employed for testing for the presence of a unit root and cointegration among the variables is tested by using the methodology of Westerlund (2008). The regression results indicate that elasticities of import demand with respect to industrial production are different at sectoral level and coefficients of real exchange rate are significant and positive for almost all of the sectors. It is seen that the sectors with highest elasticities of import demand with respect to industrial production are basic metals, motor vehicles, eletrical machinery and textiles. Also, working day variable and crisis dummy are used to explore the impact of calendar day effect and global crisis.

Keywords: Turkey, import, sectoral panel analysis

ÖZET

Bu çalışma, Türkiye imalat sanayisinde sektörel bazda ithalatın belirleyicilerini 1998Ç1-2012Ç2 dönemi için Eberhardt (2008) tarafından bulunan ve Eberhardt ve Bond (2009) tarafından geliştirilen Augmented Mean Group yöntemi kullanarak tahmin etmektedir. Model, parametre heterojenliğini ve yatay kesit bağımlılığını dikkate almaktadır. Yatay kesit bağımlılığının varlığı Pesaran (2008) tarafından geliştirilen CD-Bias testi ile sınanırken, birim kök testi için Pesaran (2007) tarafından bulunan Cross-Sectionally Augmented Dickey-Fuller (CADF), koentegrasyon analizi için ise Westerlund (2008) tarafından geliştirilen Durbin Hausman testi kullanılmıştır. Regresyon sonuçlarına göre, sektörel bazda sanayi üretimi ve reel efektif döviz kuru katsayıları pozitif ve anlamlı bulunmuştur. İthalatın üretim esnekliğinin en yüksek olduğu sektörlerin metal ürünleri, motorlu araçlar, elektrikli makinalar ve tekstil olduğu ortaya konmuştur. Ayrıca, modelde çalışma günü değişkeni ve kriz kuklası, küresel kriz ve takvim etkisini görmek için kullanılmıştır.

Anahtar Kelimeler: Türkiye, ithalat, sektörel veri analizi

1. INTRODUCTION

Turkey's economic integration with the global markets has strengthened especially in the last three decades and Turkey's openness ratio has risen to 48.61% in 2011 compared with 11.28% in 1980.[1] Turkish imports increased to 236.5 billion dollars in 2012 from 8 billion dollars in 1980 with an average annual growth rate of 11%. After the crisis in 2001, due to the recovery in the Turkish economy and the easing credit conditions as a result of the excess liquidity in global markets, imports accelerated and annual growth rate has been 16% in the last 10 years. After the decline in 2009 as a result of the global crisis, Turkish imports were back on increasing trend until 2011. The economic and monetary policy shift in 2012 resulted with a 1.8% drop in imports. In order to balance the Turkish economy and narrow the current account deficit, which reached to 10% in 2011, domestic and foreign demand was aimed to be balanced in 2012 by controlling credit growth and lowering interest rates. This policy mix led to diminishing capital inflow due to drop in interest rates and depressed domestic demand due to credit growth control.

Sectoral and regional composition of Turkish imports has also changed in the last two decades. Share of EU members in imports has dropped to 37% in 2012 from 56% in 1996 although the Customs Union agreement was put into force in the same period. On the other hand, the share of Asia mainly, due to China, India and Korea, has risen from 11% to 21% in the same time period. As a result of the increasing oil imports, Russia took the first place in import partners in 2012 while it was ranked 6th in 1996. Similarly, China was ranked as the 3rd, Iran as the 7th and India as the 10th although their rankings were 18th, 13th and 30th in 1996 respectively.

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The sectoral shift of Turkish imports is due to the product composition of imports. According to the BEC classification, 67% of Turkish imports were intermediate goods and 24% were capital goods leading a small share (9%) for consumer goods in 1996. Although the ratio of consumer goods has not changed seriously, the share of intermediate goods were up to 74% and capital goods dropped to 14% in 2012. The upward trend in intermediate goods imports is mainly due to increasing FDI inflow, developing domestic manufacturing industry and higher energy demand. Most of the FDI inflow in manufacturing industry was towards automotive sector. Foreign automotive companies carried out a high amount of intermediate good imports such as engines and software in line with their global supply chain strategies. Partly the competitive environment of Customs Union led to production of more sophisticated goods by Turkish manufacturers. However, the major inputs of these products, such as screens and display items of TVs, has been generally imported which has led to a persistent intermediate goods imports and trade deficit. Besides the production structure, increasing energy demand and prices partly explain the rise in intermediate goods imports. It is a fact that energy imports occupy an important place in intermediate goods imports.

To the best of our knowledge, there is no study in the literature estimating income and price elasticities of sectoral imports for Turkey. This paper attempts to contribute to the literature by providing sectoral production and real exchange price elasticities of sectoral imports at ISIC Rev 3[2] classification. This study differs from similar studies estimating sectoral exports dynamics (Cosar (2002), Saygılı (2010)) by using a recent panel data estimator, Augmented Mean Group analysis, which is introduced by Eberhardt and Teal (2008) and developed by Eberhardt and Bond (2009) that takes into account parameter heterogeneity and cross-sectional dependence. Also, beside seasonality, calendar day effect is taken into account by using working day variable.

The remainder of the paper is organized as follows: the next section provides a brief literature for related studies. Section 3 presents the model specifications and data set. Section 4 presents empirical findings of the panel analysis. The final section offers conclusions.

2. BRIEF LITERATURE REVIEW

In this study, the imperfect substitute model proposed by Goldstein and Khan (1985) is followed. The basic assumption of the model is that neither exports nor imports are perfect substitutes for domestic goods so that both imported and domestic goods exist in the market. Following this framework, the imports are explained by real income and relative import prices.

In the broad literature on import determinants, studies analyze determinants of imports at the aggregated and disaggregated levels by using different econometric techniques. Indeed, the aggregated models can be divided into two since some models estimate import demand as a function of aggregate income-expenditure (Kotan and Saygılı (1999), Masih and Masih (2000), Hooper et al. (2000), Aydın et al. (2004), Camarero and Tamarit (2004), Islam and Hassan (2004), Razafimahefa and Hamori (2005), Bahmani-Oskooee and Kara (2005), Yavuz and Güriş (2006), Aker (2008), Tang (2008), Chen (2008), Adnan (2008), Ziramba (2008), Petreski (2009), Bayraktutan and Bıdırdı (2010), Narayan and Narayan (2010), Omotor (2010), Alam and Ahmad (2011)) while some others take aggregate import as a function of disaggregated income expenditure namely, consumption, investment and exports components (Tang (2005), Zhou and Dube (2011), Chani and Chaudhary (2012), Modeste (2011)). In these studies the rational of disaggregating income-expenditure is explained as avoiding *aggregation bias* resulting from use of a single aggregate expenditure variable in the import function when different macro components of final expenditure produce different impacts on imports. On the other hand, disaggregated models estimate disaggregated import demand functions mostly under Broad Economic Classification (BEC) namely, capital goods, intermediate inputs and consumption goods imports (Togan and Berument (2007), Akal (2008), Aldan et al. (2012), Thaver et al. (2012), Oktay and Gozgor (2013)). Finally, in the literature there are very fewer panel studies disaggregating both trade and income-expenditure at sectoral level (Cosar (2002), Edwards and Golub (2004), Saygılı (2010)).

The studies that estimate aggregate import function for Turkey generally analyze data sets covering the period from 1980s to beginnings of 2000 which gives the opportunity to compare the model results. The income elasticities range between 0.259 and 2.72 in the long run and between 0.78 and 1.34 in the short run indicating a positive relationship although the magnitude differs significantly. On the other hand, price elasticity of imports range between -0.24 and -0.97 in the long run and between -0.52 and -0.63 in the short run indicating inelastic price elasticity. The aggregated import models suggest inelastic price elasticity while income elasticity of imports varies.

The study of Kotan and Saygılı (1999), assesses Turkish import developments by considering domestic income, nominal exchange rate, inflation rate and foreign exchange reserve movements for the period 1987 - 1999 by using quarterly data. The model estimates import demand using the Engle-Granger approach and reveals long run and short run elasticities. It is found that all explanatory variables significantly affect imports while the import function is estimated to be price and income inelastic in the long run. However, in the short run domestic income and exchange rates are the only statistically significant variables while their impact on imports improves. Also, a dummy that captures the crisis in the second half of 1998 and first quarter of 1999 are also found to have significant effects on import growth in the short run.

Aydın et al. (2004) estimate export supply and import demand for the Turkish economy for the 1987 – 2003 period using both single equation and Vector Auto Regression (VAR) model. The long run and short run elasticities show that imports are income elastic while elasticities of import with respect to real exchange rate is around 0.5 both in the short run and long run.

In the study of Bahmani-Oskooee and Kara (2005), Auto Regressive Distributed Lag (ARDL) approach is employed and income and price elasticities of import and export demand for 28 countries are estimated by using quarterly data over 1973 – 1998 period. In the study, the income and price elasticities are investigated by using real GDP and relative prices. The import function is found to be income elastic and price inelastic for Turkey.

Yavuz and Güriş (2006) investigate the aggregate import demand behavior for Turkey using annual data over the period 1982-2002 and employ ARDL approach as in the study of Bahmani-Oskooee and Kara (2005). In the study, income and price elasticities are estimated by using real GDP and relative prices. Also, a dummy variable, indicating the acceptance of Turkey into European Customs Union in 1996, is used in the model. The income and price elasticities are closer both in the long run and short run relatively to the other studies. The income elasticity is around 1.3 while the price is inelastic both in the long run and short run.

In the study of Aker (2008), the relationship between imports and GDP, fixed capital investments, real exchange rates, exports and Customs Union membership are investigated using a multiple regression technique for the 1989 – 2003 period. The model results show that the most significant variables affecting imports are fixed capital investments and GDP while coefficients for both variables are around 0.5. The study found no statistically significant relation between Turkish imports and other variables including real exchange rates.

Bayraktutan and Bıdırdı (2010) attemp to estimate the basic determinants of Turkish imports by using quarterly data over 1984 – 2004 period. The long run import function is estimated by applying Engle-Granger Two Step Method while the short run elasticities are estimated by Error-Correction Model. In the study, traditional import demand function is used and income and price elasticities are estimated. The model results show that income and price elasticities of imports are very similar in the long run and short run and the elasticities are around 2.7 and 0.3 respectively.

Income and price elasticities are estimated for disaggregated imports of Turkey under BEC classification namely, consumption goods, intermediate goods and investment (capital) goods (Togan and Berument (2007), Akal (2008), Aldan et al. (2012), Oktay and Gozgor (2013)). Although, the time period covered in the analyzes differ significantly, income and price elasticities of disaggregated imports are closer than the aggregated models. Except for the study of Akal (2008), all three components of imports are income elastic while price elasticities of disaggregated imports are generally lower than 1. On the other hand, Akal (2008) estimates inelastic income elasticities. The model results do not draw a clear picture of the import component with the higher income elasticity for Turkey. In the studies of Togan and Berument (2007) and Oktay and Gozgor (2013), price elasticities are higher for consumption goods while price elasticity of investment goods are the lowest.

Togan and Berument (2007) estimates long run income and price elasticities of disaggregated imports, namely consumption, capital goods and intermediate goods imports, by using Johansen cointegration technique over the period of 1970 – 2005. Disaggregated imports are all income elastic while the consumption goods have the highest magnitude. The elasticity of import with respect to real exchange rates is very high for consumption goods while investment goods imports are inelastic.

In the study of Akal (2008), imports are disaggregated as intermediate imports and investment imports and estimated by using variables such as real income, relative prices, real foreign

exchange rate, terms of trade, relative import price and foreign terms of trade, adjusted real foreign exchange rate, foreign TOT adjusted nominal foreign exchange rate and export for the period of 1982 – 2004 in different models. The model results show that investment and intermediate goods imports can be explained by these variables around 99%. The models indicate that income elasticity is higher for intermediate good imports than investment goods imports although income is inelastic for both type of imports. The coefficient of real exchange rates are around -0.3 for both investment and intermediate good imports.

Aldan et al. (2012), analyze short run dynamics of Turkish imports for 2003 - 2011 period using Kalman filter to obtain time-varying parameters in the ordinary least square (OLS). In the study, imports are disaggregated as consumption goods, capital goods (except transportations vehicles), transportation vehicles and intermediate goods (excluding energy). Income elasticity is highest for intermediate goods (2.2) and lowest for consumption goods imports (1.3). The elasticity of import demand with respect to real exchange rate is inelastic and lower than income elasticity except transportation vehicles.

The study of Oktay and Gozgor (2013) estimates a disaggregated import demand function for Turkey using quarterly data over the period 1989 – 2012. Short run and long run import functions are examined according to the BEC classification. Both ARDL and DOLS methods are employed in the model in order to check robustness of the results. The main conclusions of the study are higher elasticity of income than real exchange rate both in the long run and short run; higher income elasticity with respect to income and real exchange rate in the long run than in the short run; higher income elasticity of income and real exchange rate elasticity for consumption goods in the long run. Also, the effect of seasonality is significant for all disaggregated import cases while time trend and global crisis has no impact on imports for Turkey.

To the best of our knowledge, there is no study estimating sectoral import dynamics of Turkey by using a panel data analysis. Nevertheless, there few studies (Cosar (2002), Saygılı (2010)) estimating sectoral export demand functions for Turkey. Cosar (2002), calculates real exchange rate and production elasticities of the sectoral exports (9 sectors) according to the ISIC 3 classification based on quarterly data between 1994 and 2000. Similarly, Saygılı (2010) employs a multivariate panel co-integration technique for 17 manufacturing in order

to determine sectoral exports dynamics of Turkey, the role of unit labor costs and structural reforms of 2001 in particular for the data covering different sub periods between 1995 and 2006.

While estimating import demand function for Turkey, some studies take into account the effects of the facts such as European Customs Union membership or economic crisis (Aker (2008), Yavuz and Güriş (2006), Kotan and Saygılı (1999)) according to the time period covered in the study. Similarly, in this study, a global crisis dummy is used in order to take into account the effects of the global economic crisis that started to show its significant impact on both Turkish and global trade mostly in the last quarter of 2008. Another important aspect of this study is use of working day variable, which is not frequently referred in the literature, in order to take into consideration calendar effect beside seasonality. The study of Atabek et al. (2009) shows that calendar day effect, beside seasonality, is an important reason for short-term fluctuations of the economic variables. Holidays such as Ramadan and Sacrifice holidays, which are also defined as moving holidays, affects number of working days differently every year and lead to fluctuations in production indicators. Ignoring the number of working days may lead to misinterpretation of the fluctuations in production. Also, the study of Günay (2010) shows that ignoring this fact lead to a differentiation between market expectations and the realizations of industrial production growth.

3. MODEL SPECIFICATION AND DATA SET

The model covers quarterly data for the period from 1998q1 to 2012q2. 17 manufacturing sectors are covered at 2-digit ISIC Rev.3 classification level. In order to analyze Turkey's sectoral import demand, in the light of literature, many variables such as real export, credit growth, real effective exchange rate, industrial production, Euro/Dollar parity, working day variable and crisis dummy and seasonality dummy variables has been tested and the import model is estimated by using effective exchange rate, sectoral manufacturing industry production, working day variable, crisis and trend dummy because those variables are found statistically and theoretically significant. Trend dummy and crisis dummy are added to model to investigate trend effect and crisis effect. It is obvious that Turkey's foreign trade statistics have been increasing during the period from 1998q1 to 2012q2 except crisis such as 2008 global crisis. So to eliminate the trend effect from the regression analysis, trend dummy is taken as dummy variable to

the model and trend dummy takes value from 1 to 54 correspond to period. To capture the effect of 2008 global crisis, the dataset includes a crisis dummy which takes the value of 1 for 2008q3-2009q4 crisis period and takes the value of 0 for rest of the period. Also, working day variable is included in the model, in order to take into account calendar day effect, which shows the number of working days left from the all holidays including the moving holidays.

The industrial production and imports are gathered at sectoral basis, ISIC Rev. 3, 2 digit classification and other variables are not used at sectoral breakdown, which resulted with a more production side estimation of the imports.

Data of industrial production, which is one of the cross-section variant variables, is taken from TURKSTAT. Real effective exchange rate based on producer price index is obtained from Central Bank of Republic of Turkey (CBRT). Due to data limitations instead of sectoral real effective exchange rate, which is expected to be released by the CBTR in the near future, general real effective exchange rate is used in the model. Also, working day variable is taken from CBRT. Turkey's sectoral import quantity index is taken from TurkStat at ISIC Rev. 3, 2 digit classification.

The sectoral import demand model estimated is as below:

$$IMP_{it} = \beta_0 + \beta_1 Ind\,Pr\,o_{it} + \beta_2 \operatorname{Re}EfEx_t$$
$$+ \beta_3 WorkDay_t + \beta_4 CrisisDmy_t + \varepsilon \qquad (1)$$

Here, IMP_{it} is Turkey's sectoral import which is defined as the natural logarithm of quantity index, $\operatorname{Re}EfEx_t$ is Reel Effective Exchange Rate based on Producer Price Index, $WorkDay_t$ is working day variable, $CrisisDmy_t$ is the crisis dummy to see impact of global crisis, also i denotes sectors which consist of ISIC Rev.3 two digit manufacturing sectors and t denotes time.

4. EMPIRICAL RESULTS

4.1. Test of Cross-Section Dependency

Cross-section dependency is described in empirical specification in various ways. Panel data econometrics are deeply interested in models with unobserved time-varying heterogeneity caused by unobserved common shocks which affect all units. That type of heterogeneity introduces cross-section correlation or dependence between the regression error terms that can cause to inconsistency and incorrect inference in standard panel econometric approaches.

According to cross-section dependency test result, estimation method and unit-root test which are used in the study are determined. In other words, since cross-section dependency affect realibility of model results and lead to biased estimation, existence of cross-section dependency in data must be investigated before running model. To investigate cross-section dependency in panel data, Bias-Adjusted LM test which is introduced by Pesaran, Ullah, Yamagata (2008) is used.

Table 1: Bias-Adjusted LM Test

	Test Results
Test Statistic	29.024
P Value	0.000

The rejection of null hypotesis representing "There is no cross-section dependency" means that existence of cross-section dependency is not found in the panel data. The consequence of Bias-Adjusted LM test is shown in the Table 2. According to test results, the null hypotesis has been rejected and it can be said that there is a cross-section dependency between sectors analysed.

4.2. Unit Root Test

Since there is a cross-section dependency in panel data, second generaton panel unit root test is used in order to test existence of unit root. Since the first generation panel unit root tests such as Levin, Lin and Chu (1992, 2002), Im, Pesaran and Shin (1997), Maddala and Wu's (1999), Choi (2001), Hadri (2000) assume no cross section dependency in data, results of these tests would be biased. Also, some first generation unit root tests do not take into consideration parameter heterogeneity such as Levin, Lin and Chu (1992, 2002). Because of these reasons, in this paper, Pesaran's (2007) panel unit root test, Cross-Sectionally Augmented Dickey Fuller (CADF), which is one of the second generation panel unit root tests, is used. The rejection of null hypotesis representing "There is a unit root" means there is unit root in panel data.

Table 2: Pesaran Unit Root Test

	log (import)	Δlog (import)	log (industrial production)	Δlog (industrial production)
CADF Statistics	-3.645	-6.701	-3.816	-6.783
Length Of Lag	1	1	1	1
1% Critic Value	-4.6	-4.6	-4.6	-4.6

(**Notes:** Critical Values are taken from Table.1c Pesaran(2007))

As it can be seen in Table 3, all cross-sectionally variant variables are integrated to order one I(1) at 1% significance level. It means these variables are stationary in first differences. Degree of integration of cross-sectionally invariant variables such as real exchange rate and working day variable is investigated by using Augmented Dickey-Fuller (ADF) (1979) procedure. According to ADF test results, cross-sectionally invariant variables are integrated in the same order of one, I(1).

Table 3: ADF Unit Root Test for Cross Section Invariant Variables

Augmented Dickey-Fuller Test		
Variable	t-Statistic	Prob.
ReEfExc	-2.06	0.258
ΔReEfExc	-6.95	0.000
Work Day	-2.52	0.114
ΔWork Day	-11.71	0.000

4.3.Cointegration Test

Testing for the presence of long-run relationships among integrated variables with both a time-series dimension (t) and a cross-sectional dimension (N) is an important aspect in panel data analysis. Since our independent variables are integrated to order one I(1), which means that variables are stationary in first differences, and in order to avoid spurious regression we test whether there is a cointegration between variables using variables. In order to test existence of cointegration between the variables, we use Durbin-Hausman Cointegration test that is introduced by Westerlund (2008). In his paper, Westerlund proved that Durbin-Hausman Cointegration test is superior to other popular tests due to taking into consideration cross-section dependency and parameter heterogeneity. On the other hand, this test can be used when independent variables have different stationary level. Westerlund presents two cointegration dimension which are Durbin-H Group Statistics and Durbin H Panel Statistic.

Table 4: Cointegration Test

	Test Results	
	Test Statistic	Critical Value (1%)
Durbin-H Group Statistic	1.965	Oca.28
Durbin-H Panel Statistic	3.155	Oca.28

The result of cointegration test is presented in Table 4. As it can be seen from the Table, there is a cointegration relationship at significance level 1% according to both group dimension in which null hypothesis is "There is no cointegration relationship in all N sectors" and panel dimension in which null hypothesis is "There is no cointegration relationship in all N sectors and panel as a whole ".

4.4.Estimation

Augmented Mean Group Estimator (AMG), which is introduced by Eberhardt and Bond (2009) and developed by Eberhardt and Teal (2010, 2011), is used for estimation in our model. Eberhardt and Bond (2009) investigated the impact of nonstationary, parameter heterogeneity and cross-section dependency on estimation in panel data by using Monte Carlo simulations.

Eberhardt and Bond (2009) introduced a novel estimator, the Augmented Mean Group (AMG) estimator, which accounts for cross-section dependence by inclusion of a `common dynamic effect' in the country regression. This variable is extracted from the year dummy coefficients of a pooled regression in firrst differences and represents the levels-equivalent mean evolvement of unobserved common factors across all countries. Provided that the unobserved common factors form part of the country-specific cointegrating relation, the augmented country regression model encom-passes the cointegrating relationship, which is allowed to differ across countries.[3]

AMG estimator has several advantages compared to other estimation methods. One of them is that, AMG estimator takes into account cross-section dependency and parameter heterogeneity. Augmented Mean Group Estimator also can be used if variables have different stationary levels.

The model suggested by Eberhardt and Bond (2009) is presented as below:

$$y_{it} = \beta_i' x_{it} + u_{it} \qquad\qquad u_{it} = \alpha_i + \lambda_i' f_t + \varepsilon_{it}$$
$$x_{mit} = \pi_{mi} + \delta_{mi}' g_{mt} + \rho_{1mi} f_{1mt} + \dots + \rho_{nmi} f_{nmt} + v_{mit}$$
$$m = 1, \dots k \qquad and \qquad f_{.mt} \subset f_t$$
$$f_t = \varphi' f_{t-1} + \varepsilon_t \qquad and \qquad g_t = \kappa' g_{t-1} + \varepsilon_t \qquad (2)$$

Where, is the vector of observed variables and observed outcome variable. Unobserved common factors affecting all cross-sections are represented by f_t, g_t while λi, δi and ρ_i are the sector-specific factor loadings, which take into consideration that common factors affect different sectors in different ways. The second equation accounts for the effects of both unobservables common factors, f_t and g_t, and observable variables, thereby including cross-sectional dependencies in both observable and unobservable variables. Sector spesific fixed effect is

represented by sd π_{mi}.

Estimation was employed in two steps (Eberhardt ve Bond (2009)):

Step (i) $\Delta y_{it} = b'\Delta x_{it} + \sum_{t=2}^{T} c_t \Delta D_t + e_{it}$ (3)

$$\Rightarrow \hat{c}_t = \hat{\mu}_t^{\bullet}$$

In the 5th equation, the model is estimated by taking first differences of variables in order to eliminate bias stemming from non-stationary variables and time dummies are included in the model.

In the second-step, regression augments standard regression with $\hat{\mu}_t$ in order to allow for parameter heterogeneity. The coefficients for each cross-section panel coefficients are then derived as averages of the sectoral estimates $\hat{b}_i$.

Step (ii) $y_{it} = a_i + b_i'x_{it} + c_i t + d_i \hat{\mu}_t^{\bullet} + e_{it}$

$\hat{b}_{AMG} = N^{-1}\sum_i \hat{b}_i$ (4)

Table 5: Regression Results

Variables	Coef.	Std. Err.	Z value	P value	95% Interval Confidence	
					Lower	Upper
Log(Industrial Production)	0.188	0.092	2.040	0.042	0.007	0.369
Real Exchange Rate	0.005	0.001	7.550	0.000	0.004	0.007
Trend Dummy	0.007	0.001	7.520	0.000	0.005	0.008
Working Day Variable	0.053	0.006	8.620	0.000	0.041	0.065
Crisis Dummy	-0.040	0.009	-4.250	0.000	-0.059	-0.022
Constant	0.848	0.228	3.710	0.000	0.401	1.296

The model results for aggregate imports are presented in Table 5. The model results show that all variables are statistically significant at 5% significance level and have theoretically expected signs. Industrial production has the highest impact on imports. 10% increase in industrial production causes 1.88% increase in manufacturing industry imports. The other significant variable is real exchange rate and a 10 point increase in real exchange rate index, causes to 5% increase in manufacturing industry import. As anticipated, crisis dummy has negative coefficient. The significant coefficient of trend dummy indicates a trend in Turkish imports in the last decade while, as expected, working day variable has also a positive sign.

Table 6: Sector Specific Determinants of Turkish Imports

ISIC Code	Sector Name	Log(Industrial Production)	Real Exchange Rate	Trend Dummy	Working Day Variable	Crisis Dummy
15	Manufacture of food products and beverages	0.261***	0.003*	0.005*	0.051**	-0.006**
16	Manufacture of tobacco products	-0.124	0.010*	0.004*	0.05***	0.010
17	Manufacture of textiles	0.631*	0.007*	0.007*	0.030*	-0.022
19	Tanning and dressing of leather; manufacture of luggage, handbags and footwear	0.056	0.004**	0.006*	0.053*	-0.030
20	Manufacture of wood and of products of wood	0.051	0.014*	0.011*	0.146*	-0.076*
21	Manufacture of paper and paper products	0.012	0.005*	0.007*	0.054*	-0.038*
23	Manufacture of coke, refined petroleum products and nuclear fuel	-0.501	0.004*	0.008*	0.020	0.031
24	Manufacture of chemicals and chemical products	0.055	1.261	0.008*	0.050*	-0.040*
25	Manufacture of rubber and plastics products	0.296*	0.005*	0.007*	0.060*	-0.063*
26	Manufacture of other non-metallic mineral products	0.495*	0.005*	0.006*	0.032*	-0.087*
27	Manufacture of basic metals	0.843*	0.006*	0.003*	0.058**	-0.048
28	Manufacture of fabricated metal products, except machinery and equipment	0.140***	0.002**	0.010*	0.047*	-0.025
29	Manufacture of machinery and equipment n.e.c.	0.198	0.004*	0.009*	0.078*	-0.078*
31	Manufacture of electrical machinery and apparatus n.e.c.	0.447*	0.007*	0.018*	0.028**	-0.002
32	Manufacture of radio, television and communication equipment and apparatus	-0.102	0.011*	0.000	0.076*	-0.052***
34	Manufacture of motor vehicles, trailers and semi-trailers	0.745*	0.006*	0.002***	0.058*	-0.100*
36	Manufacture of furniture; manufacturing n.e.c.	-0.219***	0.008*	0.005*	0.080*	-0.043**

(**Notes:** *Denotes that related coefficient is significant at 1% significance level. ** Denotes that related coefficient is significant at 5% significance level. *** Denotes that related coefficient is significant at 10% significance level. Coefficients of real exchange should be multiplied by 100 for interpretation since real exchange rate is taken to regression in linear form.)

Sectoral regression results are presented in the Table.6. The sectoral results show that, 8 out of 17 sectors are affected by industrial production positively and coefficients of industrial production among sectors vary between -0.219 and 0.743 for these sectors. Increase in production accelerates imports in all sectors except "Manufacture of Furniture". "Sector of Manufacture of Basic Metal" has the biggest coefficient with 0.843. In other words, an 1% increase in industrial production of this sector causes 0.843% increase in imports. The sectors with highest industrial production elasticities are "Manufacture of Basic Metals", "Manufacture of Motor Vehicles" and "Manufacture of Textiles" while the elasticities are 0.843, 0.745 and 0.631 respectively. Production in "Manufacture of Fabricated Metal Sector" and "Manufacture of Food Products" have the lowest impact on import of these sector while the production elasticities are 0.140 and 0.261 respectively.

Another paramount independent variable is Real Exchange Rate which is found positive and statistically significant in 16 out of 17 sectors. Before interpretation, coefficients must be multiply by 100 since real exchange rate is entered in the regression without taking natural logarithm. In the light of this information, we can say that coefficients of real exchange rate on sectoral basis vary between 0.20 and 1.40. Real exchange rate has highest impact on imports of "Manufacture of Radio, Television etc.", "Manufacture of Wood" and "Manufacture of Tobacco" while coefficients with respect to real exchange rate are 1.4, 1.1 and 1.0 respectively. The impact of real exchange rate is positive and statistically significant for all sectors as anticipated, except chemicals, because an increase in real exchange rate indicates appreciation of Turkish Lira which leads to cheaper imports and increasing foreign input in manufacturing industry.

Similarly, working day variable and trend dummy have positive impact on all sector where the relation is statistically significant. Also, the coefficients of the crisis dummy is negative for all sectors as anticipated.

5. CONCLUDING REMARKS AND FURTHER RESEARCH

This paper estimates a sectoral import demand function for Turkey over a period from 1998Q1 to 2012Q2 by using Augmented Mean Group analysis. The model results indicate that elasticity of import demand with respect to overall industrial production is inelastic (0.2) and real exchange rate, also, has positive effect on imports. Similarly, working day variable and crisis dummy, that are used to explore the impact of calender day effect and global crisis, are found to be statistically significant.

The sectoral level analysis shows that production elasticities of sectoral imports differ significantly across the sectors while the highest elasticities are estimated for basic metals, motor vehicles, electrical machinary and textiles. These sectors are, also, known for their high import dependent production[4] and high share of intermediate goods in total imports[5]. According to the Import Map prepared by Turkish Ministry of Economy[6], the share of intermediate goods in production of these sectors are 69% in basic metals, 51% in motor vehicles, 43% in textiles and 37% in electrical machinery. High share of intermediate goods in total imports is another indicator for high use of foreign input in production. Almost all of the, 26.5 billion dollars, imports in basic metals is intermediate goods. Similarly, intermediate goods comprises 86% of imports in textiles and 45% in motor vehicles.

Based on these findings, short term and long term policy implications shall be established. There are two main aspects of managing high production elasticity of imports in manufacturing; securing sustainable input supply in the short run and reducing the need for foreign inputs in the long run. In the short term, sustainability of access to strategic foreign inputs shall be provided in order to maintain effective production in manufacturing industry by adopting input strategies. China's increasing mining activities especially in Africa are most known efforts for managing input requirements. In the medium and long term, policies should focus on reducing need for foreign input in manufacturing industry. In order to establish such a strategy, a comprehensive study shall gather information from field studies including surveys with producers, exporters and importers. Besides, incentive schemes should adopt a more sector specific strategy in addition to the existing region based structure. Sectors with high production elasticity of imports should be treated seperately and production in these sectors should be encouraged. Considering the high amount of investment needed in these sectors such as electronics, some new types of government support programmes, in which commercial risks are shared by both government and private sector, are also considered to be useful.

Another important result is significant impact of real exchange rate on imports of almost all manufacturing sectors. The model results indicate a positive relation between appreciation of Turkish Lira and imports. Considering the high current account deficit and possible risks attached to the deficit, one aspect of monetary policy should be providing sustainable equilibrium for the exchange rates.

Further research for this study shall be including sectoral real exchange rates to capture more specific and sector base differences in exchange rates. As soon as the data for calculation of sectoral exchange rates is acquired, this analysis shall be re-examined.

END NOTES

[1] All statistics in introduction section are taken from TurkStat

[2] Isıc rev.3 : international standard industrial classification of all economic activities, rev.3

[3] Eberhardt, M. and Bond, S. (2009) "Cross-Section Dependence in Non-Stationary Panel Models: A Novel Estimator" Munich Personal Repec Archive (MPRA) Paper, No. 17692.

[4] Ministry of Economy, "Turkey's Import Map", accessed on 16.09.2013, http://www.ekonomi.gov.tr/index.cfm?sayfa=ithharita,

[5] TurkStat

[6] Ministry of Economy, "Turkey's Import Map", accessed on 16.09.2013, http://www.ekonomi.gov.tr/index.cfm?sayfa=ithharita

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