The effect of real exchange rates and their volatilities on the selected agricultural commodity exports: A case study on Turkey, 1971–2010

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Abstract: This study investigates the effect of the exchange rate volatility and the real exchange rate on the bilateral agricultural exports flows of Turkey to 46 countries. A panel data set, which contains 46 cross-sections and 1840 observations, is used for exports of the selected agricultural commodities to countries from 1971 to 2010. Our empirical results based on a gravity equation show that while the exchange rate volatility does not exert a significant effect on the Turkish agricultural commodity exports, the real exchange rate has a statistically significant effect on the agricultural commodity export flows. Regardless of the region chosen, raisins and tobacco exports are very much sensitive to the real exchange rates. It means that any depreciation in the Turkish Lira leads to higher exports for these commodities. We have also some interesting results on other commodities. Exports of dried figs show no sensitivity to the exchange rate or its volatilities, except for the EU countries. For the full sample, exports of citrus, grape and hazelnuts increases as the TL depreciates. The sensitivity of hazelnut to the real exchange rates varies among regions.

Key words: agricultural trade, exchange rate volatility, gravity, panel

After the collapse of the Brettonwood system in 1973, most of the countries have abandoned to use solely the fixed exchange rate regime, and different countries have adapted different exchange rate regimes. Then, the impact of both the exchange rate level and the exchange rate volatility or variability especially on exports, the bilateral trade flows and the volumes of trade have been empirically and theoretically discussed.

A large number of studies examine both the effect of the exchange rate and its volatility on agricultural trade. However, no consensus was reached yet on the relationship between the exchange rate and agricultural trade. As discussed in the literature, it is important to use disaggregated data and/or data on the individual commodities to get more meaningful results on the size and magnitude of the effects of the real exchange rates on agricultural commodities trade. (Awokuse and Yuan 2006; Byrne et al. 2008; Bahmani-Oskooee and Hegerty 2009; Karemera et al. 2011). Byrne et al. (2008) discuss the possibility of finding a negative effect of the exchange rate volatility on trade by pooling the data of all industries together, and claim that the disaggregation of the data such as firm, industry or commodity level could provide more appropriate and meaningful results. Considering the individual sectors and/or commodities is vitally important to understand the exact nature of the relation and to further tailor effective policy measures based on these fine results. Thus, we investigate the relationship between the real exchange rates and several of the most important Turkish agricultural commodities. They represent almost a quarter of the overall Turkish agricultural exports.

LITERATURE REVIEW

A number of studies (Hooper and Kohlhagen 1978; Arize et al. 2008; Kafle and Kennedy 2012) argue that the exchange rate volatility can have a negative effect on the international trade flows, either directly through the uncertainty and adjustment costs or indirectly through its effect on the allocation of resources and government policies. The volatile nature of exchange rates has always led risk-averse traders to reduce their trading activities ultimately reducing the international trade flows. However, Arize et al.

(2000) emphasize that the effect of the exchange rate volatility on the international trade is an empirical issue because the theory alone cannot define the sign of the relationship among these variables. And yet, there is no consensus reached in the literature regarding the effects of the exchange rate and/ or its volatility on (agriculture) trade.

Several studies (McKenzie 1999; Kristinek and Anderson 2002; Coric and Pugh 2010) review the existing literature. McKenzie (1999) reviews both theoretical and empirical studies on the relationship between the exchange rate volatility and trade flows and concludes that the ambiguity of the results may be due to the factors such as the measurement of the volatility, the use of aggregated data and the underlying assumptions of the econometric models. Coric and Pugh (2010) analyze 58 articles on the effects of the exchange rate variability on the international trade using a meta-regression analysis. Despite the heterogeneity among the results, the main conclusion obtained from the analysis reveals a modestly negative relationship between the exchange rate volatility and the international trade flows. They also argue that although the trade effects of the exchange rate variability are highly conditional, the effects are generally negative for Less Developed Countries. Kristinek and Anderson (2002) particularly review the literature on the impacts of the exchange rate on agricultural trade and argue that the exchange rates affect the prices and in turn, trade.

Many empirical studies have tried to determine the effect of the exchange rate volatility on trade flows, but the result is ambiguous. Kandilov (2008) finds that the exchange rate volatility had a negative impact on trade flows and the impact was larger in the agricultural sector and even worse in the case of developing countries. Similarly, Thursby and Thursby (1987), Pick (1990), Chowdhury (1993), Arize et al. (2000, 2008), Doganlar (2002), Chit et al. (2010), Zhao (2010) and Kafle and Kennedy (2012) find that the exchange rate volatility has had a negative impact on trade flows. On the other hand, Klein (1990), Pick (1990), Broll and Eckwert (1999), Awokuse and Yuan (2006), Choudhry (2008) and Jozsef (2011) are some of the researchers who report a positive impact of the exchange rate volatility on agricultural and the total trade flows.

Of course there is another group of studies reporting mixed results on the issue. For example, Bahmani-Oskooee and Hegerty (2009) analyze the impacts of the real exchange rate volatility on the trade between Mexico and the U.S. for 1962–2004 period for 102 industries. The authors argue that there is a short-run significant impact of the exchange rate volatility on most of the sectors. Although most industries are not affected by the increased exchange rate volatility, the number of negatively affected industries (such as agriculture and textile) is much higher than of the positively affected ones. Byrne et al. (2008) find that the exchange rate volatility has a negative impact on differentiated goods, especially on exports, and no significant effect on the homogenous goods by using the bilateral US trade flows (export-import) to six European countries. Ekanayake et al. (2011) investigate the effects of the real exchange rate volatility on both export flows of South Africa to the European Union (EU) and imports from the EU by using quarterly data for the period of 1980–2009. They report that the exchange rate volatility has mixed effects on both imports and exports regarding the short and long run. Although negative impacts could be seen in the short run, no adverse effects could be seen in the long run. Hsu and Chiang (2011) assert that the non-existence of a consensus about the impacts of the exchange rate volatility on international trade could be due to the non-linearity of the effects. By applying a threshold regression model based on the bilateral export data between the US and its top 13 trading partner for the period of 1973–2004, they find that the real exchange rate volatility has a positive impact on low-income trading partners of the US. But for the trading partner countries whose real GDP per capita is over a threshold level, the negative impact of increased volatility on the US exports become apparent in their analysis. Moreover, Hondroyiannis et al. (2008) investigate the relationship between exchange rate volatility and aggregated export volumes of 12 industrialized countries by using the sample period of 1977–2003. They conclude that while a little evidence is found about the negative impact of the exchange rate volatility on trade, the negative sign on this effect can arise from the omitted-variable biases and/ or measurement-error biases.

Some studies investigate the effects of the exchange rate volatility on agricultural products. By assuming the elasticity of price, the income and exchange rate are different among sectors or commodities, Awokuse and Yuan (2006) claim that the use of aggregated data could reduce the probability of reaching an accurate result. They report that there is a positive relationship between the exchange rate volatility and the US poultry exports in their analysis depending on 49 poultry importers from the US over the period of 1976–2000. Using data on certain agricultural commodity trade flows between the OECD countries for 1996–2002 periods, Karemera et al. (2011) find that while the exchange rate volatility has a negative impact on the trade flows of most commodities, some specific ones

are affected positively. Therefore, they suggested that the influence of the exchange rate uncertainty could be different across both sectors and commodities.

There exists a substantial literature on the effects of both the exchange rate and its volatility on trade flows of Turkey. Ozturk and Avaraci (2002) find a negative relationship between the exchange rate volatility and real exports of Turkey for 1989–2002 period. By using annual data at the firm level over 2001–2003, Solakoglu et al., (2008) argue that there is no significant relationship between the exchange rate volatility and real exports of Turkey. Erdal et al., (2012) analyze the relationship between the exchange rate volatility and agricultural imports/exports of Turkey using the data from 1995 to 2007 period. They claim that the exchange rate volatility has a significant positive impact on the agricultural exports but a negative impact on the agricultural imports. Gul and Ekinci (2006) examine the causality relationship between real exchange rates and aggregated import/export of Turkey based on the data of 1990–2006 and report a unidirectional causality from export and import to the exchange rate. Fidan (2006) argues that real effective exchange rate has no significant effect on Turkish agricultural imports and exports. Given these diverse results for exports of Turkey, it is important to use disaggregated and/or commodity level data to analyze the relationship between exchange rate and agricultural exports.

However, a few studies investigate the relationship between the exchange rate, its volatility and the individual agricultural commodities for Turkey. Using data on citrus crop, hazelnuts, tobacco and cotton exports from Turkey to twenty five countries over 1971–1994 period, Yanikkaya (2001) reports that the real exchange rate is an important determinant in the exports of tobacco and cotton exports but not an important determinant in the exports other commodities. Buguk et al. (2003) investigate the effects of the exchange rate and its volatility on the dried figs, grapes and tobacco exports of Turkey and find a significant long-run relationship between these variables but unable to find any significant short-run effects of the real exchange rate and its variability on the exports of commodities. Our study examines the impact of both the levels and volatility of the exchange rate on six different agricultural commodities for much longer period of time employing the panel time series estimation tools. Our estimation results indicate that while the real exchange rates have significant impacts on the exports of all commodities with an exception of dried figs, the exchange rate volatility is not an important factor in the exports of these agricultural commodities.

THE GRAVITY MODEL

We employ the well-known gravity model to investigate the determinants of exports of the traditional Turkish agricultural commodities. This model relies on the law of universal gravitation discovered by Newton. Basically, the gravity model claims that exports from country i to j, EXP_{ij}, are proportional to the product of both countries economic mass which is usually proxied by the countries' GDP and/or population (POP), and inversely proportional to the distance between country i and j, $DIST_{ij}$. The equation is then augmented to include other factors that can be potential determinants of exports. The basic equation is;

$$EXP_{ij} = \beta_0 GDP_i^{\beta_1} POP_i^{\beta_2} GDP_j^{\beta_3} POP_j^{\beta_4} DIST_{ij}^{\beta_5} \qquad (1)$$

Since our research applies to only one country, there is no need to use "i" which denotes the source country to identify the export country specifically, therefore, the subscript "i" is left out. Considering a set of variables either facilitating or restricting exports of Turkey, the stochastic version of the augmented gravity model that we investigate is as follows:

$$EXP_j = \beta_0 GDP^{\beta_1} POP^{\beta_2} GDP_j^{\beta_3} POP_j^{\beta_4} DIST_j^{\beta_5} RER_{jt}^{\beta_6} VOL_{jt}^{\beta_7} D_{jt,k}^{\beta_{8,k}} \varepsilon_{jt} \qquad (2)$$

where RER_{ij} is the real exchange rate, VOL_{ij} is the exchange rate volatility denotes a set of dummy variables. In the gravity model literature, the use of a set of dummy variables is a long tradition. In this empirical investigation, we use the following dummies; *contiguity:* 1 for contiguity, *gatt*: 1 if importer country is the GATT/WTO member and *rta*: 1 for regional trade agreement with the source country is in force. ε_{jt} is error term.

DATA AND ESTIMATION METHOD

Our empirical investigation is carried out with annual data on the agricultural commodity exports of Turkey to 46 countries over the period between 1971 and 2010. The agricultural commodities investigated in this study are citrus crop, dried figs, grapes, hazelnut, raisins, and (unmanufactured) tobacco. Data on bilateral commodity trade values are retrieved from the UN COMTRADE database.

Annual data of consumer price indices, exchange rates against US dollar, GDPs, populations are from the World Bank's World Development Indicator database. Monthly exchange rates against US dollar and price in-

dices are collected from the IMF International Financial Statistics. The distance variable and the dummy variables of contiguity, gatt and rta are collected from the CEPII Trade database and the Gravity Dataset[1].

The real exchange rates are computed from the spot exchange rates and the local and foreign consumer prices indices in a way that an increase in the real exchange rates means depreciation of Turkish Lira. The spot exchange rates are calculated by using the cross exchange rates against US dollar because Turkish Lira against many countries currency for earlier period of analysis is not available. Summary statistics is provided in the Appendix (Table 4).

Measuring exchange rate volatility

In the relevant literature, a large variety of the exchange rate volatility has been used. Clark et al. (2004) provide a comprehensive study on measuring the exchange rate volatility and report that there is no agreement on which measures of the exchange rate volatility is most suitable. However, the most widely used measure of the exchange rate volatility is the standard deviation of the first difference of logarithm of the exchange rate. This measure has the property that it will be zero if the exchange rate follows a constant trend; in this case it could be anticipated presumably and thus produces no uncertainty. The standard deviation is calculated using the monthly exchange rate over a one-year period, as an indicator of the short-run volatility, and also over five-year period to capture medium to the long-run variability (Clark et al. 2004, Tenreyro 2007).

So we utilize the short-run and long-run measures of volatility which briefly described above.

$$VOL_{ijt}^{short} = st.dev[lnRER_{ijt,m} - lnRER_{ijt,m-1}]$$
$$m = 1, 2, \ldots, 12$$

$$VOL_{ijt}^{long} = st.dev[lnRER_{ijt,m,k} - lnRER_{ijt,m-1,k}]$$
$$m = 1, 2, \ldots, 12; k = t-1, t-1, \ldots, t-5$$

Estimation method

In the trade literature, empirical studies frequently employ the ordinary least squares method to estimate gravity models, which usually is a log-linearized gravity equation. However, Silva and Tenreyro (2006) show that the use of least squares to estimate gravity equations are inappropriate. They argue that the log-linearization or any non-linear transformation of the gravity equation in the presence of heteroscedasticity produces inconsistent estimates. Even controlling for fixed effects, the presence of heteroscedasticity can produce strikingly misleading conclusions when the gravity equation is log-linearized. Additionally, in the log-linearization the very existence of zeros in the trade data is problematic and to solve this problem, several unsatisfactory solutions including elimination of zero-trade pairs and the nonlinear transformation of the dependent variable such as adding 1 to trade data are implemented. Therefore, they suggest that the Poisson Pseudo-Maximum-Likelihood (PPML) estimation method introduced by Gourieroux et al. (1984) has all the characteristics needed to make it a promising workhorse for the estimation of gravity equations. Furthermore, they provide a simulation evidence that the PPML is superior to the standard estimation methods used to estimate the gravity model even when the dependent variable has a large proportion of zeros (Silva and Tenreyro 2006, 2011). In addition, Arvis and Shepherd (2011) argue that an additional problem with the OLS estimates of the log-linearized gravity model is that predicted trade systemically exceeds the total actual trade. They show that this effect is quantitatively important but fortunately the PPML has a unique property that solves this problem.

Since we have data on agricultural commodity exports of Turkey to 46 countries, presumably the residuals suffer from heteroscedasticity. Testing the presence of heteroscedasticity shows that for all commodities, the null of homoscedasticity is strongly rejected[2]. Thus, in the light of findings set out in Silva and Tenreyro (2006, 2011), we employ the PPML estimation method for our empirical investigation[3].

We also estimate equation 2 with as a proxy for the medium to long-run exchange rate volatility, using trade data for five-year averages, 1975, 1980, 1985, ..., 2010.

EMPIRICAL FINDINGS

Table 1 reports the PPML estimation results of equation 2 for all countries. Our estimation results

[1]For details, see http://www.cepii.fr/anglaisgraph/bdd/gravity.htm

[2]We estimate log-linearized model by employing iterated generalized least square (GLS) with panel level heteroscedasticity and GLS without heteroscedasticity. Employing LR test, we reject the null hypothesis of homoscedasticity.

[3]For further information about PPML estimation see http://privatewww.essex.ac.uk/~jmcss/LGW.html

Table 1. Estimation Results (1971–2010, 46 countries)

	Fig	Citrus	Grape	Nut	Raisin	Tobacco
Exchange rate	–0.00121	0.0532**	0.296***	0.0623**	0.117***	0.0802***
	(0.0135)	(0.0246)	(0.0499)	(0.0268)	(0.0154)	(0.0207)
Short-run volatility	0.0548	–0.0133	0.110	–0.000987	0.00745	–0.0769**
	(0.0365)	(0.0702)	(0.0830)	(0.0708)	(0.0452)	(0.0378)
Turkey's population	–1.582	0.269	–10.38***	–4.787*	–1.523	3.866***
	(1.359)	(2.412)	(3.981)	(2.790)	(1.544)	(1.318)
Importer's population	–0.244***	0.317***	0.0864	0.0755	–0.163*	–0.0370
	(0.0898)	(0.0993)	(0.134)	(0.0888)	(0.0918)	(0.0910)
Turkey's GDP	0.0695	–0.114	3.593**	0.632	0.0947	–1.841***
	(0.595)	(1.084)	(1.812)	(1.211)	(0.682)	(0.595)
Importer's GDP	1.032***	–0.136**	0.136	0.989***	1.122***	0.651***
	(0.0963)	(0.0623)	(0.135)	(0.0670)	(0.0723)	(0.0764)
Distance	–1.408***	0.538***	1.390***	–1.612***	–2.392***	0.843***
	(0.104)	(0.144)	(0.291)	(0.165)	(0.127)	(0.0925)
GATT	–0.655***	0.00926	0.100	0.290	–0.228**	0.0663
	(0.0800)	(0.176)	(0.199)	(0.181)	(0.102)	(0.115)
RTA	0.458***	0.0636	0.768***	1.228***	0.137	0.417***
	(0.0967)	(0.132)	(0.226)	(0.188)	(0.105)	(0.126)
Contiguity	–2.275***	0.806***	1.466***	–3.180***	–0.784***	–0.286
	(0.382)	(0.305)	(0.361)	(0.303)	(0.162)	(0.693)
Constant	34.83***	9.065	91.24***	77.31***	38.55***	–24.17***
	(9.049)	(16.27)	(25.16)	(19.07)	(10.32)	(8.659)
N	896	531	439	1044	976	690
R^2	0.573	0.036	0.101	0.472	0.548	0.881

Standard errors in parentheses. ***, ** and * denote significance at 1, 5 and 10% level respectively

firmly indicate that the depreciation of the Turkish Lira raises the exports all agricultural commodities except dried figs. Export of dried figs shows no sensitivity to the real exchange rates for the full sample, which could be explained by the market structure and the monopoly power of Turkish producers in the dried figs market. However, in the short-run exchange rate volatility does not exert any effects on the bilateral trade, except for the (unmanufactured) tobacco[4]. Short run volatility has a negative effect only on the exports of tobacco. Overall, our results indicate that for almost all commodities and regions the exchange rate volatility is not a significant factor for the bilateral agriculture trade of Turkey to 46 different importer countries. For agricultural commodities, where the markets for these products are not adequately developed and no extensive storage facilities exist, producers have no option to sell their goods at the prevailing price even when the exchange rate volatility is high. Thus, it is not surprising to obtain statistically insignificant results for the coefficients of the short run volatility.

We also estimate the effects of some commonly used variables on commodity exports in our gravity model. While the most estimated coefficients on the source country's population have negative signs and some significant, the estimated coefficients on the importer country's population have some mixed

[4]If we employ long-run exchange rate volatility, as explained in the previous section, we obtain very similar results for all the independent variables.

Table 2. Estimation results (1971–2010, EU countries)

	Fig	Citrus	Grape	Nut	Raisin	Tobacco
Exchange rate	–0.0538**	0.0595**	0.126	–0.118***	0.124***	0.109***
	(0.0212)	(0.0296)	(0.0788)	(0.0367)	(0.0173)	(0.0255)
Short-run volatility	0.0660**	0.0756	0.196*	0.0334	0.0188	0.0135
	(0.0317)	(0.0588)	(0.118)	(0.0680)	(0.0468)	(0.0544)
Turkey's population	–2.991**	–0.986	–12.33***	–8.755***	–2.655	0.185
	(1.232)	(2.332)	(4.723)	(2.539)	(1.647)	(2.046)
Importer's population	–0.899***	0.583***	–1.498***	–1.126***	–0.0627	–0.0128
	(0.318)	(0.132)	(0.566)	(0.253)	(0.143)	(0.140)
Turkey's GDP	0.414	0.868	4.285**	1.826*	0.635	–0.552
	(0.522)	(1.032)	(2.085)	(1.086)	(0.730)	(0.922)
Importer's GDP	1.784***	–0.207**	1.993***	2.395***	0.964***	0.527***
	(0.357)	(0.104)	(0.631)	(0.289)	(0.127)	(0.127)
Distance	–0.153	0.768***	3.150***	1.338***	–1.871***	0.0235
	(0.152)	(0.182)	(0.665)	(0.431)	(0.193)	(0.197)
GATT	–0.467***	–0.180	–0.225	0.835***	–0.161	–0.108
	(0.0797)	(0.171)	(0.218)	(0.205)	(0.117)	(0.132)
RTA	0.185*	0.00616	0.697***	0.566***	0.0655	0.761***
	(0.102)	(0.151)	(0.260)	(0.202)	(0.114)	(0.154)
Contiguity	–2.689***	0.521	1.594	–0.212	–0.570***	–1.337**
	(0.430)	(0.392)	(1.030)	(0.676)	(0.214)	(0.669)
Constant	33.07***	3.257	73.68**	78.36***	43.06***	16.87
	(7.863)	(15.69)	(31.22)	(18.23)	(10.77)	(13.51)
N	602	416	339	665	649	546
R^2	0.704	0.176	0.288	0.648	0.522	0.394

Standard errors in parentheses. ***, ** and * denote significance at 1, 5 and 10% level respectively

results. According to the gravity model, the trade between two countries is proportional to their economic mass. While the estimated coefficients on Turkish GDP are mostly insignificant, the coefficients on the importers' GDP are statistically significant and positive for most commodities.

The distance between the source country and an importer country has expectedly negative effects on the level of bilateral trade. Although our results in half support this argument, the positive and significant coefficients on distance for citrus crop, grape, and tobacco are probably the results of irregularities in data in a way that most of these products are mainly exported to a few countries. For example, approximately 60% of all tobacco for the overall period is exported to the US, which is obviously far from Turkey, which explains the positive and significant coefficient on distance for tobacco. Some weak and contradictory results for these gravity variables might be explained by the fact that we use individual commodities with some irregularities, as described above, in the data. While being a member of the GATT has some mixed effects, being in the same free trade area has positive and significant effects on the bilateral trade flows. Thus, compared to the GATT membership, the Regional Trade Agreements have more potential to expand the exports of the agricultural commodities for Turkey. Similarly having a common border with an importer country has mixed results, too. We may argue that agricultural production is basically a natural resource (land) intensive production; we can expect that countries with common border are more likely to produce similar agricultural commodities. Thus, the common

border may exert negative effects on the level of the bilateral agricultural exports[5].

Since there exist wide variations regarding the end users of Turkish agricultural exports, it is important to do our estimations for a sub-group of countries such as the European Union (EU), the Middle East and North Africa (MENA). The EU countries are the recipient countries for over 90 percent of dried figs, hazelnuts and raisins exports. Similarly, almost 60 percent of Turkish unmanufactured tobacco is exported to the United States. Turkey also exports a sixth of grapes and citrus crop to the MENA countries, too.

We replicate our results for the EU and MENA countries separately. Table 2 reports the PPML estimation results for the EU countries. Exchange rate plays an important role on the volume of agricultural commodity exports. While the estimated coefficients on exchange rate are statistically significant, positive for citrus crop, raisins, and tobacco exports, the coefficients on dried figs and hazelnuts, however, are statistically significant and negative. The latter results can be related to the market structure and the monopoly power of Turkish producers in these products.

While the estimated coefficients on the short run volatility for all commodities are positive, those for the dried figs and grapes are the statistically significant ones. These seemingly contradictory results are in line with the literature. As discussed in the literature review section, several studies find positive trade flow effects stemming from the volatility in the exchange rate. One possible explanation for these positive coefficients on the short-run volatility is that exporters can easily hedge against the short-term exchange rate fluctuations through financial markets.

The estimated coefficients on Turkey's population are statistically significant and negative in almost all cases, which imply that the volume of exports decreases with the size of the exporter country population. Given the consumption good nature of these agricultural commodities, these results can be understood easily. However, the estimated coefficients on the importer's population are statistically significant and negative for all commodities, except that for citrus crop. As expected, the volume of trade between two countries is proportional to their economic magnitudes. The estimated coefficients on Turkish GDP are statistically significant and positive in almost all equations. The coefficients on the importers GDP are statistically significant for all commodities, except for the citrus crop. These findings fit to the gravity model well.

Similar to the results for the full sample, we obtain some contradictory results for the distance between trading countries, the GATT membership, and the common border variable. As explained above, these results stem from the irregularities in the individual commodities data. Also positive and significant coefficients on the RTA imply that being in the same RTA boosts agricultural trade among member countries.

Table 3 reports the PPML estimation results for the MENA countries. While the estimated coefficients on the real exchange rate are statistically significant, positive for only raisins and tobacco exports, the estimated coefficient on the short-run volatility is significant with the expected sign only for citrus crop. These results indicate that both the exchange rate and its volatility have much less effects on agricultural commodity exports to the MENA countries compared to the EU countries.

Similar to the estimations for the full sample, we also obtain some contradictory results for the MENA countries, too. We obtain mixed effects for the Turkey's population, similar to results for the EU countries. However, the estimated coefficients on the importer's population are statistically significant and positive for all commodities, except that for citrus crop and grape. While we obtain mixed results for the Turkish GDP, which mostly contradicts the model expectations, all the estimated coefficients on the importers' GDP have correct signs but statistically significant for only dried figs and citrus crop. Our results on distance, the GATT membership and a common border dummy are no different from our overall estimations. However, our results on RTA imply that being in the same RTA reduces trade between Turkey and the MENA countries. Given 10 RTAs between Turkey and the MENA countries, these results are important.

Regardless of volatility measures chosen, exports of almost all Turkish agricultural commodities show no sensitivity to the either short-run or long-run real exchange rate volatility. These results are in line with the relevant empirical studies. Basically we have more fruitful results for the relationship between commodity exports and the levels of the real exchange rates.

The effects of the real exchange rates on exports do not vary among commodities, though this variation occurs among regions. In other words, it seems that the ability of the real exchange rates to explain

[5]For the sensitivity analysis, we also do our estimations with five-year averages instead of annual data on commodity exports. Although our results are somewhat weaken for exchange rates, we qualitatively still have similar results for the other variables. Now our results indicate that depreciation of the Turkish Lira boosts the volume of exports for only two commodities; grape and raisins.

changes in the commodity exports matter across regions. We have some interesting results for dried figs and hazelnuts because as the Turkish Lira depreciates, our exports of these two commodities, which represent 90% of exports to the EU decreases. These interesting results are probably due to the monopoly status of Turkey in these two commodities. It is evident that the export of hazelnuts increases with the depreciation in TL for other regions. The insensitivity of agricultural commodities to the levels of the real exchange rates (except for raisins and tobacco) MENA countries might be due to the amount of exports, which is insignificant relative to the other regions examined.

Of the six agricultural commodities considered in the study, Turkey dominates the world both in the production and exports in hazelnut and dried figs markets. Turkey is the world largest supplier of dried figs as it produces half of the world dried figs production. Turkey with about 60 percent of the world exports has almost a monopoly position in the exports of dried figs. Turkey also realizes almost 70 percent of the world's hazelnut crop. Turkey is the largest exporter of hazelnuts, supplying about 70 percent of the world's hazelnut exports. Being the largest producer and exporter of these products, Turkish exports have been large enough to affect the world prices significantly, so this degree of monopoly power tends to make exports of these products insensitive to the real exchange rates. The other reason for the insensitivity of hazelnut exports could be the extent of the government intervention in the hazelnut market. For example, the World Bank Agricultural Distortions database (Burrell and Kurzweil, 2007) indicates that the hazelnut market receives relatively more government subsidies since 1980. Therefore, it

Table 3. Estimation Results (1971–2010, MENA countries)

	Fig	Citrus	Grape	Nut	Raisin	Tobacco
Exchange rate	0.0800	0.0338	0.459	0.0293	0.287***	1.006***
	(0.129)	(0.0769)	(0.299)	(0.0491)	(0.0543)	(0.313)
Short-run volatility	0.00158	−0.134**	0.00492	0.0784	−0.0935	−0.0771
	(0.0602)	(0.0625)	(0.0908)	(0.0632)	(0.115)	(0.150)
Turkey's population	−0.154	11.90***	−5.318	−1.082	14.26***	−18.33**
	(3.124)	(2.902)	(4.260)	(2.611)	(2.764)	(8.724)
Importer's population	0.290***	0.209	−0.336	0.343***	0.928***	1.532***
	(0.106)	(0.245)	(0.306)	(0.0811)	(0.109)	(0.361)
Turkey's GDP	−1.648	−5.495***	1.628	0.0847	−6.424***	8.942**
	(1.397)	(1.433)	(2.020)	(1.171)	(1.271)	(3.743)
Importer's GDP	1.158***	0.430***	0.228	0.0784	0.0770	0.0374
	(0.136)	(0.102)	(0.242)	(0.0815)	(0.101)	(0.397)
Distance	−2.700***	3.184***	4.266***	0.0727	1.560***	0.473
	(0.339)	(0.638)	(0.991)	(0.282)	(0.464)	(0.725)
GATT	0.000484	−1.144**	0.456	−0.395	−1.657***	0.539
	(0.194)	(0.580)	(1.183)	(0.266)	(0.292)	(0.562)
RTA	0.423*	−0.851**	−0.457	−0.0767	−0.292	−2.196***
	(0.226)	(0.397)	(0.304)	(0.215)	(0.331)	(0.474)
Contiguity	0.368	0.692	2.081	−0.486	−1.375***	−2.510***
	(0.451)	(0.694)	(1.519)	(0.371)	(0.390)	(0.958)
Constant	56.21***	−87.00***	30.82	27.48	−95.53***	89.15
	(21.18)	(19.74)	(28.99)	(18.82)	(19.85)	(58.17)
N	209	96	92	294	243	86
R^2	0.449	0.660	0.486	0.105	0.338	0.739

Standard errors in parentheses. ***, ** and * denote significance at 1, 5 and 10 per cent level respectively

is not surprising that exports of these two products, dried figs and hazelnuts, are not very much sensitive to the level of exchange rates. On the contrary, they even obtain reverse signs when we estimate the gravity model for the EU countries. Given the fact that 90 % of these exports are shipped to the EU countries, we can easily explain these reverse signs in a way that due to the monopoly position in these products, Turkey collects monopoly rents in these products and weak Turkish Lira means less income Turkish exporters.

For the other four traditional export products (tobacco, citrus crop, grapes, and raisins) considered in the study, Turkey has been one of the major producers and exporters in the world. For all these products Turkey faces an intense competition from many countries. In most of these products, Turkey competes with the USA, China, Brazil, Spain, and Italy. For tobacco, Turkey accounts about 3 percent of the world production for the last decade and the seventh largest in the world. Similarly, the most popular fresh fruit varieties in Turkey are citrus fruits like oranges, lemon and grapefruits, apples, melons and grapes, and Turkey is the fourth largest exporter in the world. It has been among the five major producers of grapes throughout the world and Turkey is the sixth largest exporter in the world. Similarly, Turkey accounts for one quarter of both world raisins production and exports. Thus, for the last four products, in line with the expectations, exports of these four products are relatively more sensitive to the level of exchange rates.

CONCLUSIONS

This paper analyzes the effects both of the level and volatility of the real exchange rates on Turkish exports of dried figs, citrus crop, grapes, hazelnuts, raisins and unmanufactured tobacco to forty-six different countries. Panel data is used and analyzed using the Poisson Pseudo-Maximum-Likelihood method as guided by the gravity equation. While our overall results suggest that the level of real exchange rates are significant in determining the exports of almost all commodities, neither short-run nor long-run exchange rate volatility exert any significant effects on the exports of these agricultural commodities.

Our estimation results indicate that real exchange rates are important determinants of the level of Turkish agricultural exports in almost all commodities; sensitivity of agricultural commodity exports

Appendix

Table 4. Descriptive statistics

	Mean	Median	Maximum	Minimum	Std. dev.	*N*
Citrus Crop	7 484 701	1 817 459	247 000 000	325.3636	18 548 528	807
Dried Figs	2 647 767	755 257	35 928 736	182	4 775 787	1 229
Grapes	1 751 388	122 262.2	117 000 000	28.35245	7 238 704	685
Hazelnuts	17 205 464	2 110 531	562 000 000	173.7132	54 626 920	1 421
Raisin	6 183 398	602 832.4	101 000 000	27.57318	12 956 469	1 276
Unman. Tobacco	19 877 785	3 381 511	478 000 000	23.81606	57 654 370	873
Exchange rate	0.287163	0.003718	5.625522	1.98E-08	0.754099	1 714
Short-run volatility	0.045986	0.023033	0.295739	0.002874	0.059153	1 840
Turkey's GDP	2.02E+11	1.87E+11	3.89E+11	7.94E+10	9.13E+10	1 840
Importer's GDP	4E+11	7.2E+10	1.17E+13	614000000	1.25E+12	1 510
Turkey's population	54455187	54599574	72 752 000	36 245 756	1 098 6571	1 840
Importer's population	23 918 790	8 130 098	307 000 000	124 489	43 978 484	1 794
Distance	2 254.469	1 988.455	9 705.77	628.109	1 644.945	1 840
Contiguity	0.086957	0	1	0	0.281848	1 840
GATT	0.695109	1	1	0	0.460487	1 840
RTA	0.203261	0	1	0	0.402534	1 840

See section for data definitions and sources

to exchange rates varies across regions. For the EU countries, which are by far the most important destination for all these products, exports of all products, are sensitive to the changes in the value of currency. However, while it lowers the export levels for dried figs and hazelnuts, a weak Turkish Lira raises the exports of the other products. For the MENA countries, with the exceptions of raisins and tobacco, the level of exports are not sensitive to the currency depreciations. Thus, it seems that since the US is one of the most important competitors in these Turkish agricultural products, exports of these products (except dried figs) are relatively more sensitive to the changes in the level of currency.

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