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## Article

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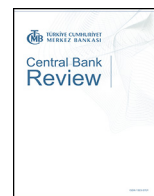
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# Import demand function for Turkey<sup>☆</sup>

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## ABSTRACT

This study revisits the import demand function for Turkey using the newly defined national income data and examines the evolution of the income and price elasticities over time. In this respect, demand functions are estimated for the total imports and its subcomponents separately, and the corresponding time varying elasticities are obtained by applying the method of Kalman filter between 2003 and 2018. The findings suggest that the growth of total imports is mainly explained by income and relative price changes. The income and expenditure elasticities decrease over time in total imports and in sub-components except for intermediate goods. The relative price elasticity remains almost unchanged for investment and consumption goods imports but increases considerably for the intermediate goods imports and total imports.

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## 1. Introduction

In this study, Turkey's import demand function is estimated with the latest data, and the evolution of income and relative price elasticities is analyzed comprehensively. To this aim, this study uses Kalman filter method that allows for a comprehensive analysis on Turkey's import function. Unlike most of the previous studies on Turkey, the demand function is estimated for both total imports and its sub components -consumption, investment and intermediate goods imports. The components of the national income -consumption and investment spending and exports -are used as explanatory variables in addition to the national income itself. Moreover, the behavior of spending and relative price elasticities over time is analyzed thoroughly with the help of Kalman filter. In

this respect, this is the first study that investigates the evolution of relative price and income elasticities in such a disaggregated level.

Many of the studies that estimate and analyze import demand function mostly focus on explaining the total import demand and differ from each other on the selection of explanatory variables, especially income variable. For instance, Bahmani-Oskooee and Niroomand (1998), Arize and Afifi (1987), Wang and Lee (2012), Senhadji (1998), Xu (2002), Bussière et al. (2011) use a single income variable while Giovannetti (1989), Abbott and Seddighi (1996), Tang (2003), Narayan and Narayan (2005), Chani et al. (2011), associate total imports with income components, pointing out that the use of a single aggregate demand variable will cause the problem of aggregation bias, as the import content of expenditure components may be different. In this context, income is generally included in the analyses as three different variables: consumption, investment and export expenditures. Similarly, in many studies on Turkey, such as Kotan and Saygılı (1999), Aydın et al. (2004), Yavuz and Güris (2006), Kalyoncu (2006), Togan and Berument (2007), Oktay and Gözgör (2013), Uçak and Ertuğrul (2013), Durmaz and Lee (2015), Çakmak, Gökçe and Çakmak (2016), and Bayramoğlu and Şükrioğlu (2016), total import function is estimated by using GDP as the income variable. On the other hand Günçavdı and Ülengin (2012) and Durmaz and

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Lee (2015) use components of national income to explain the variations in Turkey's imports and conclude that spending elasticity of imports varies considerably across the expenditure components. Some other studies that explain subcomponents of imports instead of total imports are Kreinin (1973), Tennakeen (2012), Fukumoto (2012), Ali and Chani (2013), Akal (2008), Aldan et al. (2012), Togan and Berument (2007), Oktay and Gözgör (2013).<sup>1</sup> Unlike the others, Fukumoto (2012), Oktay and Gözgör (2013) relate the sub-components of imports to the expenditure components of national income.

Against this backdrop, a disaggregated approach is adopted in this study and the sub-items of imports are associated with the components of national income, i.e. exports, consumption and investment spending, in addition to aggregated approach. The study also contributes to the related literature in regard to the fact that it is the first study to calculate the income and price elasticities of imports incorporating newly defined national income data of Turkey based on 2009 prices. Another factor that distinguishes this work from the other studies is the fact that gold and energy imports are excluded from all imports indicators employed at this study. Unprocessed gold is ignored due to its high volatility and unpredictability while energy imports is excluded because it would be better to study and estimate its demand function separately.

In line with the findings of the other studies on Turkey, it is found that changes in the imports of goods are significantly explained by the income and relative price changes, and income elasticity is higher than price elasticity. The expenditure elasticities of the total imports are found to differ significantly across the main expenditure components. Consumption expenditure elasticity is the highest and followed by exports and investment expenditure elasticities, respectively. The findings of subcomponents of import estimation differ from that of total imports and from each other: While consumption goods imports is mainly determined by consumption expenditures, intermediate goods imports is mostly explained by exports. In case of the investment goods imports, consumption and investment expenditures are the main drivers. Lastly, Kalman filter analysis of the estimated coefficients from all models leads to the conclusion that income elasticity of total imports declines over time while the price elasticity increases at a much pronounced rate.

In the next part of the study, information on the data and method used in the study will be presented. After summarizing the findings from the estimates, the import demand function with alternative variables is re-estimated. In the conclusion section, basic findings are summarized.

## 2. Data

Quarterly data covering the period 2003–2018 were used in the study. By using trade statistics and indices published by the Turkish Statistical Institute (TURKSTAT), the quantities of imports excluding gold and energy and sub-items according to BEC classification were calculated. In addition to total imports, imports of intermediate goods were also considered excluding energy and gold. The gasoline classified in the import of consumption goods was also excluded from this item.

The relative price variable is obtained by dividing the producer price index (PPI) by the unit value index of the relevant imports item. Consumer prices are used for relative prices of consumer goods. For example, the relative price for the intermediate goods imports is calculated as the following:

Relative price(intermediate goods, excl.gold and energy)

$$= \frac{PPI(excl.gold\ and\ energy)}{Pm(intermediate\ goods,\ excl.gold\ and\ energy)*e(TL/\$)}$$

Consumption expenditures include public expenditures as well as private consumption. Export quantity index is used instead of exports of goods and services under GDP in order to remove gold and energy components easily. All variables except relative prices are seasonally adjusted. Seasonally adjusted GDP, consumption and investment expenditures have been taken from TURKSTAT, while (excluding gold and energy) exports, imports and sub-items have been adjusted for the seasonal and calendar effects by Tramo-Seats method by the authors. It can be observed that the total imports excluding gold and energy tend to increase in parallel with the economic growth except crisis periods (Fig. 1-a). Furthermore, after 2011, obviously import growth rate is mostly below GDP growth. This observation may indicate that income elasticity of import has declined since 2011.

Imports of both total and sub-items in the pre-crisis period grew rapidly, but the rate of increase in the post-crisis period slowed down (Fig. 1-c). In this development, relative price movements are thought to be effective. Conceptually, the increase in the relative price index, in other words, the appreciation of the Turkish lira has an increasing effect on the import demand. It is observed that the Turkish lira, which tended to appreciate continuously in the pre-crisis period, lost value in the post-crisis period and thus the rate of increase in imports slowed down (Fig. 1-b). In terms of sub-items, it is observed that imports of intermediate goods, which account for over 60 percent of total imports, have a parallel course with total imports, while imports of consumption goods, which have a share of around 16 percent, displayed a more volatile trend. Imports of investment goods were on the rise in the pre-crisis period, but remained flat in the post-crisis period compared to total imports and other sub-items. (Fig. 1-c and 1-d).

## 3. Methodology

The early studies based on the application of the least squares (LS) and Two-Stage Least Squares (2SLS) methods in econometric technique have been replaced by the cointegration method. On the other hand, it is noteworthy that state-space models have been included in the analysis in recent years, in order to shed light on the change in the estimated parameters over time, especially in country and sector-based studies. (See Asemota and Saeki, 2011 for Japan; Gouvêa and Schettini, 2015 for Brazil; Uçak and Ertuğrul, 2013; Aldan et al., 2012 for Turkey; and Viktor, 2014 for agricultural imports in Ukraine).

Accordingly, in this study the income and relative price elasticities of the total imports and its sub-components are estimated by applying the method of Kalman filter and the resulting time-varying parameters are obtained. The parameters that determine the relationship between the dependent variable and the independent variables are likely to change over time due to many factors such both global and local crises and the structural changes. From this point of view, in order to obtain time-varying income and relative price elasticities the state-space model is estimated in which the parameters are unobservable and follow a random walk process.

$$y_t = Z_t \alpha_t + e_t, e_t \sim i.i.d.N(0, H) \quad (1)$$

$$\alpha_t = \alpha_{t-1} + w_t, w_t \sim i.i.d.N(0, Q) \quad (2)$$

$$E(e_t w_s) = 0, E(e_t \alpha_0) = 0, E(w_t \alpha_0) = 0, \text{ for } t = 1, \dots, T$$

<sup>1</sup> Akal (2008), Aldan et al. (2012), Togan and Berument (2007), Oktay and Gözgör (2013) focus on Turkey's import demand.

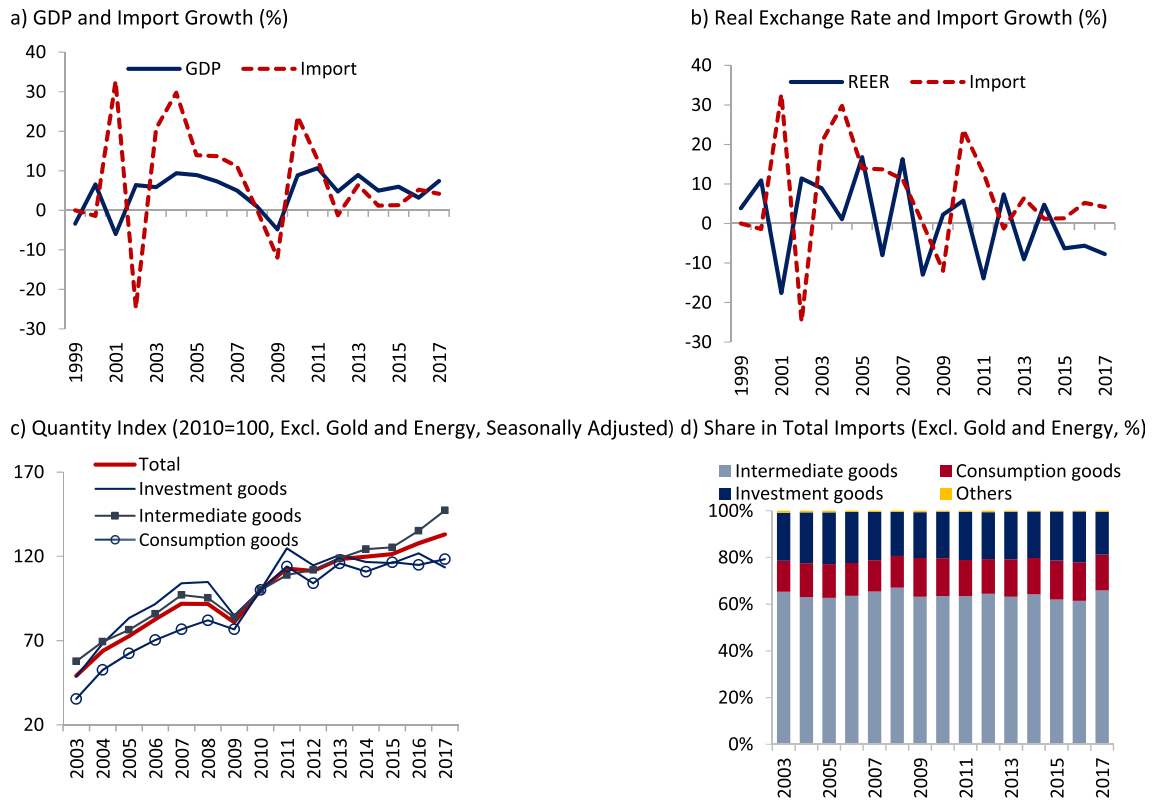


Fig. 1. Total imports and its sub-components.

In Equation (1),  $Y$  refers to the quantity of imports, which is the dependent variable, while  $Z$  refers to income and relative prices, which are the explanatory variables. The  $\alpha_t$  defined as the first-order Markov process, refers to the vector of time varying parameters. The vectors  $e_t$  and  $w_t$  represent identically independent distributed (iid) error terms which have zero mean and constant variance, represented by  $H$  and  $Q$  vectors, respectively.

Once the state-space model is defined and the initial values of the parameters ( $\alpha_0$ ) are determined, the time-varying parameters ( $\alpha_t$ ) are obtained by the Kalman filter algorithm. Kalman filter is a recursive algorithm that calculates the best approximation of the state vector based on the available information at time  $t$  (Harvey, 1990). In order to determine the lag length of the explanatory variables and to determine the initial values of the parameters, Equation (1) is estimated by the OLS method under the assumption that the relationship between the variables is linear. Estimated equations are in the following form<sup>2</sup>:

$$\Delta \ln(\text{Real Imports}_i) = f(\Delta \ln(\text{Income}_i), \Delta \ln(\text{Relative price}_i))$$

<sup>2</sup> The studies on import demand are mainly based on the imperfect substitutes model developed by Goldstein and Khan (1985). Accordingly, in a world where imported goods cannot be substituted by goods produced in the country and consumers attain maximum utility under budget constraint, the import demand is determined by the price of the imported goods, the country's income, and price of the domestic substitution of the imported goods.  $M_i = f(Y_i, P_{M_i}, P_i)$ ;  $M_i$ ,  $Y_i$ ,  $P_{M_i}$  and  $P_i$  represent the amount of import demand in the country  $i$ , nominal income, the price of imported goods in domestic currency, the price of imported goods produced in the country, respectively.

In the first stage, total imports are considered within the framework of a standard demand equation using total demand or GDP. In the second stage, changes in both the total imports and the sub-items of imports are explained with more structural estimation models where the export, consumption and investment expenditures are included separately as the income variable. In this context, in the above equation, real imports represent four different variables: total imports, imports of investment goods, imports of consumption goods and imports of intermediate goods. Income shows total demand and GDP in the first stage equations, and exports, consumption and investment expenditures in the second stage equations.  $\Delta \ln$  is the change of the natural logarithms of the variables compared to the previous period. Thus, the estimated coefficients reflect the elasticity of the imports, which is the dependent variable, to the independent variables. More specifically, the coefficient value signifies the rate of change of dependent variable when the independent variable change by one percent. Income elasticity of import demand is expected to be positive and the relative price elasticity is expected to be negative.

Once the equations are estimated, the time course of the elasticity coefficients obtained by the Kalman filter is analyzed. In the Kalman filter method, two different paths can be estimated for each explanatory variable, which are filtered and smoothed. When estimating the smoothed elasticity estimation in any period, the information obtained from the observations of both previous and subsequent periods is used, thereby creating a path with relatively low volatility. Therefore, the elasticity charts in the study were derived from the smoothed coefficient estimates that reflect the general trend. In order to make a comparison between the

variables, elasticity coefficients are converted to an index with a base 2003Q1 = 1.

### 3.1. Findings

In this section, import demand functions are estimated by using the method of ordinary least squares (OLS) and their evolution over time is investigated with the help of Kalman Filter method. In the first stage, total imports excluding unprocessed gold and energy products are estimated using two alternative explanatory variables, namely, total demand and gross domestic product (GDP) as the real income indicators while employing the PPI-based relative price to capture the changes in the price of imported goods relative to domestic prices. The total demand variable is obtained by simply adding the expenditures on imported goods and services to the GDP. Thus, while the GDP represents the sum of the expenditures on the goods and services produced domestically, the total demand variable includes the sum of the expenditures on the products produced both in Turkey and abroad. Table 1 presents the selected models for each definition of real income variable separately.

The model selection is based on various criteria such as the absence of residual autocorrelation, having the smallest Schwarz information criterion, and the statistical and economic significance of estimated coefficients. Although two different income variables are used, the estimated model does not alter and the changes in imports are meaningfully explained by the changes in the current and lagged real income as well as the changes in relative price. When the results obtained from the two models are compared, it is seen that both the income and relative price elasticities do not differ much between the models. For comparison purposes, the same models are estimated using PPI-based real effective exchange rate instead of the relative price, and the results are summarized in the last two columns of Table 1. The total income elasticities from the latter models are very close to those from the models with relative price whereas the estimated price elasticities are lower.

Considering the findings of each model, total income elasticity is almost three times higher than the relative price elasticity. In other words, the total impact on the import growth of a one-percentage-point shock in income growth is close to three times the total impact of a shock of the same magnitude in relative price growth.

**Table 1**  
Estimated parameters of import demand function.

	Total Demand	GDP	Total Demand	GDP
Income	<b>1.22*</b> (0.24)	<b>1.10*</b> (0.28)	<b>1.37*</b> (0.20)	<b>1.20*</b> (0.24)
Income(-1)	<b>0.60*</b> (0.22)	<b>0.76*</b> (0.19)	<b>0.43***</b> (0.23)	<b>0.53**</b> (0.21)
Relative Price	<b>0.59*</b> (0.08)	<b>0.72*</b> (0.10)		
Real Effective Exchange Rate			<b>0.46*</b> (0.15)	<b>0.57*</b> (0.17)
Number of Observations	61	61	61	61
Adjusted R <sup>2</sup>	0.68	0.56	0.60	0.43
<i>Total Elasticities</i>				
Income	1.82	1.87	1.81	1.73
Relative Price	0.59	0.72	0.46	0.57
<i>Total Scaled Elasticities</i>				
Income	0.76	0.70	0.76	0.65
Relative Price	0.47	0.58	0.35	0.44

1) Standard errors are given in parentheses.

2) \*, \*\*, and \*\*\* represent significance at 0.01, 0.05, and 0.1, respectively.

3) Estimation equations include constant term.

4) Total elasticity is defined as the sum of instantaneous and lagged elasticities.

However, it would be misleading to say that the growth of imports is largely determined by the growth of real income relying only on the estimated elasticities. To give a more accurate answer to such a question, it would be better to compare the scaled coefficients that are estimated by using the series normalized by their own standard deviations. The scaled elasticities are given at the bottom panel of Table 1. According to the findings here, changes in income seem to be more dominant than the relative price changes in determining the growth rate of imports. However, it is clear that the difference is not around three-folds or four-folds as indicated by the total elasticity coefficients. In the rest of the paper, scaled coefficient estimates are not reported along with the coefficient estimates to save space and to keep the focus rather on the behavior of the estimated elasticities over time.

The temporal changes in the estimated elasticities are shown separately for four models in Fig. 2.<sup>3</sup> The lower panels display the results from the models with PPI-based real exchange rate for comparison reasons. In the model with GDP, total income elasticity exhibits a downward trend while the relative price elasticity tends to increase over time. Yet, both changes seem to be rather limited. When the total demand is used as the income variable, the direction of the change remains the same for both income and price elasticities but the amount of the change becomes more pronounced for the price variable. Moreover, the evolution of the income variable does not appear to alter when the PPI-based relative price indicator in the regression equation is replaced by the PPI-based real exchange rate (see Fig. 2c and d). On the other hand, the results suggest that the elasticity of imports to the real exchange rate increases at a much higher rate than the one implied for the relative price. So, a Kalman filter analysis of the estimated coefficients from all models leads to the conclusion that income elasticity of imports declines over time while the price elasticity increases at a more pronounced rate.

The decline in income elasticity means that any change in income growth is reflected at a lesser rate over time to the imports growth. Possible causes of such a change in the elasticity include the developments such as the change in consumer choices in favor of the domestically produced goods, expansion of domestic production to include the types of goods that are previously imported, technological transformation that allows a reduction in the imported input use, and increases in the taxes levied on the imported products. On the other hand, the rise in the relative price elasticity can be attributed to the expansion of substitution possibilities due to the increase in the variety of domestically produced and imported goods. Another explanation for the rise in the price elasticity is that the composition of imports may have changed over time in favor of the products with high price elasticity.

In the second stage, demand functions are estimated for the total imports and its main components separately by using the expenditure components of GDP. The estimations that use the aggregate income indicators such as GDP or total demand implicitly assume that the elasticity of imports to spending does not vary across expenditure components such as consumption, investment and exports. However, it is not unlikely that the elasticity of imports to spending varies significantly across expenditure components. In this context, whether the income is spent for consumption or investment carries an important information value for the estimations and analyses carried out in this study. Therefore, four different import demand functions that depend on consumption, investment and exports growths were obtained and reported in Table 2. In the regressions, instead of export component of GDP, which consists of

<sup>3</sup> For the change in the parameter values instead of normalized values, see Figure A1 in Appendix A.

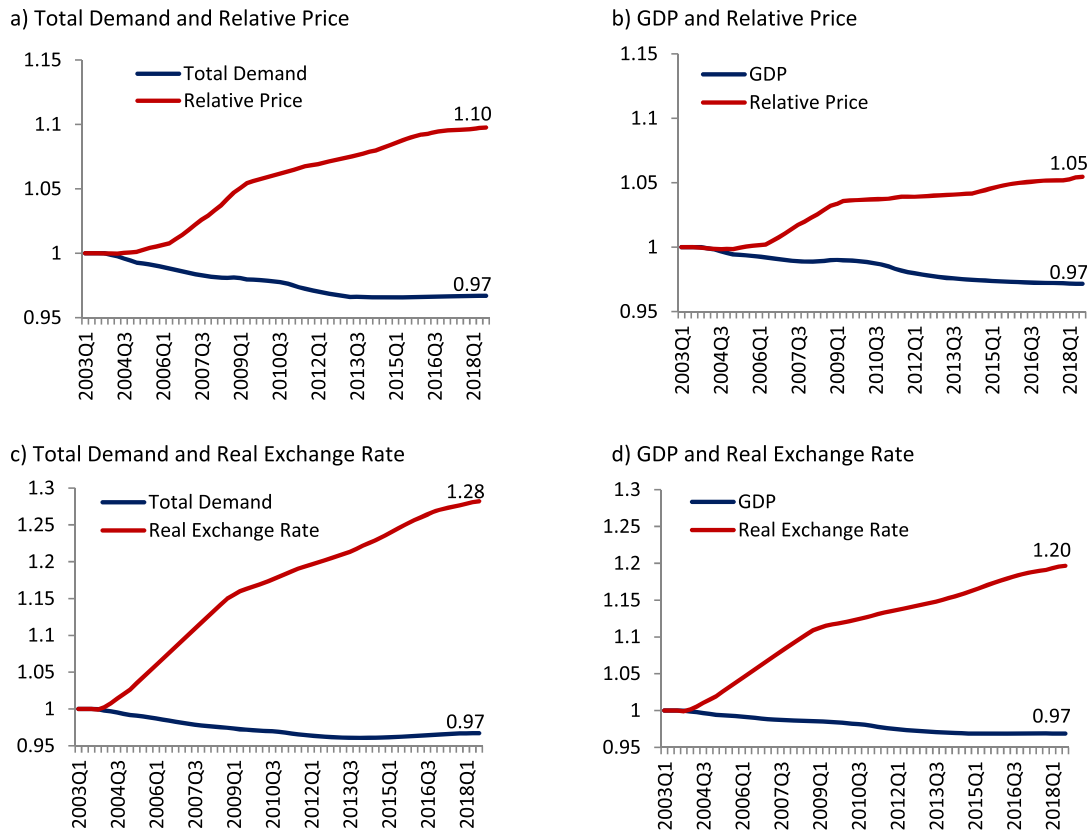


Fig. 2. Time varying elasticity estimates: Total imports excluding gold and energy.

Table 2

OLS results (expenditure components of GDP replace the income variable).

	Total Imports	Intermediate Goods	Investment Goods	Consumption Goods
<b>Consumption Expenditures</b>	<b>0.97*</b> (0.15)	<b>0.69*</b> (0.20)	<b>1.03*</b> (0.36)	<b>2.62*</b> (0.53)
<b>Investment Expenditures(-1)</b>	<b>0.33**</b> (0.11)		<b>0.62*</b> (0.18)	
<b>Merchandise Exports</b>	<b>0.33*</b> (0.10)	<b>0.63*</b> (0.11)		
<b>Merchandise Exports(-1)</b>	<b>0.15**</b> (0.06)	<b>0.41*</b> (0.07)		
<b>Relative Price</b>	<b>0.47*</b> (0.08)	<b>0.32*</b> (0.10)	<b>0.70*</b> (0.13)	<b>0.52*</b> (0.13)
<b>Relative Price(-1)</b>	<b>0.27*</b> (0.09)	<b>0.25**</b> (0.11)	<b>0.29**</b> (0.13)	
Number of Observations	61	61	61	61
Adjusted R <sup>2</sup>	0.75	0.67	0.53	0.47

1) Standard errors are given in parentheses.

2) \*, \*\*, and \*\*\* represent significance at 0.01, 0.05, and 0.1, respectively.

3) Estimation equations include constant term.

merchandise and services exports, the quantity of merchandise exports is used so that the unprocessed gold and energy products can be excluded easily.<sup>4</sup>

Before an analysis of the estimated elasticities, it is important to draw attention to two points: first, the explanatory power of the model for the total imports, which is given in the second column of Table 2, is found to be higher than those of the models that use the aggregate income variables. When expenditure components are used as the independent variables, the resulting adjusted  $R^2$  was found to be 19 and 9 percentage points higher than those of the models that employ the GDP and the total demand, respectively. Second, considering that the sum of expenditure components constitutes the income variable that is called as the total demand in the previous section, the sum of the relevant coefficient estimates is expected to give the income elasticity of imports. Here, income elasticity of imports is defined as the percentage-point change in the real growth rate of imports as a result of one percentage point change in the growth rate of real income, in this case the total demand. If the growth rate of each spending component is changed by one percentage point, the growth rate of total demand rises by one percentage points regardless of the shares of spending components. In other words, if each component's growth increases by one percentage point, the growth rate of total demand rises by one percentage point. Therefore, the sum of the estimated coefficients of the expenditure components, by definition, is the income elasticity of quantity of imports. In this context, the income elasticity implied by the expenditure components is computed to be 1.78 percent. This is very close to the elasticity (1.82) obtained by using the total demand variable.

According to the estimation results, total import growth responds to a change in the consumption expenditure growth contemporaneously, to a change in investment expenditure growth with a lag of one period, and to a change in exports growth both contemporaneously and with a lag of one period. More specifically, one percentage point increase in the quarterly growth rate of consumption expenditures raises the growth rate of the total imports by 0.97 percentage points while the same increase in the growth rate of investment expenditures increases the total import growth by 0.33 percentage points in the following period only. Similarly, one percentage point increase in the quarterly growth rate of exports quantity translated into a total of 0.48 percentage point increase in the total imports growth, of which 0.33 percentage points occur in the current period and 0.15 percentage points in the next period. These results show that the spending elasticity of imports differs significantly across the main expenditure components. Consumption expenditures has the highest elasticity coefficient and is followed by exports and investment expenditures, respectively. These findings are in line with the results of Günçavdı and Üleşin (2012). Moreover, the relative price elasticity of total imports is estimated to be 0.74 with varying degree of divergence from the estimates obtained in the above models where aggregate income and relative price variables are used.

The relationship of the sub-components of imports such as intermediate, investment and consumption goods to the components of total demand differs from that of the total imports and from each other. The findings suggest that the growth of intermediate goods import depends on the consumption spending growth contemporaneously, and on the exports growth and relative price growth both contemporaneously and with one-period lag. In case of the

investment goods imports, contemporaneous consumption expenditures and exports are the main drivers of growth. On the other hand, the growth of consumption goods imports is driven by consumption expenditure growth and relative price growth contemporaneously. Consumption spending growth affects the growth rates of all the sub categories of imports that are considered here but with different elasticity coefficients.

The time varying coefficients that are estimated with the help of Kalman filter method are presented in Fig. 3 for the total imports.<sup>5</sup> Fig. 3-a displays the aggregated elasticities (sum of lagged and instantaneous elasticities), and 3-b shows the contemporaneous and lagged elasticities separately only if they both appear simultaneously in the relevant regression equation. The elasticity of total imports to consumption spending is observed to go up during the period of global financial crisis and to decrease significantly in the post-crisis period until 2018. In this context, the effect of one percentage point increase in consumption expenditures on total import growth, which is consumption spending elasticity, decreases over time and returns to its initial level at the end of the period. The possible causes of the change in the consumption expenditure elasticity of total imports are as follows: (i) Change in the composition of consumed goods in favor of the domestically produced ones, (ii) Shift of demand between domestic and foreign intermediate goods in the process of domestic production of consumption goods, (iii) starting the production of previously imported goods,<sup>6</sup> (iv) Relatively higher or lower increase in the consumption of non-tradeable goods, and (iv) Tax increases or reductions for the high end products with some particular features. Because it is outside scope of this paper and the observed change in the consumption spending elasticity is relatively small and can safely be ignored, the listed causes are not elaborated more.

The findings also suggest that there is a slight fall (4 percent) in the export elasticity of total imports, which drops from 0.47 to 0.46. As a matter of fact, the total export elasticity of imports is said to remain unchanged over time (Fig. 3-a). The most probable channel through which export growth affects import growth is the demand for imported intermediate goods by the producers of exported goods. The intermediate goods that are essential to produce exported goods are imported either because domestic producers do not possess the technical capabilities to produce those intermediate goods domestically or because the foreign producers offer lower prices than the domestic producers. The findings indicate that there may have been very little or no change in the responsiveness of the demand of exporters for the imported inputs. On the other hand, although the lagged elasticity of total imports to investment spending declines slightly during the global financial crisis and returns to its starting level in the following years. Possible explanations for changes in investment expenditure elasticity includes (i) a change in the choices of investors in favor of domestic or foreign produced goods, (ii) the expansion of domestic production to include new investment goods as new technologies and capabilities are acquired, and (iii) implementation of government policies that encourage the use of domestically produced goods.

On the other hand, the relative price elasticity shows signs of a more pronounced change during the period of analysis and increases by around 9 percent, in levels, from 0.71 to 0.77 (see Figure A2a in Appendix A). As can be seen from Fig. 3-b, the decline

<sup>5</sup> For the change in the parameter values instead of normalized values, see Figure A2 in Appendix A.

<sup>6</sup> For example, some global automotive brands have started to produce several models in Turkey. Despite the fact that this has the potential to reduce the need for imports, the demand for these products continued to support consumption expenditures, and thus the consumption expenditure elasticity of total imports is observed to decline over time.

<sup>4</sup> The correlation coefficient between merchandise trade exports and export component of real GDP is found to be around 0.95. Given this high correlation, merchandise trade seems to be a good proxy for the real exports of goods and services under GDP.

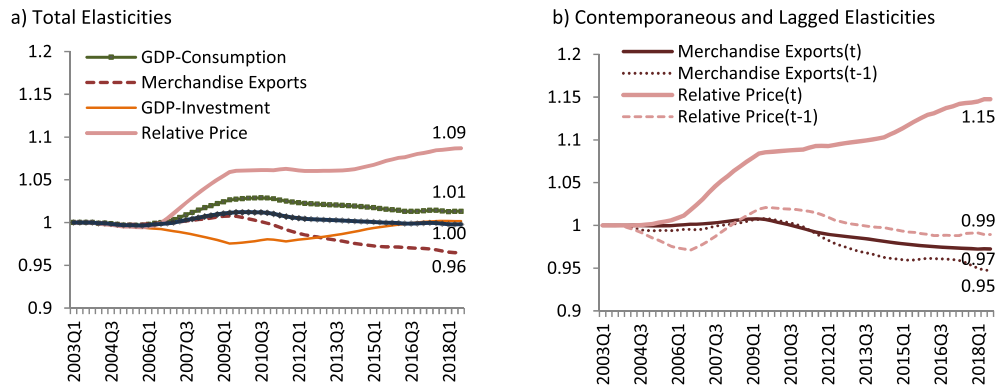


Fig. 3. Time varying elasticity estimates: Total imports excluding gold and energy.

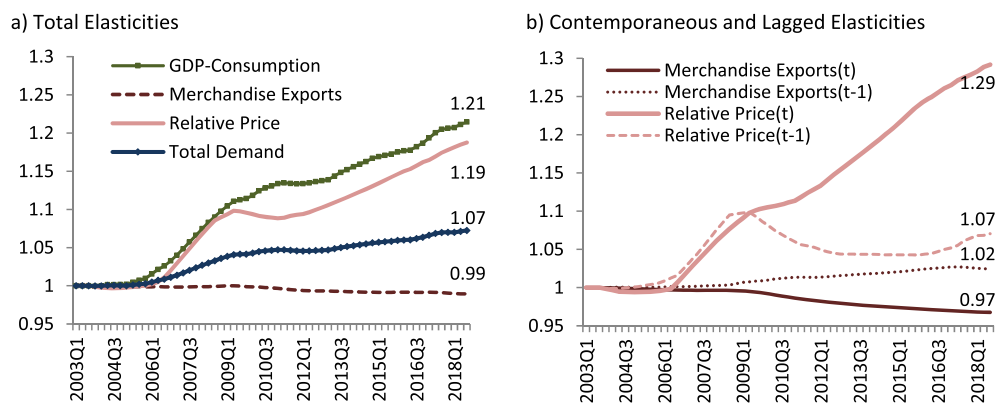


Fig. 4. Time varying elasticity estimates: Imports of intermediate goods excluding gold and energy.

in the lagged price elasticity appears to limit the rise in the total relative price elasticity. The rise in the price elasticity indicates that the substitution opportunities expanded either because the variety of domestic goods that could substitute the imported goods increased or because the variety of imported goods that could substitute the domestic goods increased. To wrap up, total demand elasticity remains almost unchanged despite its small ups and downs while the price elasticity continuously increases with a total change of around 9 percent. Despite the obvious level differences in the elasticity of total imports to the subcomponents, their behavior over time exhibits little difference and they all remain almost unchanged throughout the period of analysis.

Fig. 4 shows the temporal movement of spending elasticities of the intermediate goods imports, which is the biggest item in Turkey's imports.<sup>7</sup> According to the panel (a) of the figure, the total export elasticity coefficient, which is the sum of the instantaneous and lagged effects on the intermediate goods imports of a one-percentage-point shock, hardly changes over time. It can further

be said that both the instantaneous and lagged elasticities do not change much either (Fig. 4-b). The elasticity of intermediate goods import to consumption expenditures increases significantly during the period. There are two possible explanations for such a change: first, the share of domestically produced goods, which require use of imported inputs at varying levels across products, may have increased, and second, the import content of domestic consumption goods may have augmented. On the other hand, the relative price elasticity of imports of intermediate goods increases by 19 percent from 0.54 to 0.64 during the period of analysis. This suggests that the substitution options between imported and domestically produced inputs may have expanded considerably.

While the relative price elasticity of investment goods falls by 5 percent throughout the period of analysis, the investment spending elasticity goes down by 4 percent (Fig. 5-a).<sup>8</sup> Despite a limited increase in the instantaneous price elasticity, the lagged price elasticity decreases noticeably so that total price elasticity decreases from 1.01 to 0.96 (Fig. 5-b). The fact that the total relative price

<sup>7</sup> For the change in the parameter values instead of normalized values, see Figure A3 in Appendix A.

<sup>8</sup> For the change in the parameter values instead of normalized values, see Figure A4 in Appendix A.



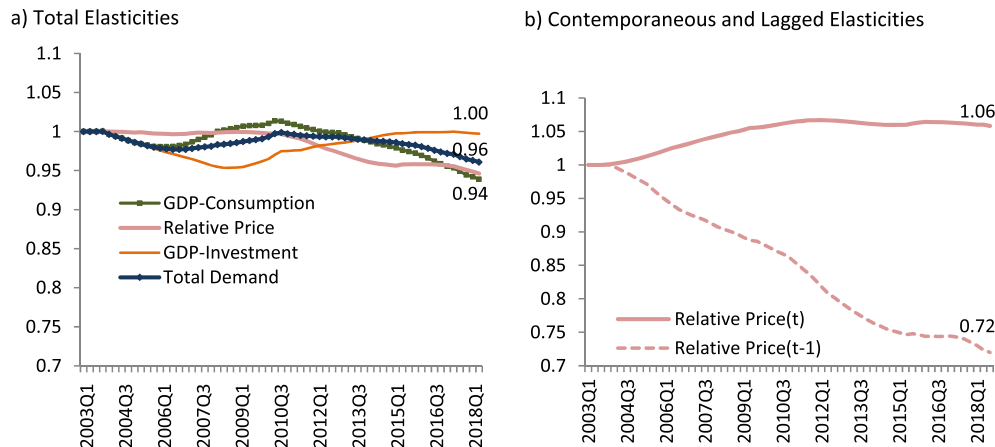


Fig. 5. Time varying elasticity estimates: Imports of investment goods.

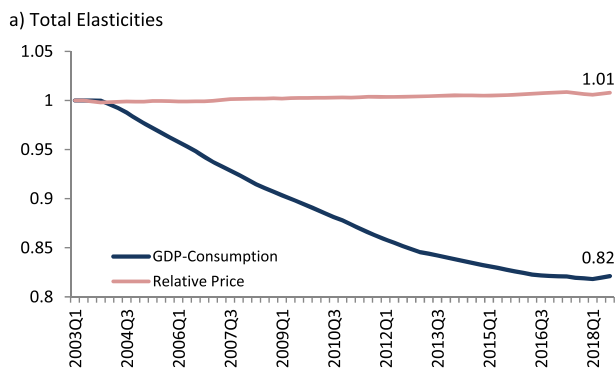


Fig. 6. Time varying elasticity estimates: Imports of consumption goods.

elasticity of investment goods imports falls at a relatively low rate implies that there has been a relatively small change in the substitutability of domestic and imported investment products. A closer look at the period of analysis reveals that the consumption spending elasticity of investment goods imports becomes smaller over time while the investment spending elasticity remains roughly the same. The fall in consumption expenditure elasticity is around 6 percent.

According to Fig. 6, there is not a significant change in the total relative price elasticity of consumption goods imports while its elasticity to consumption spending decreases substantially over time.<sup>9</sup> Although there is an upward trend in total relative price elasticity, the amount of rise remained too small. This makes an impression that there is no significant change in the diversity or number of domestic and imported consumer goods that can be substituted for each other. Meanwhile, the decline in the consumption spending elasticity is noteworthy. So, the impact of one percentage point increase in consumption spending gradually diminishes over time. This may be a sign of decreasing demand for

the imported consumer products or increasing share of non-tradeable goods in the total consumption expenditures.

#### 4. Conclusion

The findings suggest that changes in imports are mainly explained by both income and relative price changes with the former having a higher elasticity. Our findings also indicate that the explanatory power is considerably increased when the expenditure components are used. Total import growth responds to the consumption expenditure growth contemporaneously, to the investment expenditure growth with one-period lag, and to the exports growth with both contemporaneously and one-period lag. The elasticity of income is found to decline throughout the period of analysis. Consumption and investment expenditure elasticities remain almost unchanged while the export elasticity decreases over time. Moreover, the relative price elasticity increased over time for total imports at a more pronounced rate.

The growth of intermediate goods imports depends on the consumption spending growth contemporaneously, and on the exports growth and relative price growth both with contemporaneously and one-period lag. In case of the investment goods imports, contemporaneous consumption expenditures and lagged investment expenditures are the main drivers of growth. On the other hand, the growth of consumption goods imports is driven by consumption expenditure growth and relative price growth contemporaneously. Consumption spending growth affects the growth rates of all the sub-categories of imports that are considered here but with different elasticity coefficients.

Regarding to the behavior of the elasticities over time, consumption expenditure elasticity of intermediate goods imports increases considerably while the export elasticity shows no sign of change. The consumption expenditure elasticity of investment goods imports decreases slightly whereas the investment expenditure elasticity remains unchanged. Meanwhile, the consumption expenditure elasticity of consumption goods imports falls substantially unlike the other import components. Last but not least, the relative price elasticity stays constant over time for investment and consumption goods imports but increases noticeably for the intermediate goods imports that exclude gold and energy.

<sup>9</sup> For the change in the parameter values instead of normalized values, see Figure A5 in Appendix A.

Appendix A

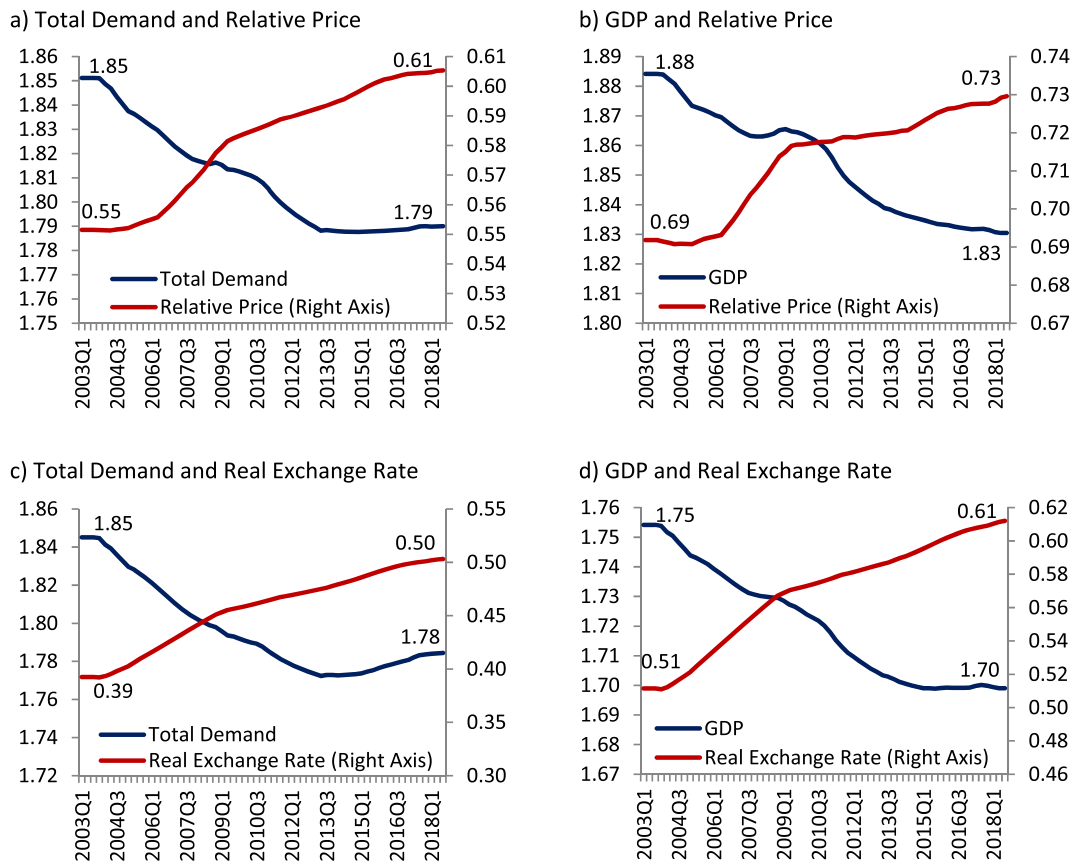


Fig. A1. Time Varying Elasticity Estimates: Total Imports Excluding Gold and Energy.

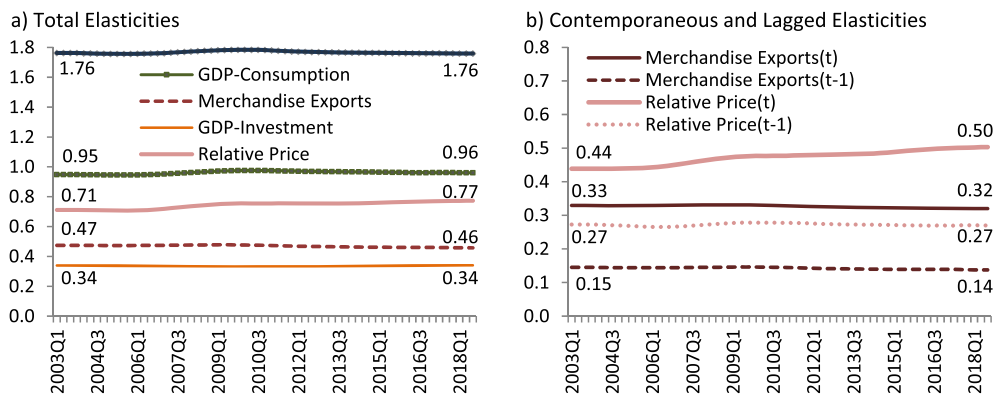


Fig. A2. Time Varying Elasticity Estimates: Total Imports Excluding Gold and Energy.

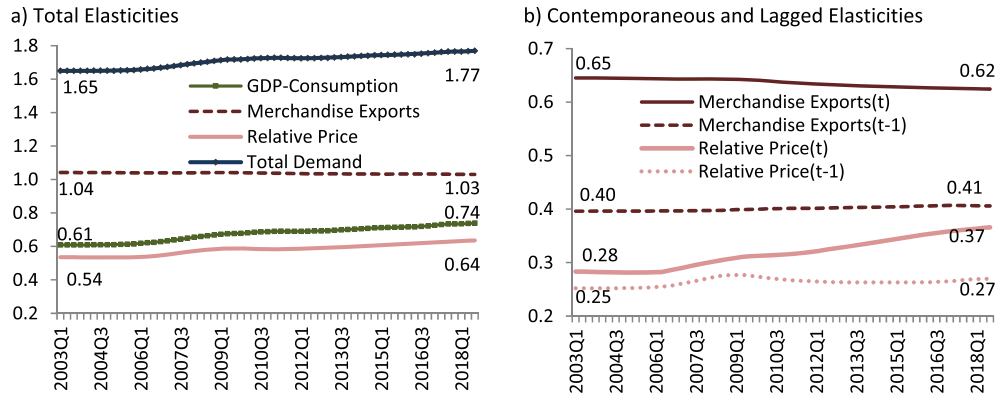


Fig. A3. Time Varying Elasticity Estimates: Imports of Intermediate Goods Excluding Gold and Energy.

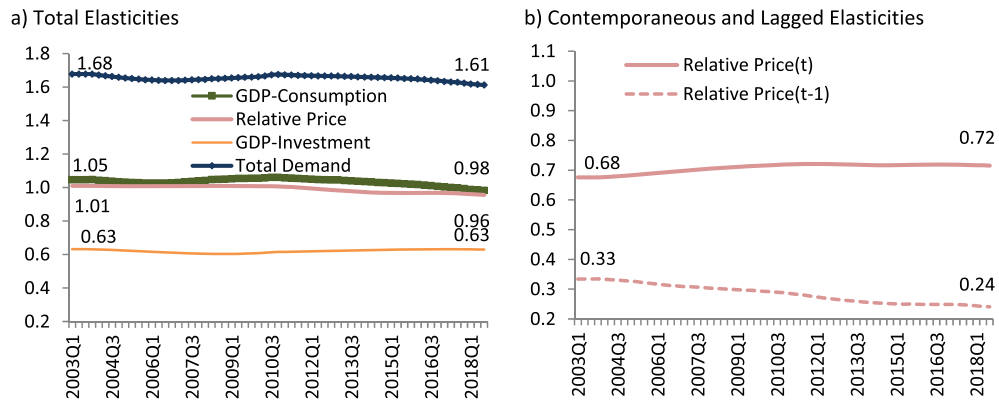


Fig. A4. Time Varying Elasticity Estimates: Imports of Investment Goods.

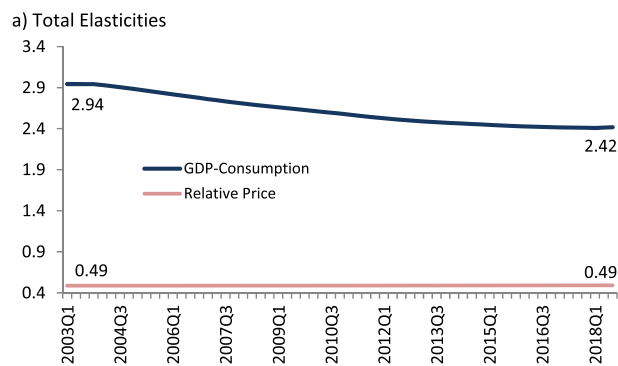


Fig. A5. Time Varying Elasticity Estimates: Imports of Consumption Goods.

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