THE WELFARE EFFECTS OF CHANGES IN GLOBAL FOOD PRICES ON INCOME DISTRIBUTION IN TURKEY

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DECLARATION OF ORIGINALITY

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ABSTRACT

The Welfare Effects of Changes in Global Food Prices
on Income Distribution in Turkey

This study examines the pass-through effects of global food prices on food prices in Turkey, and the welfare effects of food price changes on income distribution in Turkey. Food products are the indispensable part of the consumption basket for entire households, especially for low-income groups. Therefore, food price changes can directly influence the living conditions of people positively or adversely. To figure out these impacts in Turkey, we first obtain the pass-through coefficients for the selected food groups using econometric tools. Then, we integrate these coefficients and Turkish household groups, which are divided into five brackets based upon nominal income, into the CGE analysis. This analysis allows us to estimate how an economy can react to changes in a part of the economy under the determined framework. Finally, we apply both a positive 5% shock and a negative 5% shock to world food prices. According to the findings, the income of all household groups declines when global food prices surge. However, rising food prices have a more adverse effect on low-income household groups, and accordingly distort income distribution in Turkey. Inversely, under the scenario wherein world food prices decline, low-income households are affected more positively in wealth terms. It is observed that income distribution in Turkey recovers slightly. Meanwhile, disruptive impact of increased food prices is stronger than remedial impact of tumbled prices on income distribution.

ÖZET

Küresel Gıda Fiyatlarındaki Değişimlerin Türkiye'deki Gelir Dağılımı Üzerindeki Refah Etkileri

Bu çalışmada, küresel gıda fiyatlarının Türkiye'deki gıda fiyatları üzerindeki geçişkenlik etkileri ve gıda fiyat değişimlerinin Türkiye'deki gelir dağılımı üzerindeki refah etkileri incelenmektedir. Gıda ürünleri, başta düşük gelirli hanehalkları olmak üzere tüm hanehalklarının tüketim sepetinde önemli bir yer tutmaktadır. Bu nedenle, gıda fiyat değişimleri insanların yaşam şartlarını olumlu ya da olumsuz yönde doğrudan etkileyebilir. Türkiye özelinde bu etkileri anlayabilmek için, ilk önce seçilmiş gıda grupları için ekonometrik araçlar vasıtasıyla geçişkenlik katsayıları elde edilmiştir. Ardından, bu katsayılar ile beraber harcanabilir gelirlerine göre beş gruba bölünmüş hanehalkları, CGE analizine eklenmiştir. Bu analiz, oluşturulan yapı altında, ekonominin değişimler karşısında nasıl tepki verebileceğini tahmin etmemize yardımcı olmaktadır. Son olarak, dünya gıda fiyatlarına hem %5'lik pozitif şok hem de %5'lik negatif şok verilmiştir. Bulgulara göre, küresel gıda fiyatları arttığında tüm hanehalklarının geliri azalmıştır. Ancak, artan gıda fiyatları düşük gelirli hanehalkları üzerinde daha olumsuz bir etki göstermekte ve bu doğrultuda Türkiye'deki gelir dağılımını bozmaktadır. Diğer yandan, dünya gıda fiyatlarının gerilediği durumda ise düşük gelirli hanehalkları refah yönünden daha olumlu etkilenmektedir. Böylece, Türkiye'nin gelir dağılımı da bir miktar iyileşmektir. Bu arada, artan gıda fiyatlarının gelir dağılımı üzerindeki yıkıcı etkisi, düşen fiyatların iyileştirici etkisinden daha güçlüdür.

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CHAPTER 1

INTRODUCTION

Food is one of the basic needs to survive (Shaw, 2007). Thus, all people should all the time have an opportunity to reach a minimum amount of food to stay alive. However, several difficulties such as continuing population increase, high consumption growth, high competition for land, water, and energy, etc. (Godfray et al., 2010) break the balance between supply and demand conditions. Shaw (2007) shares that one child dies every five seconds from hunger and related causes. Similar pathetic facts bring the substance of policies regarding food security, which basically means enough food according to Pinstrup-Andersen (2009), to mind. Moreover, Rosegrant and Cline (2003) claim that global food security will remain a worldwide concern for the next fifty years and beyond. Accordingly, downward or upward adjustments in food prices are vital in every sphere of life and tend to keep its importance in the upcoming years.

Like other social phenomena, a policy response to food prices always remains on the agenda as well. De Janvry (1983) emphasizes that governments might alter their agriculture, trade, and exchange rate policies to direct domestic food prices. Especially undeveloped and developing countries, which more low-income people live in, should be cautious against the starvation risk with the aid of developed countries as well as reputable organizations. Zezza et al. (2009) share that poorer households are likely to be adversely affected the most by an increase in the price of staple food commodities. Unfortunately, this condition holds regardless of the country, region and location (urban or rural). The key reason is that poorer households are overwhelmingly net buyers of food. In general, they have a higher weight of food items in their total consumption baskets, while richer groups can cope with rising food prices a bit by cutting their non-essential expenditures. Therefore, the

periods, when food prices peak globally (or only domestically), have a tendency to affect the income distribution of the countries in a negative way. Moreover, this adverse effect can take place in the short run (Headey & Fan, 2008).

Based on the TurkStat data (2019a), 20.1% of the total population in Turkey (15,864,000) was below the poverty line in 2017, under the assumption that 60% of the median disposable income at TL 9,532 was the poverty threshold. In this direction, we can say that Turkey should substantially pay attention to food prices similar to other developing countries when forming and implementing its social policies. Zezza and Tasciotti (2010) can be checked for further policy examples and empirical evidence from developing countries. All in all, the high importance of stable foods for human life makes their prices one of the issues often discussed in public, politics, and economic literature.

Based on the FAOSTAT data (2019), global food prices exposed to solid spikes in the 2007/2008 and 2010/2011 periods. Headey and Fan (2008), Timmer (2008), and Gilbert (2010) assert that these extra movements were chiefly due to heavy global commodity demand especially from China and other Asian countries, financial market speculations, export restrictions, weak dollar currency, growing production costs with increasing energy and metal prices, accelerating bio fuel production, productivity slowdown, rising population with limited land and water facilities, and lastly elevating risks related to the climate change.

After removing the exchange rate effect from the TurkStat data (2019b), one can see a similar trend between world food prices and local food prices in Turkey from Figure 2. This transmission brings about the concept of the law of one price [1]. LOOP

[1]The Law of One Price will be referred as "LOOP" throughout the text

affirms that international arbitrage leads to prices of identical or near-identical commodities traded in spatially separated markets to track similar movements and the long-run trends. LOOP asserts that the price of the same good in each market must be the same by definition. Many simulation models, which are backed by this concept, assume that there is a full transmission between global prices and local prices. However, there are opinions against LOOP (Ardeni, 1989), while there are articles showing that the transmission mechanism works accurately only in the long run (Baffes, 1991). Besides, the degree of price transmission may vary depending on conditions such as market location (Minot, 2010), trade restrictions (Götz et al., 2010) as well as the type of market competition. The non-linearity of price transmission is another crucial subject discussed under this information flow according to Lo and Zivot (2001). To touch the real world better in our analysis, we will calculate the pass-through coefficients between all food groups considering their global and local prices. The coefficients will show us the manner of price transmission mechanism between the selected food groups. To be aware of these coefficients, accordingly transmission mechanism, is highly meaningful as a difference in the pass-through coefficients might lead to a variation in both consumption habit of households and the welfare of them for any case, in which food prices move upward or downward.

We can take one step further, by blending the concepts above, thanks to several guiding studies working on the wealth effects of changes in food prices that are core of our study. Cudjoe et al. (2010) take a local view on global food price shocks by analyzing price transmission among regional markets in Ghana. The paper uses the major traded and non-traded food commodities. It shows that price transmission is heterogeneous for different food crops and different regional markets. Moreover, it indicates that the poorest of the poor, especially poor urban households, face the

hardest hit by high food prices using the VECM model. By using nine low-income countries data, Ivanic and Martin (2008) underline that the overall impact of higher food prices on poverty in generally adverse. Considering the developments in global food prices in 2005-2007, the simple average of the estimated effects on national poverty rates (USD/day) was an increase of 4.5 percentage points. They apply this result to all low-income countries and the result translates into a rise in the poverty headcount of 105 million people out of the low-income population of 2.3 billion. Ivanic et al. (2012) indicate also that the average poverty change was more in low-income countries than in middle-income countries during the 2010/2011 surge period in food prices. These two articles are benefiting from the GTAP analysis.

Meanwhile, we have to mention here that relatively high-income households also suffer somewhat due to increasing food prices. The price increase only may have a positive effect on people, who work in the agricultural sector (Hertel et al., 2004). On the other hand, outcomes are vice versa when world food prices collapse. The income level of all groups recovers, while the low-income household is the most favorably affected group based on the wealth effect.

Grethe et al. (2012) investigate the distributional effects of the transmission of world market prices shocks for Israel under the CGE simulation. While assuming the full transmission, total household consumption tumbles by 0.8% and total supply declines by 0.3% under the 100% positive shock for the selected world food prices. Additionally, the aggregated welfare loss at the country level is 4.9 billion NIS (0.9% of GDP). In detail, high-income households face higher income declines in absolute but low-income households are harder hit by the shocks compared with them. Likewise, we observe the welfare effects of global food price changes using the CGE analysis in this study.

There has been no extensive study working on price transmission mechanism between global and local food prices considering sub-groups. Our contribution to the literature is becoming more striking for Turkey because annual food inflation has shown a clear upward trend in recent years, and it has pushed the annual headline figure up as well. The authority wanting to find a solution to high food prices in Turkey that might turn into a widespread social wound, should understand the FX pass-through effects based on various food groups.

Additionally, we discuss the impacts of the potential positive or negative shock to global food prices on the income distribution of Turkish households, who are separated based on the nominal income level. The previous studies, even using different analysis methods, have often acquired similar results. The income of each consumer groups declines when global food prices rise. However, on the wealth effect basis, low-income households show the most welfare loss as they allocate more their earnings to food spending. Yet there has been no extensive paper investigating the wealth effects of food prices on household groups for Turkey. In detail, the CGE analysis method has not implemented for this kind of studies for Turkey yet. This method enables us to digest various impacts of food price changes on the Turkish macroeconomic figures such as GDP, imports, exports, and consumption.

The thesis is organized as follows. Chapter 2 introduces the structure of Turkish economy and Turkish households, Chapter 3 shows the econometric procedures and results, Chapter 4 describes the CGE analysis and has outcomes about Turkey's income distribution after the simulated shocks. Chapter 5 concludes the thesis.

CHAPTER 2

THE STRUCTURE OF TURKISH ECONOMY AND HOUSEHOLDS

This chapter provides the necessary information related to both Turkey's key macroeconomic indicators and Turkish households. We believe that these materials make the interpretation of the analysis results to be obtained in the following sections easier. The first part of this chapter includes crucial macroeconomic variables of Turkey and the essential factors that determine the pass-through mechanism, while the second part presents the structure of the country's households.

2.1 The structure of Turkish economy

We employ Turkey's macro figures on the Social Accounting Matrix (the SAM matrix) of the economy, to be introduced in detail in Chapter 4, to understand the wealth effect of global food price changes. According to the latest data published by TurkStat (2019c), Table 1 represents the key macroeconomic indicators of the economy. Hereafter, billion will be shown as *bn*.

Table 1 points that domestic absorption, which is the sum of public consumption, private consumption, and investment, exceeded the Turkish GDP in 2018, indicating that Turkish economy has a dependency on imports, because of its economic structure. For example, since the share of high value-added technology products is very low in domestic production, demand for such products is mainly provided from abroad. Likewise, domestic investments depend on imports of intermediate investment goods from abroad. Therefore, Turkey's nominal exports are rising with nominal imports during the periods when economic activities are solid.

Meanwhile, we would like to underline that the key driver of the economic growth is consumption as seen in Table 1. In 2018, 71% of domestic absorption was

from the consumption items (57% was from private consumption and 14% was from public consumption).

Table 1. Key Macroeconomic Indicators of Turkey

Indicator	Value	Year
GDP	TL 3.701bn	2018
GDP (per capita)	USD 9,632	
Domestic absorption	TL 3,762bn	
Investment	TL 1,098bn	
Private consumption	TL 2,131bn	
Government consumption	TL 533bn	
Import demand	TL 1,140bn	
Export supply	TL 1,096bn	
Inflation (year-end)	20.3%	2018
Food inflation (year-end)	25.6%	
USDTL (year-end)	5.28	
Unemployment rate (ave.)	11.0%	
Gini coefficient	0.40	2017

Source: TurkStat, Annual National Accounts Statistics (2018)

Table 2 shows the foreign trade figures of Turkey including the place of agricultural products in particular, based on the TurkStat data (2018). Total exports of Turkey came in at USD 157bn in 2017, while total imports were USD 234bn. The exports of agricultural products were at USD 17bn, while their imports were at USD 18bn. 9.0% of the total trade volume consists of agricultural products including food products. The agricultural sectors constitute 6.1% of the 2017 GDP print.

Food products also seem to take a key position in agricultural trade, considering the composition of imports and exports. The total food exports were USD 15.2bn (9.7% of total exports) in 2017, while total food imports (3.0% of total imports) realized at USD 7.1bn throughout the year. Table 3 expresses the share of food

Table 2. Foreign Trade Figures of Turkey

Item	Exports	Imports
Total Figure	USD 157bn	USD 234bn
Agricultural Products	USD 17bn	USD 18bn
Food Products	USD 15bn	USD 7bn

Source: Turkstat, Foreign Trade Statistics (2017)

products in Turkey's food trade. The SAM matrix includes food items such as cereals, dairy, fruit, meat, vegetable oils, rice, sugar, vegetable. However, it does not contain beverage as it is focusing on food items only.

As shown in Table 3, fruit has the highest share of food exports, followed by cereals, vegetable, meat. More importantly, on the imports side, cereals have the highest share in total figures, followed by vegetable oils, vegetable. McCarty (2007) finds that the pass-through is larger in countries with a larger import share and more persistent exchange rates, and import prices. Therefore, the pass-through coefficient is expected to be higher for cereals and vegetable oils, which occupy more place in imports.

One of the problem for Turkish economy (especially for inflation) is clearly that domestic food prices remain above world food prices. Figure 1 has world and Turkey's general food prices, and visualizes the situation above as December 2003 is a base year. Global price data is from FAOSTAT (2019), while Turkey food prices are taken from TurkStat (2019b). The Central Bank of the Republic of Turkey (CBRT), whose primary objective is to achieve and maintain price stability, is one of the big local institution following this development closely. The CBRT attempts to identify the developments in Turkey's food prices relative to general consumer prices in comparison with different groups of countries (Akçelik & Yücel, 2016). The study

Table 3. Share of Food Products in Turkey's Food Trade

Item	Exports	Imports
Cereals	18.6%	24.5%
Dairy	4.7%	1.8%
Fruit	25.6%	3.9%
Meat	9.5%	4.5%
Vegetable oils	6.7%	19.8%
Rice	0.3%	2.1%
Sugar	4.0%	2.9%
Vegetable	11.1%	8.1%
Beverage	2.1%	3.1%
Other foods	17.5%	29.4%
Total	100%	100%

Source: TurkStat, Foreign Trade Statistics (2017)

underlines also that relative food prices are high in Turkey compared to the European Union countries, and Turkish food inflation has exhibited a negative outlook in terms of both level and volatility. The negative separation is particularly noticeable in the post-global food crisis period (2010-2016). As a result, the findings extempore imply that the pass-through of world food prices may not make sense on local food prices.

On the other hand, Özmen and Topaloğlu (2017) find a considerable amount of exchange rate and import price pass-through both for processed and unprocessed food prices. They say that the import price pass-through is in the range of 12-15%, while the exchange rate pass-through is in the range of 23-27% for local food prices. Food prices, which have been considered that they are hit by the domestic supply shocks, are actually subject to the foreign price shocks to a large extent.

Although the correlation between food prices is low when Turkish food prices in TL, we obtain local price data moving closer to the trend of world prices after the adjustment of the exchange rate effect from local prices. Figure 2 includes the

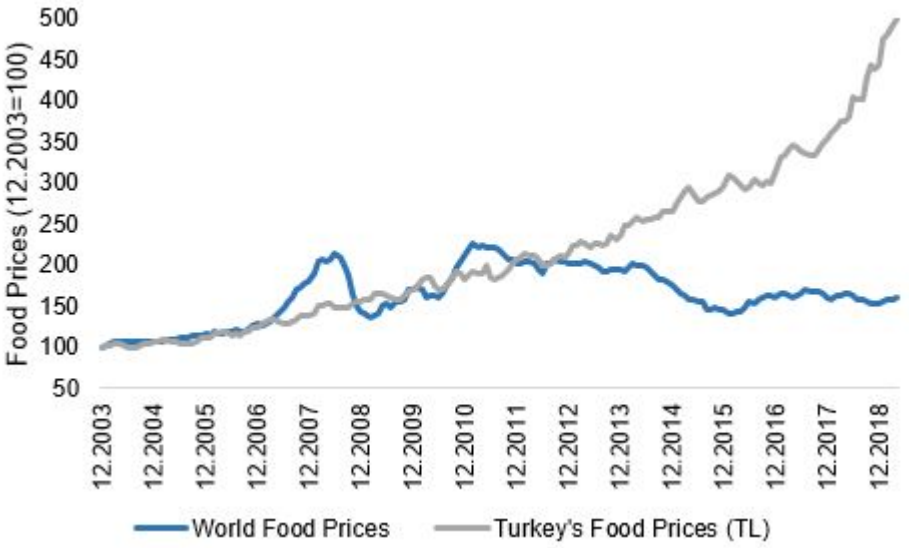

Figure 1. World (USD) and Turkey's (TL) general food prices

Source: FAOSTAT (2018), TurkStat (2018)

relationship between Turkey's general food prices in terms of USD and world general food prices while using the same sources with Figure 1. Firstly, local prices were converted from TL to USD using average monthly USDTL data from IMF (2019). Then, both have been indexed as December 2003 is a base period. Figure 2 aims to reflect the pass-through effect of world food prices on Turkey food prices visually.

Many inferences, which can be derived from Figure 2, are opposite of inferences from Figure 1. Most importantly, global food prices are generally higher than domestic prices when Turkish prices are in terms of USD. However, the volatility of domestic prices is a common negative attribute for two comparisons. The volatility of domestic food prices is relatively high due to the unprocessed food prices. The main reasons are the seasonal effects, the length of supply chain going from the manufacturer to the final consumer, structural problems like the informal economy

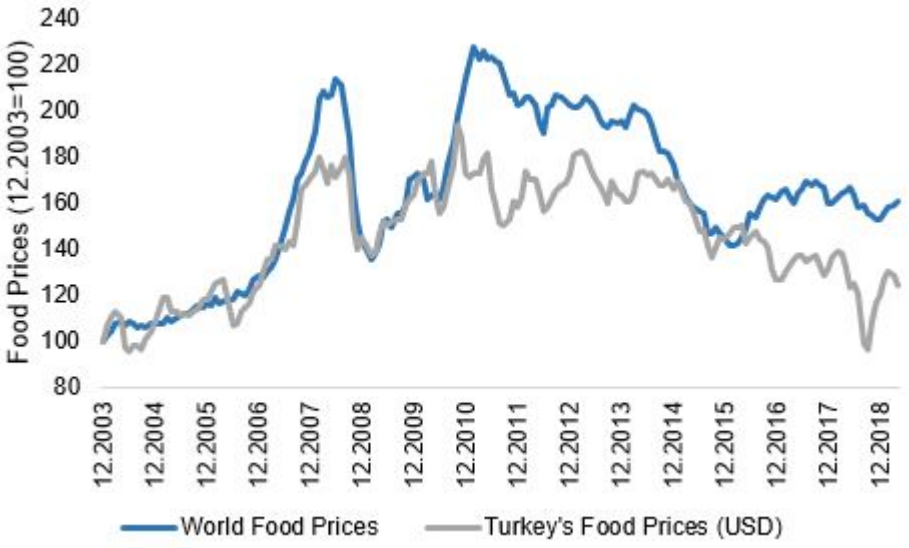

Figure 2. World (USD) and Turkey's (USD) general food prices

Source: FAOSTAT (2018), TurkStat (2018)

and the lacks of irrigation, necessary stocks, big producers having financial strength, production and storage technologies (Öğünç, 2010).

Given the above developments, the interpretation of the food data will be made in terms of USD as calculating the pass-through coefficients in econometric analysis. Moreover, the series seen in the figures above are not seasonally adjusted. However, the data in the analysis section will be seasonally adjusted because the correlation between global and domestic food prices increase by lowering the volatility in the case of adjustment.

In this section, we have focused more on general food prices. Furthermore, the similar development can be monitored for the sub-items of food prices as well. The figures of other food items in the SAM matrix, are attached in Appendix A. As a guidance, Figure A1 shows world and Turkey's prices in TL for meat, while Figure

A2 shows world and Turkey's prices in USD for that. Figure A3 and Figure A4 include same prices for dairy, respectively. Figure A5 and Figure A6 for cereals prices, Figure A7 and Figure A8 for vegetable oils prices, Figure A9 and Figure A10 for sugar prices have same historical data, based on FAOSTAT (2019) and TurkStat (2019c).

2.2 The structure of Turkish households

We declare how we classify Turkish households in the second part of this section. Also, we provide their main characteristics such as income and consumption levels. To investigate any changes' effects on the income inequality, we need to classify households according to their income levels. Therefore, the SAM matrix, which we use for the CGE model in the next section, has five household groups ordered by their nominal income. Table 4 shows the income characteristics of five Turkish household groups. The data is from the TurkStat for the 2017 year (2019a).

Turkish consumers are classified as Household 1 (HH1) has the highest income, and Household 5 (HH5) has the lowest income. The number of people owned by each household group is equal (20% of the total household size). Table 4 includes average and median income of households. As illustrated in it, HH1 has 46.7% of the total disposable income in Turkey. The lowest income group has only 6.3% of the total income. The median income of HH1 was 82,694 TL in 2017, while its median income was 82,694 TL. Unfortunately, the average disposable income of HH5 was only 15,584 TL, which is only one eight of HH1. Table 4 also states that household groups are highly separated on an income basis. HH1 has an astronomic income compared to other households, while HH2 and HH3 are roughly close to the average levels. However, HH4 and HH5, which constitute the 40% of Turkey's total

population, are forced to live under low prosperity. In addition, the average disposable income of households was 46,132 TL. Lastly, the overall picture points out that income equality in Turkey is substantially corrupt.

Table 4. Income Structure of Turkish Households

Household	Share *	Ave. Income (TL)	Median Income (TL)
HH1	46.7%	107,616	82,694
HH2	21.4%	49,299	48,630
HH3	15.1%	34,797	34,709
HH4	10.6%	24,412	24,300
HH5	6.3%	14,537	15,584

* Household's share in total income
Source: TurkStat, Income Distribution and Living Conditions Statistics (2017)

In the economic literature, the Gini coefficient is one of the most used indicators to show income inequality. There are also various indicators (Atkinson, 1970) as well as the different extensions of the Gini coefficient (Lerman & Yitzhaki, 1984). However, we select the Gini coefficient for the comparison among the OECD countries in Figure 3 as the respectable global organizations consider this ratio. As a definition, the Gini coefficient is a measure of statistical dispersion that represents the income or wealth of a nation's citizens. The Gini coefficient of zero indicates perfect equality, while the Gini coefficient of one expresses maximal inequality. Figure 3 shows the rank of Turkey in 2015 among the OECD countries according to the Gini coefficient (OECD, 2018). The explanation of the country codes is in Appendix B.

According to Figure 3, Turkey is the second country with the worst income distribution among the selected OECD countries. Chile is at the first rank. U.S., Israel and Great Britain are ranked respectively following Turkey. Turkey should focus on the inequality needs besides reaching the strong growth figures. As income inequality

can raise the socio-political instability. For instance, deteriorating inequality with rising food prices is considered as one of the triggers of the Arab Spring, which started in 2010 (Lagi et al., 2011). The study implies that avoiding global food crises and associated social unrest requires rapid and concerted action. Also, Ianchovichina et al. (2014) say that both international prices and their volatility matter for domestic inflation among the Arab countries. On the macroeconomic side, inequality is negatively, and robustly, correlated with growth (Clarke, 1995). As a result of the article, decreasing inequality from one standard deviation above to one standard deviation below the mean increases the long-term growth rate by approximately 1.3% per year.

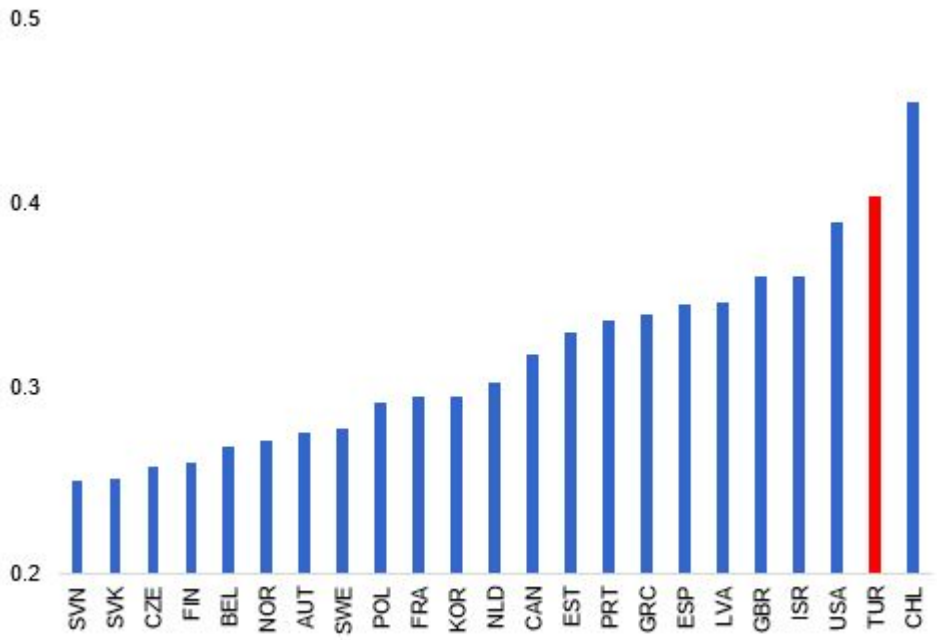

Figure 3. The selected OECD countries ranked by the Gini coefficient

Source: OECD, Income Inequality (2015)

Figure 4 includes savings rates of Turkish households. The calculations are based on the Household Budget Survey Micro Data Set 2012 prepared by TurkStat. The properties of households such as disposable income, consumption expenditure are calculated with the help of this budget survey. Çolak and Öztürkler (2012), which benefit from the Household Budget Survey Micro Data Set 2010, achieve similar results. In addition, saving rate of households is added into the SAM matrix to strengthen its bond with the real economy. In parallel to Figure 4, we can say that Turkish households have rather low savings. Saving rates are even negative for low-income households. Saving rate for the highest income group is 21%. Based on the 2012 data, the general saving rate of all households is 6.6%, pointing out that all but the highest-income group fall below this threshold level. The most important reason for this situation is that Turkish citizens can earn insufficient level of disposable income. This realization also can be considered as another proof that Turkey has higher income inequality. Similarly, Çolak and Öztürkler (2012) claim that the income levels of households must be raised to increase savings.

Although wealth of all households diminishes under the case of rising food prices harshly, the differences might exist due to various income composition per group for instance. Table 5 demonstrates the shares of income sources such as labor, capital, transfer, and rest of world transfer for households. The calculations are made using the Household Budget Survey Micro Data Set 2012 prepared by TurkStat. The average household income is composed of 46% from labor factor, 22% from capital factor, 31% from government transfers, 1% the rest of the world. We assume that nearly all sources of income are weakening, while global and local food prices are rising, but the government transfers remain the same. Consequently, low-income households can obtain a higher share from the fixed government transfers than

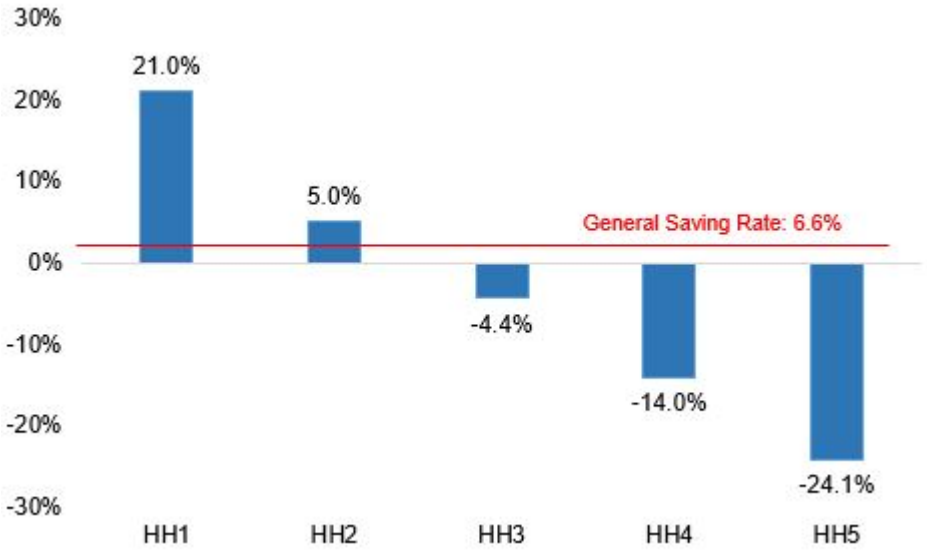

Figure 4. Saving rate of Turkish household groups

Source: TurkStat, Household Budget Survey Micro Data Set (2012)

high-income ones in relative terms. In the case of rising prices, the transfer incomes usually work as a stabilizer.

Figure 5 shows the distribution of the households' consumption basket, based on the TurkStat (2019b). In detail, housing and rent item is at the first rank in consumer expenditures with a weight of 24.7% in the basket. Behind it, food and non-alcoholic beverages item, which is the cornerstone of our analysis, come with a weight of 19.7% in the consumer basket. Transportation item is in third place as well. One may expect that price shocks that may arise from these three items can be more effective on household welfare as the total weight of these items in the total consumption basket is 62.9%. Nevertheless, when compared with 10 years ago, we detect that this ratio has decreased and that there is a recovery in the consumption basket. The weight of housing and rent item was 27.2%, the weight of food and non-alcoholic beverages

Table 5. Share of Income Sources For Household Groups

Household	Labor	Capital	Transfer	Rest of World Transfer
HH1	51.5%	34.5%	13.2%	0.8%
HH2	55.4%	19.7%	24.2%	0.7%
HH3	49.1%	20.5%	29.6%	0.8%
HH4	44.7%	18.7%	36.0%	0.6%
HH5	31.6%	15.4%	52.0%	1.0%
Average	46.4%	21.8%	31.0%	0.8%

Source: TurkStat, Household Budget Survey Micro Data Set (2012)

item was 24.8% and lastly, the weight of transportation was 13% in 2006. The high concentration of certain products in the consumption basket makes the household more sensitive to the price level and volatility of the related products.

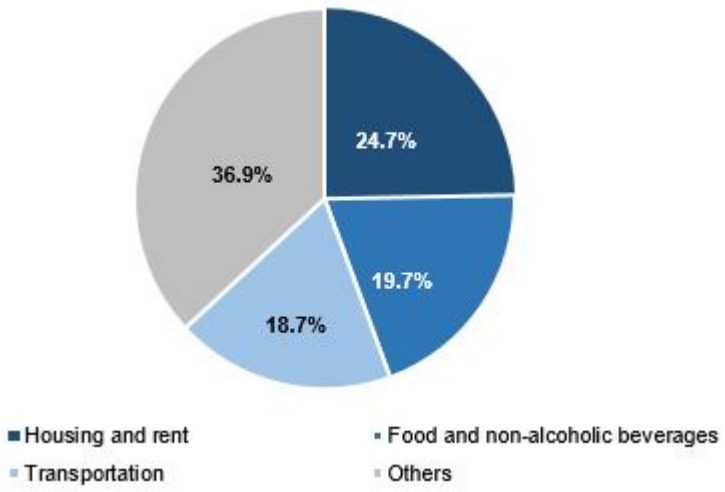

Figure 5. Distribution of consumption expenditures in Turkey

Source: TurkStat, Consumer Price Index (CPI) Statistics (2017)

Before examining the welfare effects of food prices on consumers, we must understand the consumption trend of Turkish households better. The weight of food

item in the consumer basket is the main factor that generating the welfare effects on households. The greater the household's consumption share of food, the more likely it is affected by food prices naturally. Therefore, the group with relatively high food spending is adversely affected by the increases in food prices but positively affected by price decreases.

Yükseler (2014) points out that the consumption pattern of Turkey was getting closer to the European countries during the period from 2005 to 2014. However, there are still significant differences in some of the sub expenditure groups. The weight of food and non-alcoholic beverages item in Turkey is still 8.7 percentage points higher than the weight in the European countries for the 2014 year. Meanwhile, the difference is more limited with Greece, Spain, and Italy, where are located in the same climatic zones with Turkey and have high tourism potential. Moreover, the distribution of food consumption in Turkey is diverse comparing with the European countries on a product basis.

Based on the Turkstat data (2019a), the highest income household group (HH1) constitutes the 37.4% of total expenditures in Turkey, while the household group with the lowest income (HH5) has the 8.9% of total expenditures. Based on the same dataset, also, Table 6 presents the consumption habits of households in Turkey for the year 2017. The first noticeable result is that the weight of food and non-alcoholic beverages item in the basket of HH5 is the twice of the weight of this item in the HH1s consumption basket. In addition, housing and rent item constitute almost a third of the consumption basket of HH5 with a share of 32%. Transportation, entertainment, education and restaurant expenditures are significantly higher for HH1 due to its high-income level.

Table 6. Consumption Baskets of Households Ranked by Their Incomes

Expenditure Item	HH1	HH2	HH3	HH4	HH5
Food and non-alcoholic beverages	14.6%	19.3%	22.6%	24.9%	28.6%
Alcoholic beverages and tobacco	3.6%	4.6%	5.0%	5.2%	5.4%
Clothing and footwear	5.4%	5.0%	5.0%	4.5%	4.0%
Housing and rent	20.9%	24.2%	26.4%	28.6%	31.9%
Home appliances	6.7%	6.2%	6.3%	5.7%	5.7%
Health	2.3%	2.1%	2.2%	2.1%	2.2%
Transportation	23.9%	19.7%	15.9%	12.5%	10.2%
Communication	3.3%	3.6%	3.7%	3.4%	2.7%
Entertainment and culture	3.4%	2.8%	2.4%	2.1%	1.5%
Educational services	3.9%	1.8%	1.4%	0.9%	0.7%
Restaurant and hotels	7.1%	6.4%	5.5%	5.2%	4.5%
Various good and services	5.1%	4.2%	3.7%	4.9%	2.7%

Source: TurkStat, Income Distribution and Living Conditions Statistics (2017)

Akçelik (2016), who interprets these consumption expenditures, claims that inflation inequality across households increases as the income gap widens, meaning also that wealth inequality rises. Because high inflation decreases the welfare level of low-income households more. Akçelik (2016) says also that main upside contributors to inflation differential between low and high-income level consumers are bread and cereals, vegetables, tobacco products, rent, and solid fuels, while main downside contributors are the automobile, motor fuel products, and services. As a result, the inflation of poor households is more sensitive to shocks to food prices, while that of rich households is more sensitive to exchange rate and import price changes in Turkey.

CHAPTER 3

ECONOMETRIC TOOLS AND OUTCOMES

We examine the pass-through effects of global food prices on local food prices via econometric tools in this section. Our goal is to understand what extent the local price of food product changes when there is a change in its global price. Once we have this information for the selected food groups, we can employ it in the CGE analysis. The dataset description is given first. The definition, calculation and result of the analysis methods such as unit root, cointegration, and the Phillips-Curve estimation are presented later.

3.1 Description of the dataset

We analyze the long-term relationship between the global and local price of the selected food products including general food, meat, cereals, vegetable oils, sugar, dairy. The Turkstat (2019b) dataset is used for local prices, while the FAOSTAT dataset (2019) is used for global prices. Two monthly price series in nominal terms cover the period from 2003 to the first half of 2017. Both series are seasonally unadjusted. However, food prices show significant seasonality by its nature. We are benefiting from the Census 12 method to correct the seasonality. Turkish food prices are also converted into USD using the nominal exchange rates taken from the IMF dataset (2019). Recall that, we have pointed out that the pass-through of exchange rate on food prices is highly significant (Özmen & Topaloğlu, 2017). Finally, we calculate the monthly changes (monthly inflation) of price series as we are interested in the effects of the price changes.

3.2 Unit root

We work under the framework of the time series models. Standard time series models assume that variables are stationary. In the simplest terms, a time series is classified as stationary if its mean, variance, and autocovariance are constant for all time periods, meaning that they are time-invariant (Asteriou & Hall, 2015).

However, so many economic time series are non-stationary in practice. If the series is non-stationary, all the results of the classical regression analysis are not valid. Therefore, regressions with these series might be not meaningful. In the presence of the non-stationary variables, a regression may return high R^2, and significant t-statistics but the variables may not have any economic relationship. Granger and Newbold (1974) called these regressions as spurious regressions. For example, shocks to a stationary time series are temporary and the effects of them will disappear over time. The series will converge to the long-term mean but non-stationary ones do not show the property of mean reversion. As a result, making forecasts and monitoring relations may be misleading with non-stationary series.

Non-stationary time series must have at least one unit root in the generating process. Autoregressive time series models (AR) can be used to introduce this crucial property. Consider the autoregressive series with order 1 (AR(1)) :

$$Y_t = \alpha Y_{t-1} + u_t \tag{1}$$

where, u_t is a white noise error term and t is time period.

If $|\alpha|$ = 1, this means that this series is non-stationarity. The effects of the past shocks will carry over time. If $|\alpha| <$1, this means that this time series is stationarity

and will revert to its long-term mean value. If $|\alpha| > 1$, this means that this time series is explosive and will get larger in each period.

Due to the unfavorable impacts of non-stationarity, many studies try to detect the presence of unit roots. There are various unit root tests in the literature such as the (Augmented) Dickey-Fuller test, the Phillips-Perron test, the KPSS test, etc. We apply the Augmented Dickey-Fuller (ADF) test to our time series as it is a commonly used test that is valid in large samples. The Dickey-Fuller method puts the account of the above feature of the AR models. The (Augmented) Dickey-Fuller test has the null hypothesis that the AR model of order p has an autoregressive operator with a single unit root. Thus, it tests the null hypothesis that the series has a unit root. The Augmented Dickey-Fuller test also can consider the regression equations in the presence of intercept and trend variable.

Table 7 reveals the Augmented Dickey-Fuller (ADF) test results for price series. All series are the monthly change of the raw indices as we study on the effects of the global food prices changes on local food prices. Raw price series also are generally non-stationary in the case of inflation because they increase over time based on the inflation level. For this reason, it is more logical to continue our analysis with the monthly changes in the food price series. As we mentioned, the ADF test has the null hypothesis that the series has a unit root. As a result of the tests illustrated in Table 7, we can reject this null hypothesis for all series and described them as stationary for the 1% percent significance level. Moreover, the ADF test outcomes guarantee the stationarity of food series for their equations with no intercept no trend, with intercept, and with intercept and trend.

Table 7. ADF Test Statistics

Variable	None	I	I/T
Food	-9.0611	-9.0783	-9.2073
Food_w	-5.8550	-5.8808	-5.8971
Cereals	-8.6940	-8.6848	-8.7483
Cereals_w	-9.5959	-9.5953	-9.6094
Dairy	-10.7233	-10.6936	-10.8468
Dairy_w	-6.9224	-6.9449	-6.9194
Meat	-9.0767	-9.1163	-9.1599
Meat_w	-7.1182	-7.2003	-7.1775
Vegetable Oils	-8.7343	-8.7258	-8.7613
Vegetable Oils_w	-9.0445	-9.0318	-9.0178
Sugar	-9.5265	-9.4961	-9.5518
Sugar_w	-9.0759	-9.1194	-0.2435

Variables having the subscript of w indicate world prices
None: No intercept and trend
I: with intercept term
I/N: with intercept and trend term

3.3 Cointegration

If two series are non-stationary, the error can be represented as a combination of two accumulated error processes and normally we expect them to produce another non-stationary process. However, in the special case, two series can move together so the two trends would be very similar. We can also find a combination of them that eliminates the non-stationary. In this special case, the series are cointegrated. This should only happen when there is a solid long-run relationship between the two series (Asteriou & Hall, 2015). The concept of cointegration was introduced by Granger (1981) and developed further. At last, Engle and Granger (1987) gave the formal definition of cointegration.

As a definition, time series Y_t and X_t are said to be cointegreated of order d, b where $d \geq b \geq 0$, written as $Y_t, X_t \sim CI(d, b)$, if both series are integrated of order d and there exists a linear combination of these variables, $\beta_1 Y_t + \beta_2 X_t$, which is integrated of order d-b. The vector β_1, β_2 are called the cointegration vectors.

As Table 7 shows, all the series we work are stationary at their level (I(0)). Thus, we can test whether there is a long-run relationship between them. So, we can examine whether they are cointegrated in other words. There are many methods such as the Engle-Grange test, the Johansen test, etc. to detect the cointegration. We employ the Johansen test for our price series. We try to understand whether there is a long-run relationship between the change in world price of the selected food products and the change in its local price.

After Engle and Granger (1987) had introduced a simple test for the existence of integration, Johansen (1988) developed a new method that avoids the problems posed by the Engle-Granger procedure. The Johansen test extends the single-equation error correction model (ECM), which illustrates the long-run relation between the variables, to a multivariate one. The Johansen procedure includes the following steps:

i) To test the variables for their order of integration

ii) To estimate the below equation (2) and to find the rank of π

$$\Delta x_t = (A_1 - I)x_{t-1} + \epsilon_t = \pi x_{t-1} + \epsilon_t \tag{2}$$

iii) To observe the cointegrating vector(s) and speed of adjustment coefficients

iv) To test on innovation accounting and on the ECM

Table 8 reveals the outcomes of the Johansen test for the selected six groups. We test whether there is a long-term reliable relation between the monthly change of food

item's world price and the monthly change of food item's domestic price. To select the appropriate lag length, five information criterion tests provided by the EViews package, which are sequentially modified likelihood ratio, final prediction error, Akaike information criterion, Schwarz information criterion, and Hannan-Quinn information criterion, are used. The lag length, which is most commonly indicated by these tests, is used for the Johansen test. In the case of equality, the Akaike information criterion is employed as a prior indicator. In addition, the appropriate model is obtained with the help of the Eviews package that specifies the meaningful model according to the series properties.

Table 8. Johansen Test Statistics

No of CE *	Variable	Lag	Model	Eigenvalue	Trace Statistic	Prob.
None	Food	2	N	0.2835	80.5834	0.0001
At most 1				0.1591	27.5561	0.0000
None	Cereals	3	N	0.2342	69.9688	0.0000
At most 1				0.1613	27.8053	0.0000
None	Dairy	1	N	0.3824	107.6464	0.0001
At most 1				0.1736	30.5193	0.0000
None	Meat	2	N	0.2216	76.2253	0.0000
At most 1				0.2045	36.2892	0.0000
None	Vegetable Oils	6	N	0.1448	45.3403	0.0000
At most 1				0.1271	21.0805	0.0000
None	Sugar	1	N	0.3455	109.8279	0.0001
At most 1				0.2308	41.9917	0.0000

* Cointegration equation
N: No intercept and trend in CE or test VAR

As a result, we can reject the null hypothesis that there is no cointegration for all series considering the probability values. Thus, our series are cointegrated at the 1% significance level. From now on, we can calculate the pass-through coefficients between these series.

3.4 Phillips-Curve estimation

Economics literature usually examines the effects of the commodities prices on inflation with the help of the empirical models like the Phillips-Curve estimation. Phillips (1958) contributed to the original idea that there is a negative correlation between the rate of change in money wages and the rate of unemployment. After the developments, the variables of money wages and unemployment were converted to other variables according to the aim of the established econometric model. Gordon (2011) summarizes the Phillips-curve method as the dependence of inflation on three basic factors that are inertia, demand, and supply.

In this study, the Phillips-Curve equation in (3) is used to examine the effect of changes in global food prices on changes in domestic food prices. Food products are regressed by the following equation separately to observe the pass-through coefficients. The dependent variable is the domestic monthly inflation of food group. The independent variables encompass the lagged values of domestic monthly inflation of food group to capture inertia, the current and lagged values of the output gap as a measure of the economic slack and the global monthly inflation of food group to capture the supply side. For each regression, we used the lag length obtained before.

$$\pi_t = \alpha + \sum_{i=1}^{n} \delta_{t-i}\pi_{t-i} + \sum_{i=0}^{m} \phi_{t-i} Gap_{t-i} + \sum_{i=0}^{p} \theta_{t-i}\pi_{t-i}^{world} + \epsilon_t \tag{3}$$

where, π_t is the domestic monthly inflation of the related food group, Gap_t is an output gap of Turkey as well as π_t^{world} is the global monthly inflation. ϵ_t is an error term.

From this equation, the pass-through of global food prices (PT) on local food prices is calculated as:

$$PT = \frac{\sum_{i=0}^{p} \theta}{1 - \sum_{i=1}^{n} \delta_{t-i}} \tag{4}$$

Three more things should be shared so that the analysis can be better understood. Firstly, the output gap is obtained on a quarterly basis using the Hodrick-Prescot filter from the Gross Domestic Product (GDP) volume data of Turkey (TurkStat, 2019c). Then, it is converted to a monthly basis by proportion to the monthly industrial production data of Turkey (TurkStat, 2019d). Secondly, the Newey-West method is used for the coefficient covariance to avoid the heteroskedasticity problem. Lastly, the standard errors of the pass-through coefficients are calculated by the Delta method. The Eviews package is employed for these calculations.

Table 9 shows the pass-through coefficients for the selected food commodities. All regression outcomes are significant at the 5% significance level according to the standard errors. Cereals item has the highest pass-through with the coefficient of 0.4649. This means that when the world cereals price hikes by 100%, domestic cereals price also increase by 46.5%. Cereals are followed by vegetable oils food group.

Table 9. Pass-through coefficients

Variable	PT	Std. Error	t-Statistic	Prob.
Food	0.4007	0.1380	2.9030	0.0043
Cereals	0.4649	0.1264	3.6770	0.0003
Dairy	0.1230	0.0622	1.9790	0.0496
Meat	0.3830	0.1485	2.5784	0.0109
Vegetable Oils	0.3856	0.1230	3.1357	0.0021
Sugar	0.1305	0.0548	2.3824	0.0184

This outcome is not a surprise as these commodities have the highest shares in total imports. On the other hand, dairy and sugar products have lower pass-through coefficients. Under the same logic, we know that these food products occupy a very low place in total imports. This development is also closely related to the Turkish government's trade policies. The pass-through coefficient is low in the products that the government restricts its imports, while the pass-through coefficient is higher in the products whose imports are supported frequently or permanently. All in all, there is a 40% pass-through between world food price and local food price.

CHAPTER 4

CGE ANALYSIS AND OUTCOMES

This section presents the results of the simulated shocks to world food prices in line with the econometric estimations. We first present the description of the Computable General Equilibrium (CGE) model [2]. Then, the sub-titles such as the price system, closure rules, database, scenarios as well as simulation results are provided respectively.

4.1 Description of the CGE model

There has been no CGE model for Turkey that examines the welfare impacts of changes in global food price in the literature. Therefore, we can say that our CGE analysis will be one of the first studies in this area. The study will contribute to the literature when we consider the importance of food for human life, and the food security policy of countries.

The CGE model used in this study is a modified version of the CGE model developed in Dudu (2013), and Dudu and Çakmak (2018). The first modification in the Walrasian CGE model is updating the Social Accounting Matrix (SAM) by using 2012 supply [3]. Then, the Turkish economy is disaggregated into 65 activities, and 10 agricultural products. The main economic groups of activities in the model are agriculture, manufacturing, services, finance, and energy. Also, household accounts are disaggregated into 5 groups according to their income by using household budget surveys. Households use their income for consumption, leisure, savings, and taxes.

[2]Here I would like to express my deepest appreciation to Hasan Dudu for his guidance throughout the preparation of this chapter in particular.

[3]One can reach the SAM matrix, which is also used for this paper, via the following link: https://github.com/economystic/tacogem/tree/master/xls

Households maximize a linear expenditure system (LES) utility function to make a consumption decision. Meanwhile, the wage income is included as a budget constraint.

Households receive income from labor employment, while capital income goes to the firms. Firms pay institutional taxes, make transfers to the rest of the world, and distribute the remainder to households with the transfers from the government.

There is a three-level nested production function which aggregates different factors and inputs. At the first level of the production nest, different labor types are aggregated in a constant elasticity of substitution (CES) production function. Then, the aggregate labor factors enter to a CES function together with capital to produce a factor composite. Lastly, the factor composite is combined with the intermediate inputs composite in a Leontief nest. Different intermediate inputs are also combined in a Leontief production function making them perfect complements to each other.

Production activities provide payments to commodity accounts for intermediate inputs, to factors as wage payments, to the government as direct and indirect taxes and to the rest of the world for imports. They take payments from commodity for the supply of goods and services, from households for consumption of goods and from the rest of the world for exports. The government receives tax income from activities, commodities, firms and households. In addition, it receives transfers from the rest of the world. This income goes to government consumption, transfers to households and firms, government savings as well as transfers to the rest of the world.

4.2 Price system of the CGE model

The prices for commodities, activities and production factors are constructed in line with the classical CGE model, which can be also found in Siddig and Grethe (2014).

The supply prices of the composite commodities (PQS) are the weighted averages of the domestically produced commodities, which are consumed domestically (PDD), and the domestic prices of imported commodities (PM). PM is also determined as the product of the world prices of commodities (PWM) and the exchange rate (ER) with the ad valorem import duties (TM). These weights are calibrated thanks to the first order conditions for the optimal solution. Lastly, the composite price of the commodities (PQD) is defined as the sum of PQS and the ad valorem taxes of sales taxes (TS) and excise taxes (TEX).

In a similar manner, the producer prices of commodities (PXC) are the weighted averages of the prices received for the domestically produced commodities sold on the domestic market (PQS) and export market (PE). These weights are also calibrated thanks to the first order conditions for the optimal solution. The prices from the export market are the product of the world price of exports (PWE) and the exchange rate (ER) less the ad valorem export duty rates (TE).

4.3 Closure rules

Closure rules of the CGE model lean on the conventional neoclassical assumptions. Also, the closure rules of the model aim to reflect the properties of the Turkish economy as realistically as possible and aim to reflect the price transmission mechanism with the obtained results in the previous section. The quantity supplied of each factor is fixed. The quantities of activity-specific factor demands, i.e capital, and the wage are fixed, while the activity specific wage rates and the supply variables are flexible. The consumer price index is the numeraire, while domestic producer price index changes to guarantee the market clearance. Investments are fixed, and marginal propensity to save adjusts to ensure saving-investment balance. The exchange rate is

flexible, while foreign savings are fixed. Government savings are fixed, while government expenditures adjust freely.

Meanwhile, the further details of the closure rules for both the neoclassical assumptions and alternative ones can be followed from Lofgren et al. (2012).

4.4 Database

The aggregate version of the SAM, which we used in the CGE analysis, follows from Erhan Ünal et al. (2018). In addition, the five income quantiles of Turkish households ranked by their nominal incomes are introduced. The first household group (HH1) has the highest nominal income, while the fifth household group (HH5) has the lowest. All data on the Turkish economy are based on the 2012 year. The SAM is based on 2012 Supply use tables of TurkStat and disaggregated using other auxiliary data sets from TurkStat.

Turkey's SAM matrix has 65 sectors and 10 agricultural products that are suitable for our model. These items are agricultural products, general food products, meat, dairy, cereals, vegetable oils, sugar, vegetables, fruits, and rice. In line with the price transmission mechanism, the changes in income, expenditure, and welfare levels of household groups will be studied.

4.5 Simulated scenarios

Before monitoring the effects of the price shocks over global food prices, the CGE model is solved in line with the database and closure rules above. Then, we add the equation below into the CGE model to use the pass-through coefficients of the related food products, which were obtained via the econometric tools. Thus, we define the price transmission mechanism as an exogenous variable.

$$PQD = (1 + (PTRAN * ((PWM/PWMbase) - 1))) * PQDbase \quad (5)$$

where, PWMbase shows the base value PWM, while PQDbase is the base value of PQD.

After that, PQD and PX can be considered as exogenous variables. This equation means that the change in PQD is directly related to the change in PWM via the pass-through coefficients (PTRAN). The Armington elasticities (rhoc) for PQD and the sectoral productivities (ADX) for PX are converted to endogenous variables to calibrate the appropriate elasticities and productivities are calibrated in line with the econometric results. As a definition, the Armington elasticity determines the trade-off between the domestic demand and the import demand for one commodity. Moreover, Siddig and Grethe (2014) explain other prior assumptions that are necessary to execute the price transmission mechanism in the CGE model correctly.

Lastly, two simulation scenarios are defined as the backbone of our wealth analysis. PosShock simulates a 5.0% increase in the world price of selected food products. On the contrary, NegShock simulates a 5.0% decrease in the world price of the selected food products. We cannot give a price shock up to 100% like Grethe et al. (2012) due to two main reasons. First, the long-term average of the monthly change in global food prices is about %0.5. Therefore, a shock of around 5% is more realistic. There are very few months when the absolute value of the monthly global food inflation is a higher than 5 %. Secondly, the CGE model using the Armington elasticities doesn't allow to benefit from higher percentage for a shock. Meanwhile, if

the severity of a shock becomes stronger, its impacts will be higher as expected. However, the effects of the shocks will be partly proportional but not fully linear.

PWM and PM import prices of food products are given exogenous shocks. Due to the adjustment, these simulation shocks affect the domestic prices (PQD) of the related food commodities according to the pass-through coefficients, which are introduced into the CGE model as PTRAN. PQD are changed based on the product of the simulated shock and PTRAN.

The selected items in the SAM matrix are agricultural products, general food products, meat, dairy, cereals, vegetable oils as well as sugar items. These are the items providing a significant pass-through coefficient based on the econometric analysis in the previous section. Moreover, the price changes in other food products, which are included in the SAM but have no significant pass-through coefficient for domestic prices, can be observed under the CGE model.

4.6 Simulation results

For traded staples, the pass-through coefficient plays a crucial role when prices are set on the domestic market. Naturally, products in the domestic market, which are imported more from abroad, are fluctuated in parallel to the global price changes. This section contains the impacts of a positive and negative simulated shock beginning from product's world price (PWM). By the CGE model, these shocks reflect directly on the domestic prices of imports (PM). Based on the price transfer mechanism described in detail above, the impacts of the simulated shocks can be followed through all prices in the transfer mechanism, including consumer prices.

We will show the results of the CGE model through four sub-titles in this section. Firstly, we discuss the impacts of the shocks on all types of prices that we

have already introduced. Thereafter, price increase or decrease in global food prices is expressed in terms of key macroeconomic indicators, domestic production and the welfare change of households, respectively. Finally, income inequality is reviewed.

4.6.1 The changes in products' prices

The changes in all prices in the face of the shocks can be seen in Table 10 and Table 11. If not mentioned otherwise, the positive shock is applied at +5.0% to global food prices (PosShock) and the negative shock is applied at -5.0% to global food prices (NegShock). As mentioned before, the simulated shocks change world price of the relevant commodities.

Table 10 indicates the impacts of the PosShock on other values throughout the price transmission mechanism. Depending on the pass-through coefficients we have calculated in the previous section, the impact of the given shock on the domestic consumer prices is changing significantly. The products, in which the effects of the prices hikes are most obviously seen on the consumer prices, are the cereals and meat groups. On the other hand, the consumer price of the dairy products which are less traded is the least affected. In the case of the 5.0% rise in the world price, food item's general consumer price of food surges by 2.0% for Turkish households.

For the pass-through level of import prices into domestic prices, the most decisive factors are the nominal level of imports of the related commodity, the substitutability level between the imported and the domestically produced commodity, the substitutability level between the exported and the domestically sold commodity as well as the substitutability level of factors and intermediate goods in the production (Siddig & Grethe, 2014).

Table 10. Price changes under the 5.0% positive shock (%)

Item	PM	PQS	PQD	PDD	PXC	PX	PINT	PVA
Agriculture	5.00	1.55	1.30	2.66	2.63	1.30	0.82	1.40
Food	5.00	2.46	2.00	-0.18	-0.15	2.00	1.10	0.16
Cereals	5.00	3.19	2.30	3.98	3.59	-	-	-
Dairy	5.00	0.93	0.60	3.29	3.10	-	-	-
Meat	5.00	2.64	1.90	4.18	3.88	-	-	-
Oils	5.00	2.76	1.95	2.99	2.55	-	-	-
Sugar	5.00	1.00	0.65	2.73	2.43	-	-	-

Note: PX, PVA and PINT values are produced only by agriculture and food activities and hence other commodities do not have these prices.

Furthermore, Table 10 shows the increase in the world food prices pushes up almost all the figures under the price transfer mechanism. Only general food prices have a limited retreat in the consumer price for the domestic supply (PDD) and in the producer price for the composite domestic output (PXC).

On the other hand, Table 11 points out the impacts of the NegShock on other values throughout the price transmission mechanism. The changes remain similar to the previous ones as the changes in the consumer prices depend on the pass-through coefficients.

However, when compared to the positive shock impacts, the negative shock causes different changes in other prices. In addition, Table 8 shows that the decline in the world food prices pulls down almost all values under the price transfer mechanism. There are only slight increases in the consumer price for the domestic supply of general food prices (PDD) and in the producer price for the composite domestic output of general food prices (PXC).

Table 11. Price changes under the 5.0% negative shock (%)

Items	PM	PQS	PQD	PDD	PXC	PX	PINT	PVA
Agriculture	-5.00	-1.52	-1.30	-4.77	-4.72	-1.30	-0.86	-2.62
Food	-5.00	-2.42	2.00	1.57	1.31	2.00	-1.13	-0.10
Cereals	-5.00	-3.12	-2.30	-4.04	-3.61	-	-	-
Dairy	-5.00	-0.86	-0.60	-4.49	-4.20	-	-	-
Meat	-5.00	-2.57	-1.90	-4.49	-4.13	-	-	-
Oils	-5.00	-2.68	-1.95	-3.12	-2.64	-	-	-
Sugar	-5.00	-0.94	0.65	-3.41	-3.01	-	-	-

Note: PX, PVA and PINT values are produced only by agriculture and food activities and hence other commodities do not have these prices.

Following the price impacts of the simulated shocks, their impacts on the macroeconomic figures including GDP, private and government consumptions will be analyzed.

4.6.2 The changes in macroeconomic indicators

Before moving on to the microeconomic issues, such as the changes in the wealth of households, the changes in the Turkish economys macroeconomic variables will be monitored in this sub-section. The main aim is to observe the impacts of the determined shocks on the macroeconomic items such as GDP, private and public consumption, and so on.

Table 12 shows the simulations' impacts on the Turkish economy as a snapshot. For both simulations, the change in the selected indicators does not exceed 1.0% except for one indicator. In the event of a negative shock to world food prices, there is a 1.43% surge in import demand. Under the circumstance, where import prices decline, a recovery in import demand is stronger than the import demand decrease while import prices go up.

Table 12. Real changes in macroeconomic indicators (%)

Indicator	Base Period (TL mn)	PosShock	NegShock
GDP	1,569,672	-0.30	-0.07
Absorption	1,692,783	-0.52	0.31
Private consumption	1,025,099	-0.90	0.58
Government consumption	223,402	-0.44	0.12
Import demand	448,325	-0.87	1.43
Export supply	325,214	0.06	0.03
Total domestic production	2,956,762	-0.38	0.18
Total intermediate inputs	1,571,349	-0.37	0.21

Turkey's GDP declines by 0.3% in real terms when global prices rise. The main reason is cooling in the domestic demand because of rising local food prices in step with global prices. Total domestic production, which is the sum of the product value in all sectors, decreases by 0.4%. Meanwhile, there is a limited real contraction of 0.07% in GDP as global food prices fall. The most important reason for this situation is that the production side prefers to import these commodities instead of the increase in domestic production. As seen in Table 13, import demand notably increases by 1.4% when food prices go down. Domestic demand only recovers by 0.3% and accordingly cannot compensate the strong demand increase for import. On the contrary, total domestic production arises by 0.2% thanks to a production recovery in other sectors than agriculture. Value of labor and capital used in the agriculture sector decreases in keeping with food prices. That creates a cost advantage for other main sectors and increases their production. Lastly, it will be also helpful to speak on private consumption, which has been the main driver of the growth in recent years. Private consumption retreats by 0.9% when food prices rise, while it is only up by 0.6% when prices decline.

All macroeconomic indicators have narrowed except for the export supply due to the PosShock. On the other hand, there are surges in all macroeconomic indicators except for the small decline in GDP under the NegShock. To sum up, we see that the impacts of both positive and negative global food price shock are highly limited to the macroeconomic indicators. They can be considered as insignificant.

4.6.3 The changes in domestic production

On the domestic production side, Table 13 provides the production changes when a positive or negative shock is given.

Table 13. Changes in the domestic production (%)

Item	PosShock	NegShock
Agriculture	0.67	-2.85
Cereals*	-1.94	1.98
Dairy*	-1.95	1.97
Food*	-2.07	2.30
Fruit	0.05	-1.47
Meat*	-1.93	1.97
Oils*	-1.96	2.00
Rice	-0.09	-0.94
Sugar*	-1.96	2.00
Vegetables	-0.07	-0.98

* Sectors we applied a shock

The production change in other food items, whose import prices are not changed, can be seen on the table as well. Under the positive shock, the domestic production of nearly all products declines due to declined domestic demand. Food and sugar items have the highest fall in their production. Table 12 illustrates that the total domestic production decreases by 0.38% when world food prices increase by 5.0%. In products with the high pass-through coefficient, the domestic production

decline is more pronounced. The biggest decline is in the general food item at 2.07%. There is a rise in the products having no global price shock such as agriculture item with 0.65%, and fruit item with 0.05%.

In an environment, where the world food prices fall by 5.0%, there is around 2.0% rise in domestic production, contrary to the previous situation. Production rise is stemmed mainly from the rise in the domestic demand. The strongest production rise is in the general food item at 2.30%. The production decline in other products is due to the fact that the production interest has shifted to sides supported by the falling world prices. There is a 2.85% decrease in agriculture production.

4.6.4 The changes in the welfare of Turkish households

Table 14 includes the changes in the nominal income level of household groups as a percentage. We see at first sight that income of all households slides under the PosShock but the nominal income of households goes up under the NegShock.

As we see in Table 12, nearly all macro indicators recover under the NegShock. Only GDP contracts due to the solid import demand increase, not bad economic conditions. Therefore, an increase in the nominal income of households is expected. On the contrary, under the PosShock, Turkish economy deteriorates, causing the households' income to be lower also.

Table 14. Changes in income per household group (%)

Household	PosShock	NegShock
HH1	-0.70	0.35
HH2	-0.62	0.30
HH3	-0.69	0.37
HH4	-0.75	0.42
HH5	-0.80	0.47

Among household groups, we see that the lowest income group is affected negatively at most when global prices increase by 5.0%. Their income declines by 0.8%. HH4 and HH1 are at the following ranks respectively. There is no considerable difference between the lowest and the highest income group. The most decisive reason for this outcome is the structure of the income earned by households. 86% of the income of HH1 comes from labor and capital. On the other hand, the share of these resources in HH5's income is only 47%. 52% of its total income comes from government transfers, which remain constant when price changes. The government transfers work as stabilizers under this case. As a second reason for this realization, we can state that the members of the low-income groups work mostly in the agriculture sector. The price increases in food and agricultural products affect these households in a positive way. However, the proportion of the members working in agriculture is very low for HH1 so high-income households cannot get the positive effect of the price hikes.

In the case of decreasing global food price, the opposite of relations what we have established above works. However, there are differences in ranking among households. The highest nominal income increase is observed for the lowest-income group with a recovery of 0.47%. Then, HH4 and HH3 come respectively. If looking at the absolute values for all households, rises due to the NegShock are lower than decreases due to the PosShock. Accordingly, households are not able to benefit from the price declines so much.

Table 15 shows the combined welfare effects of the increasing and decreasing food prices on household groups in terms of the equivalent variation (TL mn). By definition, the equivalent variation is the amount of income necessary to obtain a new level of utility at old prices. It is one of the money metric welfare measures as

explained by Hanslow (2000). Under the upward price shock (PosShock), the EV results indicate that the lowest income household (HH5) is hit more than other households in terms of percentage of the income. The most important reason is that food items take up more place in the consumption basket of low-income households. As a result, the wealth of HH5 declines by 2.27% in terms of the income, although its members heavily work in the agriculture sector. The strong negative impacts on the expenditure side overcompensate the positive impacts on the income side.

Table 15. Changes in household welfare (TL mn and % of income)

Households	PosShock		NegShock	
	TL mn	% income	TL mn	% income
HH1	-2,658	-0.38%	2,374	0.34%
HH2	-974	-0.28%	452	0.13%
HH3	-980	-0.40%	381	0.16%
HH4	-1,289	-0.71%	532	0.29%
HH5	-2,281	-2.27%	1,237	1.23%

The highest-income group (HH1) is the worst affected group in terms of the income level. The most important reason is that this groups members do not work in the agricultural sector and therefore they do not benefit from the positive impacts of price hikes on the income side. However, the wealth loss of HH1 is only 0.38% in terms of income. 0.28%, 0.40%, and 0.71% are the welfare declines as a percentage of the income level for HH2, HH3, and HH4 respectively. According to our CGE analysis, low incomes are affected more adversely by food price increases. In light of this development, we can say that the income distribution of Turkey is more unequal following the simulated PosShock. The aggregated welfare loss for Turkey is 8.182 bn TL for the 2012 year. This figure is equivalent to 0.52% of GDP.

In addition, Table 15 summarizes the welfare effects of NegShock, where world food prices are up by 5%. The EV results show that the welfare gain of the lowest-income household is 1.23% as of its income level under the developments we stated above. The welfare gain of the highest-income household that separate the lower portion of its nominal income into food items is only 0.34% as of its income. On the income side, food price declines hit HH5 at most due to its income source, while HH1 is not so much affected by these drops. 0.13%, 0.16%, and 0.29% are the welfare gains as a percentage of the income levels for HH2, HH3, and HH4 respectively. According to our CGE analysis, low incomes are affected more positively by food price increases. In light of this development, we can say that the income distribution of Turkey is more equal following NegShock. Lastly, the aggregated welfare gain for Turkey is 4.976 bn TL for the 2012 year. This figure is equivalent to 0.32% of GDP.

CHAPTER 5

CONCLUSION

The thesis examines the welfare effects of global food prices on income distribution in Turkey by making use of CGE analysis, which has thus far not been used in Turkish literature.

Food is the primary product essential for sustaining human life. Thus, food security (convenient access to sufficient food) is crucial. The significant share of the household consumption basket is that of food expenditure, although this share varies from country to country. Accordingly, food price movements are variable, and thus closely monitored both in daily life and in economic literature. Furthermore, governments are assumed to determine their social policies by following these price changes.

Although Turkey meets its needs for agricultural products via domestic production, certain needs are met by imports. The import share varies with a food product. The changes in global food prices generally cannot affect domestic TL prices to a significant degree due to customs tariffs. In this study, the pass-through coefficients of global food prices on domestic prices are obtained on the basis of food product groups. When the exchange rate effect, which is a significant variable in determining local price prices, and seasonality effects are taken into account, the 1% change in global general food prices impacts Turkish general food prices by 0.54%. The analyzed dataset belongs to the period between 2003 and the first half of 2017. The pass-through coefficients can vary according to the share of imports in the respective product groups.

The pass-through coefficients obtained in the econometric analysis section are then used in the CGE analysis. In addition, Turkish households are divided into five

groups based on their nominal income levels and added to the SAM matrix to comprehend the welfare impact of global food prices on income distribution in Turkey. Due to the structure of the SAM matrix, the dataset contains information for the year of 2012. However, the latest states of the relevant data are also shared within the study. Under the two main scenarios, global prices of selected groups (agriculture, general food, meat, cereals, dairy, vegetable oils, and sugar) are increased by 5% (PosShock) or decreased by 5% (NegShock). The effects of the shocks are monitored for the development of product prices, key Turkish macroeconomic prints, domestic production and the welfare of Turkish households.

To summarize, when global food prices increase by 5%, Turkeys GDP is observed declining by 0.3%, while import demand decreases by 0.87%. Macroeconomic impacts are more limited. For all households, nominal income decreases. The largest income decrease is for the group with the highest income, as its members do not work in the agricultural sector. Therefore, this group cannot benefit from the positive effects of price hikes on the income side. In addition, government transfers act as a stabilizer because such transfers do not change in the event of price increases. According to the source of income, low-income households earn more from government transfers.

When we consider the welfare effects of food price increases, the lowest income household faces the highest welfare loss as a percentage of the level of income. This is because the group has the highest share of food items in the consumption basket compared to other groups. The strong negative impact on the expenditure side negates the positive impact on the income side. On the other hand, the highest income household has the lowest welfare loss as a percentage of income. Therefore, we conclude that Turkeys income distribution deteriorates under the case of increased

food prices. The aggregated welfare loss of Turkey is 0.52% of GDP when global food prices increase by 5%.

We observe an increase in the income of all households when global food prices decline by 5%. However, there is a 0.07% decline on the GDP side as Turkish citizens prefer to consume imported products over domestic ones when prices fall. Import demand increases by 1.43%, while domestic production rises by just 0.18%. Positively, the welfare effect is supportive, as the income and welfare levels of all household groups rise. Based on income level, the lowest income group has the highest positive impact. Therefore, the decline in global food prices demonstratively improves income inequality in Turkey. Moreover, the aggregated welfare gain of Turkey is 0.32% of GDP when global food prices fall by 5%.

Considering the outcomes, we can suggest that Turkish government should focus on the social effects of food prices intensively, and take the structural measures to lower local food prices without a further deterioration in income distribution. Moreover, these steps should protect local food prices in an environment that global prices spike.

APPENDIX A

PRICES OF FOOD GROUPS

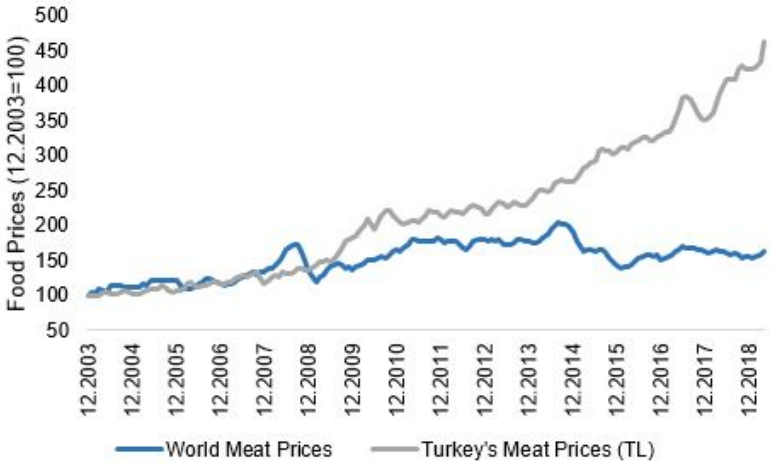

Figure A1. World (USD) and Turkey's (TL) meat prices

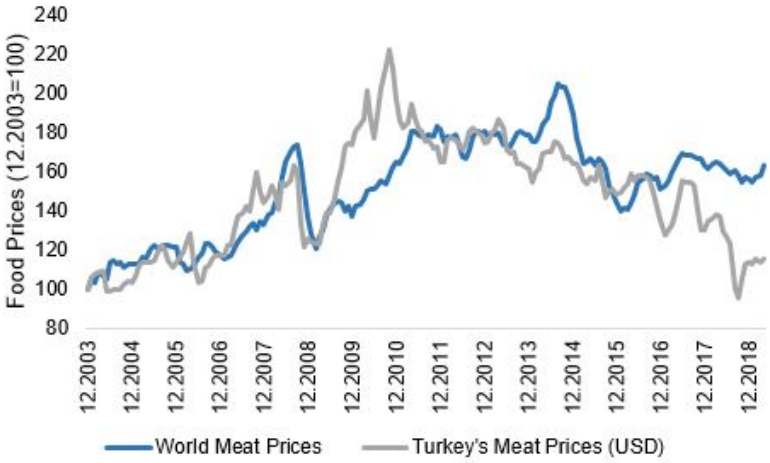

Figure A2. World (USD) and Turkey's (USD) meat prices

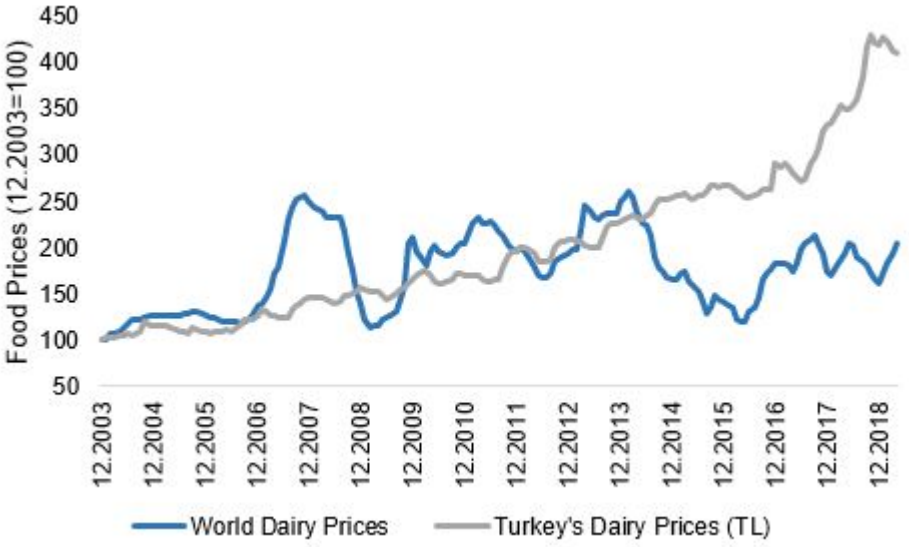

Figure A3. World (USD) and Turkey's (TL) dairy prices

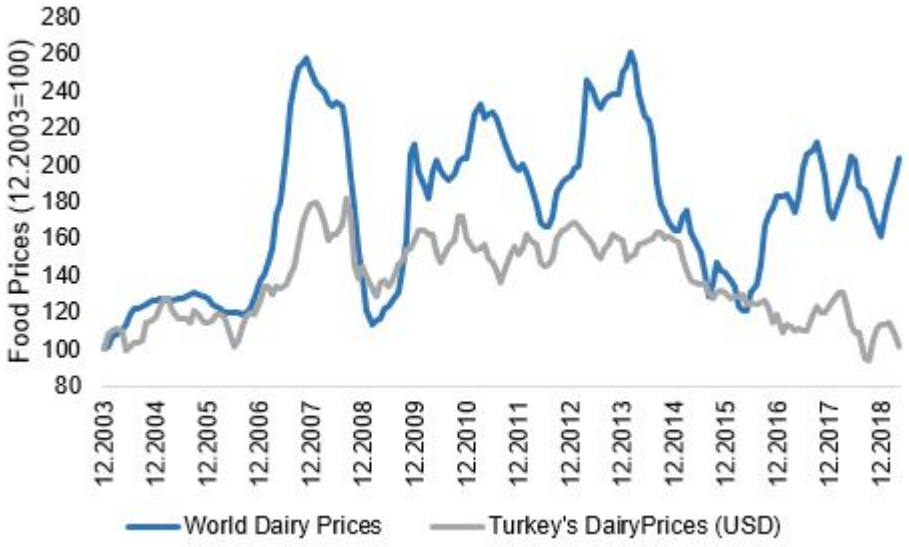

Figure A4. World (USD) and Turkey's (USD) dairy prices

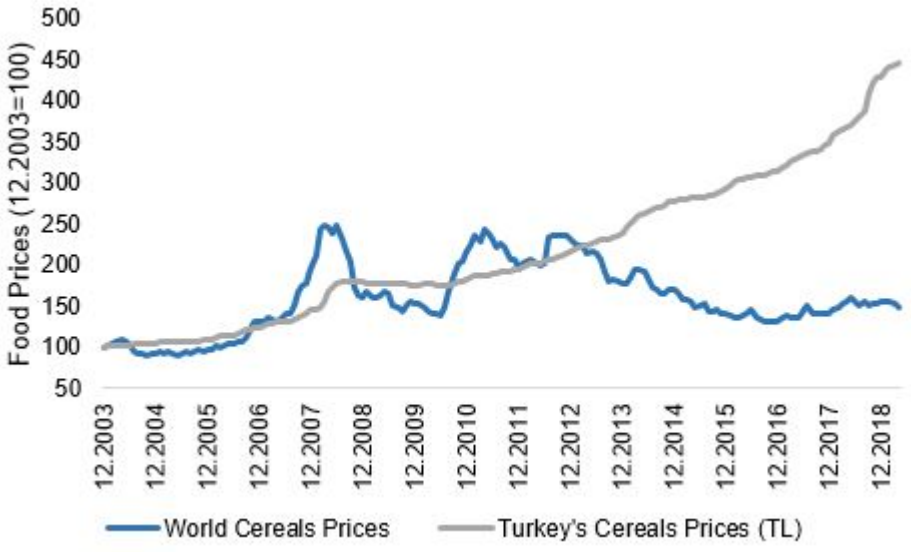

Figure A5. World (USD) and Turkey's (TL) cereals prices

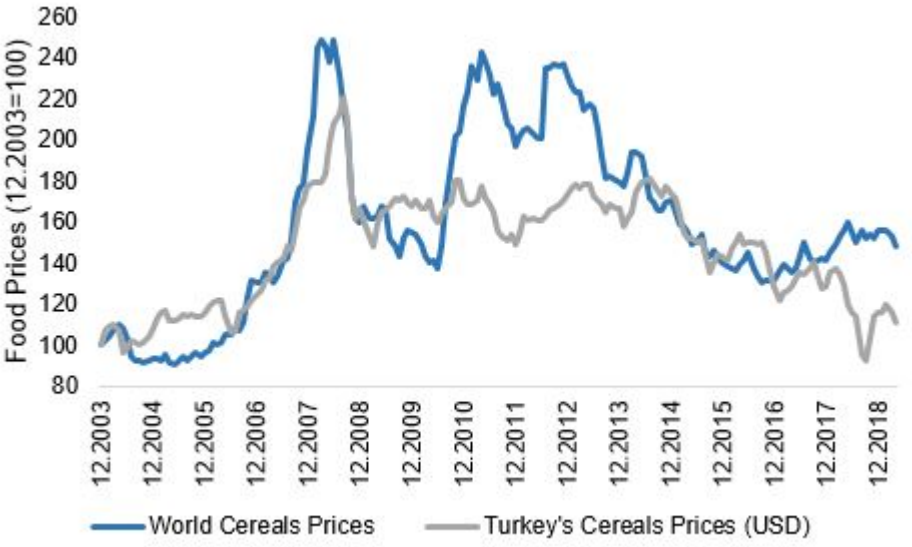

Figure A6. World (USD) and Turkey's (USD) cereals prices

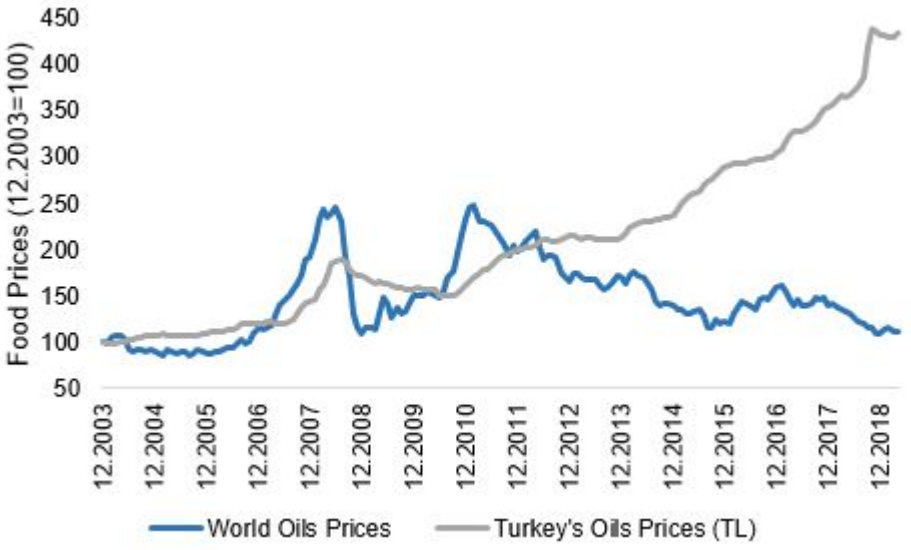

Figure A7. World (USD) and Turkey's (TL) vegetable oils prices

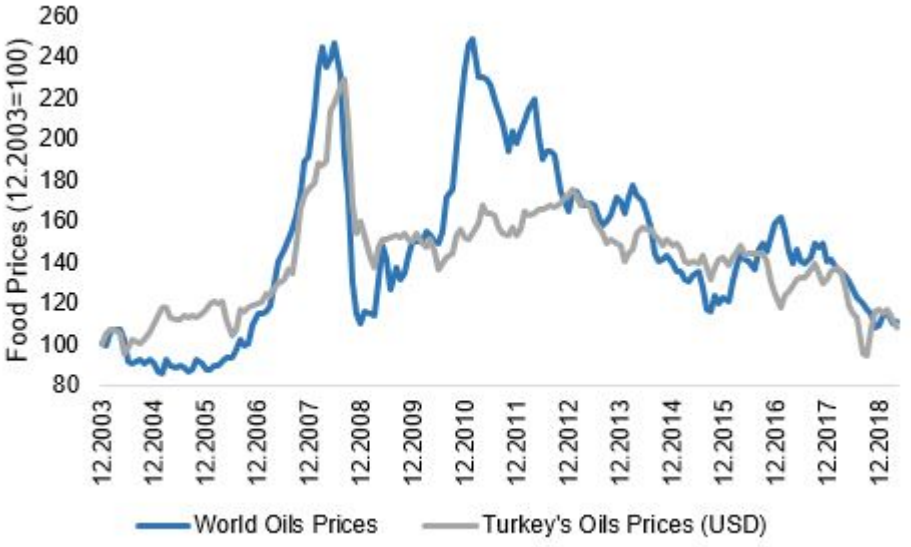

Figure A8. World (USD) and Turkey's (USD) vegetable oils prices

Figure A9. World (USD) and Turkey's (TL) sugar prices

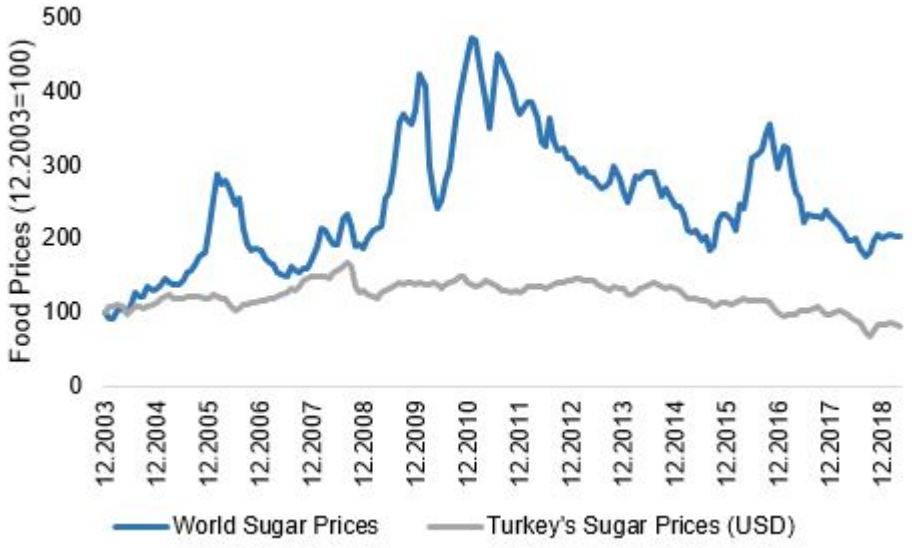

Figure A10. World (USD) and Turkey's (USD) sugar prices

APPENDIX B

THE OECD COUNTRIES

AUT: Austria

BEL: Belgium

CAN: Canada

CHL: Chile

CZE: Czech

ESP: Spain

EST: Estonia

FIN: Finland

FRA: France

GBR: United Kingdom

GRC: Greece

ISR: Israel

KOR: Korea

LVA: Lithuania

NLD: Netherlands

NOR: Norway

POL: Poland

PRT: Portugal

SVK: Slovakia

SVN: Slovenia

SWE: Sweden

TUR: Turkey

USA: United States

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