

The Influence Of Real Exchange Rates On Turkish Agricultural Exports

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This paper employs a regional commodity specific export demand equations to test the hypothesis of a casual relationship between real exchange rate movements and Turkish exports of citrus fruit, nuts, tobacco, and cotton to twenty-five different countries. While our regression results suggest that real exchange rates are statistically significant in determining the exports of tobacco and cotton generally to all regions, they do not show that real exchange rates are an important factor for the exports of citrus crop and nuts regardless of the region.

1. INTRODUCTION

The variety of Turkish exports has undergone important structural changes over the last two decades. In the 1960s, Turkey's exports were mainly agricultural products. The share of agricultural exports of total exports has diminished gradually from 57 percent in 1971 to 5.1 percent in 1994. Nevertheless, agriculture has economy-wide importance in Turkey, since nearly half of its population still lives in rural areas and most of the manufacturing industries are agriculture based, processing farm products or producing inputs to agriculture. In addition, among industrial exports, processed agricultural goods such as food items, textiles, ginned cotton, and leaf tobacco have an important share. For these reasons, policies related to agriculture have a crucial effect on both the variety and the magnitude of Turkish exports.

There was a substantial increase in total exports of agricultural commodities between 1979 and 1981, followed by a steady downward trend until 1985. Since 1985 the total value of agricultural exports has been increasing. The decline in the share of agricultural exports during the last two decades is most likely due to the strong bias toward import substitution in both domestic and exchange rate policies up until the end of the 1970s.

Towards the end of the 1970s, Turkey followed a fixed and multiple exchange rate policy. The Turkish lira was substantially over-valued during the 1970s. With

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trade liberalization during the 1980s, the multiple exchange rate system was removed. After May 1981, the exchange rate was adjusted daily against major currencies in order to sustain the competitiveness of Turkish exports. In August 1988, major reform was undertaken, and a system of setting foreign exchange rate was adopted. The real exchange rate has depreciated until 1988, contributing to a large increase in exports. Thereafter, the trend in real exchange rate has reversed. The objective of this paper is to determine whether an identifiable casual relationship exists between exchange rate movements and Turkish agricultural commodity trade flows.

2. LITERATURE REVIEW

Since the early 1950s, the effects of exchange rates on agricultural trade flow were first studied by Schuh (1974). He claimed that the exchange rate has been a crucial, yet, neglected variable in past explanations of U.S. agricultural exports. More specifically, his analysis attempted to incorporate the over-valuation of the dollar into past interpretations of the U.S. agricultural exports. The consequence of the over-valuation of a currency is a rise in the price of the product in terms of foreign currency, thus lowering the demand for the product and lowering the price of the product in the domestic market, in turn raising the quantity demanded domestically. Schuh (1984) also argued that an over-valued currency is equivalent to a tax on exports and a subsidy on imports. In addition, Kost (1976) found that when supply and demand are inelastic, devaluation had only a small impact on agricultural exports.

Chambers and Just (1979) used a simple two-country excess demand and excess supply model to examine the impact of devaluation on the agricultural market. Their model implied that a devaluation by the exporter country causes an increase in price in terms of the exporter's currency. If the elasticity of excess supply with respect to price is zero, a devaluation will have no impact on exports, but prices rise. If the excess supply is perfectly elastic, however, a devaluation has no effect on prices; all adjustment occurs in exports. Therefore, the response of exports basically depends upon the elasticity of excess supply.

Although exchange rates have been generally recognized as an important factor affecting agricultural exports, the magnitude of the effects of exchange rates has been mixed. Numerous efforts have attempted to quantify the effects of exchange rate movements on agricultural exports. For example, Krueger (1974) examined the effects of the real exchange rates on a variety of Turkish exports. She concluded that direct government interventions were frequently the dominant determinants of Turkish exports.

Childs and Hamming (1984) used the Granger causality to test the hypothesis of a casual relationship between exchange rates and various U.S. agricultural

commodity exports. Although U.S. agricultural exports were inversely related to the real exchange value of the dollar, exchange rate movements had their full effect only over a considerable time period. At the same time, Hudson, Lins, and Seger (1989) examined the effects of interest rates and exchange rates on U.S. agricultural exports to Japan by using Granger causality. They found little evidence of a relationship between these two variables and agricultural exports.

Two studies by Batten and Belongia (1984, 1986) focused specifically on the effects of changes in the exchange rate on agricultural exports. Although the real exchange rate was shown to have a significant and negative effect on U.S. agricultural exports, U.S. agricultural exports responded more to changes in foreign real GNP.

Several studies also attempted to demonstrate the importance of including macro monetary variables in analyzing the effects of exchange rate movements on U.S. agricultural markets. Empirical results showed that the U.S. dollar value has a significant impact on U.S. farm exports (Chambers and Just, 1981; Dunmore and Longmire, 1984; Belongia and Stone, 1984; and Coleman and Meilke, 1988).

Recently two studies focused on the impact of exchange rate risk on agricultural trade flows. Anderson and Garcia (1989) found that the quantity of U.S. soybean exports was sensitive to short-term variations in nominal bilateral exchange rates. These effects vary across countries. In Pick's (1990) article suggested that the real exchange rate was an important factor in determining U.S. agricultural exports, but exchange rate risk is not always an important factor.

3. THE MODEL

Regional commodity specific export demand relations are estimated to test the hypothesis of a casual relationship between real exchange rate movements and Turkish exports of citrus fruit, nuts, tobacco, and cotton. The model has two appealing features. First, it treats distinctly the amount of each commodity exported to different importing regions. Secondly, it develops and utilizes region, commodity-specific trade weights to assign relative importance to the magnitudes of the bilateral exchange rates of each country included in each regional export demand equation for a specific commodity.

The importing regions are comprised of countries that have similar per capita incomes, geographic location, population growth rates and economic growth rates. These similar characteristics ease the analysis of the empirical results of the commodity export equations. The four importing regions taken for analysis are European Community (EC), European Free Trade Area (EFTA), North America, and Middle East. Together, these four regions have accounted for approximately 49 percent of the total value of Turkish exports of citrus crop, 85 percent of the total

value of Turkish exports of nuts, 85 percent of the total value of Turkish exports of tobacco, and 72 percent of the total value of Turkish exports of cotton during the 24 years examined. The rest of Turkey's citrus fruit, nuts, tobacco, and cotton exports go to other OECD countries, ex-centrally planned economies and North African countries. Only exports originating through normal market channels are considered. For each commodity-region relationship examined, with the exception of nut exports, Turkey competes with other major exporters, and in several regions with local producers.

There are a number of reasons why these commodities were chosen to test the relationship between commodity exports to distinct import regions and real exchange rates: the magnitude of the total amount of each commodity exported from Turkey, the consistency over time of the commodity exports to the regions, and the reliability and availability of the data.

The paper examines twenty-five importing countries, though not every country chosen for study imports each commodity. Thus, zero values are used for these non-importing countries. When this happens, these countries have no effect on the trade-weight calculations. In other words, the non-importing countries exchange rates are excluded from the calculation of the trade-weighted exchange rate within each region.

Next, country specific trade-weights for each commodity are calculated and used in order to develop trade-weighted country level real exchange rates for those importing countries. These trade-weighted real exchange rates are summed across countries within each importing region to produce the proper explanatory variable to test for the importance of the commodity-region export relations.

The paper calculates the trade weights for each commodity by using the technique developed by Childs and Hamming (1987).

$$W_i = XPT_i / XPT_r \quad (3.1)$$

where;

W_i = trade weight of country i in region r ,

$i = 1, \dots, n$ for each country in region r ,

$r = 1, \dots, 4$ for each importing region of the commodity,

XPT_i = total amount of the commodity exported to country i from Turkey during the 1971 through 1994,

XPT_r = total amount of the commodity exported to region r from Turkey the period 1971 through 1994.

To test the casual relationship between commodity exports and real exchange rates, exchange rate movements need to be adjusted by the inflation differential between domestic and foreign price levels. Therefore, for each importing country

in each region, its nominal bilateral exchange rate in Turkish Lira (TL) per unit of foreign currency is multiplied by the ratio of its own CPI to the Turkish CPI in order to determine its real bilateral exchange rate. The real exchange rate for each country is developed in the following manner;

$$\text{Nominal Exchange Rate} = \text{Turkish Lira / Foreign Currency} \quad (3.2)$$

$$\text{Real Exchange Rate} = \text{Nominal Exchange Rate} * \quad (3.3)$$

$$(\text{Foreign CPI} / \text{Turkish CPI})$$

To calculate trade-weighted bilateral real exchange rates, we then multiply each bilateral exchange rate by its appropriate trade weight (w_i). Moreover, trade-weighted regional multilateral real exchange rates are calculated for each commodity-region export relationship. The TL value of per capita exports is computed by using total population of each region and used in the estimation procedure as the control variable for each commodity-region export relationship.

The Granger causality test assumes that the information related to the estimation of the particular variables is included only in the time series data on these variables. More specifically, we regress y on its own lagged values and lagged values of x . If lagged values of these variables significantly explain the changes in y , then we can conclude that x causes y (Gujarati, 1995). In this paper (y) indicates a particular Turkish commodity export to specific regions while (x) indicates the commodity-region specific trade-weighted real exchange rates. Since Granger causality tests are very sensitive to the number of lags included in the analysis, determining the lag lengths for both the past values of per capita commodity exports (m), and the past values of real exchange rates (n), is the crucial step in this analysis. Consequently, to find the optimal lags, the paper employs the method that combines Akaike's final prediction error (FPE) criterion and the Granger causality test developed by Hsiao (1981).

The two steps involved in computing FPEs are as follows. First, regress current y on its own lags varying from 1 to M , which is the a priori (assumed) highest possible order of lags for y and x and compute FPEs for dependent variable, with assuming n is zero. We, then, choose the order that gives the smallest FPE, as m . Second, regress current y on its own optimal lag (m), and lagged values of x varying from 1 to N . Again compute the FPEs of the estimated equation and choose the order which yields the smallest FPE, say n . Next, if $FPE_y(m, 0)$ is greater than $FPE_y(m, n)$, then we conclude that x causes y , otherwise we say that x does not cause y .

Hsiao computes FPEs for the control variables;

$$FPE(m, n) = (SSR / T) * [(T + m + n + 1) / (T - m - n - 1)] \quad (3.4)$$

where;

SSR is sum of the squared residuals from the appropriate regression and T is the number of observations.

The Granger test includes predicting the following equations by assuming m and n optimal lags for y and x, respectively.

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$$y_t = a_{10} + a_{1i} y_{t-m} + u_{1t} \quad (3.5)$$

$$y_t = a_{20} + a_{2i} y_{t-m} + b_{2i} x_{t-n} + u_{2t} \quad (3.6)$$

where;

a_{1i} , a_{2i} , and b_{2i} are the regression parameters, and u_{1t} , and u_{2t} are independent serially correlated residuals with zero means and finite variances for all $t = 1, \dots, T$. If the direction of causality is from x to y, the b_{2i} in equation (3.6) will be significantly different from zero. In other words, the null hypothesis that x does not cause y is that $b_{2i} = 0$. To test this null hypothesis, we apply the F test given by the following equation,

$$F = [(SSR1 - SSR2) / (n * SSR2)] * (T - m - n - 1) \quad (3.7)$$

where;

SSR1 and SSR2 are the sum of squared residuals calculated from the OLS regressions on equations (3.5) and (3.6), respectively. It follows the F distribution with (m) and (T- m -n -1) degree of freedom. Results from both Akaike's FPE criterion and Granger tests are reported in the following section.

4. EMPIRICAL RESULTS

In this section, the Akaike's final prediction error criterion is applied to estimation of per capita Turkish exports of citrus fruit, nuts, tobacco, and cotton and the effect of the trade-weighted real exchange rates for each commodity. The resulting FPEs for the control variables are presented in Table I and II.

As can be seen from Table I, the optimal lags for the control variables, which are the smallest FPEs, are mostly for one period. It interesting to note that the optimal lag for cotton exports to the Middle East is eight periods. The plus and minus signs in Table II indicate how the treatment of real exchange rates as the manipulated variables affect the FPEs of per capita exports. Plus (minus) indicates the FPEs become higher (smaller) when real exchange rates are included. We can say that in the cases of the smaller FPEs, real exchange rates affect the commodity exports. The addition of past values of the exchange rates does not improve the predicting power for citrus crop exports and nut exports except for citrus fruit exports to EFTA and nut exports to the EC. Moreover, lagged values of real exchange rates considerably affect exports of cotton and tobacco to all regions.

TABLE I
The FPEs for the controlled variable

The order of lag	EC				EFTA			
	citrus	nuts	tobacco	cotton	citrus	nuts	tobacco	cotton
1	0.010093*	1.359995*	0.358668*	0.974254	0.526337*	5.435942*	0.666063*	50.35473*
2	0.01754	2.098771	0.407063	0.849748*	0.599468	10.39819	0.679643	77.2586
3	0.021762	2.449743	0.479091	1.051259	0.678958	15.11829	0.865212	104.4536
4	0.041948	2.804003	0.605029	1.363882	0.712024	17.61708	1.056403	131.902
5	0.066111	3.214617	0.730546	1.346329	0.792786	20.0172	1.272958	142.7363
6	0.095446	3.079519	0.76189	1.095656	0.991353	22.07041	1.315668	159.5248
7	0.118535	2.873792	0.739429	1.229574	1.194664	22.34373	1.265368	210.2791
8	0.148658	3.670717	1.227399	1.293642	1.52087	19.59285	1.904729	278.236

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The order of lag	N. America		M. East			
	nuts	tobacco	cotton	citrus	nuts	cotton
1	0.014059	1.508482*	0.000526*	0.364298*	0.671915*	2.22191
2	0.011312	2.120145	0.000755	0.668052	1.23846	3.692471
3	0.006146*	2.474517	0.000911	0.761288	1.504081	1.819966
4	0.008864	3.078206	0.000913	0.790172	1.807967	1.056844
5	0.008615	3.733358	0.001062	0.86052	2.127776	1.110268
6	0.007375	4.489341	0.001377	1.050158	2.445626	1.05557
7	0.007704	5.270228	0.001435	1.299089	2.876929	1.247528
8	0.00786	6.395893	0.001396	1.570276	3.615162	0.996546*

* It indicates the optimal lags for per capita exports.

TABLE II

The FPEs of the controlled variable with the optimum lags of the manipulated variable.

Controlled variable* :	Manipulated variable:		The optimum lag of manipulated variable	The FPE of controlled variable
Per capita commodity exports	Trade-weighted real exchanges rates for			
EC	citrus (1)	Citrus	--	0.010933 (+)
	nuts (1)	Nuts	1	1.347355 (-)
	tobacco (1)	Tobacco	1	0.292198 (-)
	cotton (2)	Cotton	3	0.745305 (-)
EFTA	citrus (1)	Citrus	1	0.520289 (-)
	nuts (1)	Nuts	--	5.918718 (+)
	tobacco (1)	Tobacco	1	0.625643 (-)
	cotton (1)	Cotton	1	49.63581 (-)
N.America	nuts (3)	Nuts	--	0.006791 (+)
	tobacco (1)	Tobacco	1	1.153122 (-)
	cotton (1)	Cotton	--	0.000534 (+)
M. East	citrus (1)	Citrus	--	0.393419 (+)
	nuts (1)	Nuts	--	0.683533 (+)
	cotton (8)	Cotton	1	0.624722 (-)

* The numbers in the brackets indicate the order of optimal lags for per capita exports.

Next, the Granger causality test is used to estimate the causality between real per capita Turkish exports of citrus fruit, nuts, tobacco, and cotton to specific importing regions and lagged values of trade-weighted regional multilateral exchange rate, which is deflated by the CPI by using annual data from 1971 through 1994. The causality test is computed for each commodity export relationship based on optimal lag structures. The results are shown in Table III.

According to the regression results, the causality of real exchange rates with respect to changes in per capita exports varies among commodities and regions. Regardless of lag length and region chosen, citrus fruit exports and nut exports are insensitive to the real exchange rates, though tobacco exports are highly sensitive.

TABLE III
Granger Causality Results Based on the Optimal Lags.

Region	Commodity			
	Citrus fruit	Nuts	Tobacco	Cotton
		Test	Statisti	
EC	0.15867	2.04489	6.808195 ²	3.381206 ²
EFTA	2.093914	0.058563	3.251006 ³	2.156326
N.America	*	0.000275	8.570484 ¹	1.525055
M. East	0.223378	1.468769	*	5.612928 ³

¹Significant at the .01 level.

²Significant at the .05 level.

³Significant at the .10 level.

* Region accounts for less than 1% of commodity exports for the years 1971-1994.

The sensitivity of cotton exports varies among regions. Although it seems that cotton exports to EFTA and North America are insensitive to real exchange rates, they have relatively higher t statistics. These results are similar to results found by Krueger (1974), except tobacco. Krueger's study examined the effects of real exchange rates and other explanatory variables on the major Turkish agricultural commodity exports by using ordinary least squares regressions. Krueger found that nut and tobacco exports were insensitive to real exchange rates, since direct government intervention was the most important factor determining exports of those rather than exchange rate policy. Cotton, where government intervention was relatively insignificant, was more sensitive to real exchange rates.

Real exchange rates do not appear to affect the quantity of nut exported from Turkey. This may be due to Turkey's market share in the hazelnut market, which is the approximately 80 percent of nut exports during the 24 years examined. Turkey produces much more than half of the world hazelnut production. Forker (1967)

estimates that about 90 percent of the crops are exported. For nut exports, Turkish exports have been large enough to affect the world price significantly, so this degree of monopoly power tends to make nut exports insensitive to real exchange rates. The other reason for the insensitivity of nut exports might be the extent of government intervention in the hazelnut market. Citrus crop also appears insensitive to real exchange rates. The reason may be due to perishable feature of the citrus crop. Citrus fruit farmers do not have adequate storage capacity to keep these items fresh for a long time. Another reason might be due to the lower domestic price level of citrus crop, relative to the world price level of citrus crops. For both reasons farmers tend to sell the crop immediately.

Tobacco regional export equations are the most sensitive to real exchange rates, while the ability of exchange rates to explain cotton exports varies among regions. These results might be explained by both the smaller amount of market intervention by the government in the tobacco and cotton markets, and the insignificant share of Turkey in tobacco and cotton markets, relative to hazelnut market. In these two markets, Turkey faces an considerable amount of competition from other supplier countries.

The effects of trade-weighted exchange rates on exports vary among commodities, though this variation does not occur among regions. In other words, it seems that the ability of exchange rates to explain changes in commodity exports is not differentiated across regions. However, cotton exports to the EC and Middle East reflect a causal relationship with exchange rates, while its exports to EFTA and North America do not reflect this causal relationship. The insensitivity of cotton exports to North America and EFTA might be due to the amount of exports, which is insignificant relative to the other regions examined.

5. INTERPRETATION

For citrus crop and nut exports to all regions, the estimated coefficients of lagged exports are mostly statistically significant, but none of those for real exchange rates are significant, at least .10 significant level. Estimated coefficients of lagged tobacco exports to all regions are statistically insignificant and those of real exchange rates for tobacco exports to the EC and North America are statistically significant. Furthermore, estimated coefficients of lagged cotton exports and its lagged real exchange rates are statistically significant for the EC and Middle East, but they are not significant for EFTA and North America.

The long-run effects of movements in trade-weighted real exchange rates in each export equation vary among commodities. An increase in real exchange rates, which means depreciation of TL, will make Turkish products more attractive in international markets and foreign products less attractive to Turkish consumers. At

this point, long-run multipliers associated with one percent increase in real exchange rates for the annual dependent variables of model for citrus crop, nuts, tobacco, and cotton, are -0.4921, -0.1935, 0.6886, and 1.2816, respectively. Apparently, depreciation of TL could lead to fairly dramatic effects in the agricultural commodity exports. Tobacco and cotton exports appear to be positively sensitive to fluctuations in the exchange rate, though the long-run multipliers for citrus fruit exports and nut exports have the incorrect signs. For example, a ten percent increase in the exchange rates eventually evokes a seven percent increase in tobacco exports, and a twelve percent increase in cotton exports. These results are particularly interesting in the light of ceaseless attempts to depreciate TL after the 1980s.

6. CONCLUSION

This paper analyzes the effects of real exchange rates on Turkish exports of citrus fruit, nuts, tobacco, and cotton to twenty-five different countries. While the results suggest that real exchange rates are significant in determining the exports of tobacco and cotton, they do not show that exchange rates are an important factor for the exports of citrus crop and nuts.

Although the sensitivity of commodity exports varies among commodities, it does not vary across regions. One period lagged exchange rates yield the most significant relationships with commodity exports. For policy reasons, these results suggest that commodity exports respond to exchange rate changes with a one year lag. This seems to indicate that commodity markets respond quickly to changes in exchange rates. On the other hand, the impact of other factors also need to be examined in a complete trade model, especially direct government interventions, which could lead to distortions both in the exchange rate and in trade flows.

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