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THE EFFECTS OF EXCHANGE RATE
FLUCTUATIONS ON EXPORTS:
A SECTORAL ANALYSIS FOR TURKEY

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Abstract

The paper examines the effects of exchange rate fluctuations on disaggregated data comprising 21 exporting sectors (BEC classification) in Turkey. Building on a theoretical model that decomposes movements in the exchange rate into anticipated and unanticipated components, the empirical investigation traces the effects through demand and supply channels. Anticipated exchange rate appreciation has significant adverse effects, contracting export growth across many sectors. Random fluctuations in the exchange rate have asymmetric effects on sectoral export growth. The evidence indicates higher sensitivity of export demand to currency appreciation over time. In contrast, the effect of depreciation in stimulating export growth has lost momentum over time. Anticipated exchange rate guides export plans, signaling the importance of managing fundamentals to anchor rational forecasts. Moreover, less variability of the exchange rate is likely to improve sectoral export growth in Turkey over time.

ملخص

تدرس هذه الورقة آثار التقلبات في أسعار الصرف للعملات على البيانات غير المجمعة التي تضم 21 قطاعا للتصدير (تصنيف BEC) في تركيا. وبناءً على النموذج النظري الذي يحلل التحركات في أسعار الصرف إلى مكونات متوقعة وغير متوقعة، فإن هذا البحث التجريبي يرسم الآثار المترتبة عن طريق قنوات الطلب والعرض كما أن للارتفاع المتوقع في أسعار الصرف آثار غير متوائمة هامة إذ تقلص نمو الصادرات في كثير من القطاعات. وللتقلبات العشوائية في أسعار الصرف تأثيرات تفتقد إلى التساوق على نمو الصادرات على مستوى القطاعات وثمة دلالات على أن سرعة تقلب الطلب على الصادرات بالنسبة لارتفاع أسعار الصرف بمرور الوقت. وعلى نقيض ذلك نجد أن تأثير انخفاض أسعار الصرف على تحفيز نمو الصادرات قد فقد قوة الدفع بمرور الوقت. وتهتدي خطط التصدير بأسعار الصرف المتوقعة مشيرة إلى أهمية إدارة الأساسيات للتيقن من صدق التنبؤات. أضف إلى ذلك أن انخفاض درجة التقلبات في أسعار الصرف قد يؤدي إلى تحسن نمو قطاعات الصادرات بمرور الوقت

Introduction

The nineties were the years of currency turmoil, as evident by the near-breakdown of the European Exchange Rate Mechanism in 1992-93, the Latin American Tequila Crisis following Mexico's peso devaluation in 1994-95, and the severe crises that swept through Asia in 1997-98. Therefore, the effects of exchange rate misalignments attract considerable interest. However, unexpected currency depreciation and appreciation may affect the economy differently because the exit-entry decisions and price setting behaviors of export-oriented firms may vary with the currency movements in different directions so as to avoid a decrease in their profits (Knetter, 1989). Fluctuations on the demand and supply sides of the economy may differentiate the effects of overvaluation or undervaluation of the exchange rate. Therefore, it is important to point out the benefits and costs of depreciation and appreciation in exporting sectors before deciding on the appropriate macroeconomic policies. The aim of this study is to explore the asymmetric effects of random misalignments due to exchange rate fluctuations on export sectors in Turkey.

There are a few studies discussing the asymmetric effects of exchange rate shocks on exports. Most of them discuss these asymmetric effects within a micro-economic modeling framework. Froot and Klemperer (1989) and Knetter (1989) point out that the asymmetric response of stock prices to currency movements may occur due to asymmetric pricing-to-market behavior. When the domestic currency appreciates, exporting firms with a market share objective do not permit local currency prices to increase because of the risk of losing their share, so they decrease their profit margins. On the other hand, under currency depreciation, exporting firms with a market share objective maintain rather than increase their profit margins as a result of their focus on sales volume. Other studies supporting the same arguments are Marston (1990) and Goldberg (1995). Another type of the asymmetric effects of exchange rate fluctuations on exports is proposed by Baldwin and Krugman (1989) and Dixit (1989). They argue that new export competitors enter the market during depreciation periods. However, these competitors remain in the market when the currency appreciates (hysteretic behavior).

The effects of exchange rate misalignments on exports have drawn attention in the literature, particularly in the wake of recent currency crises. Kandil and Mirzae (2002) suggest that there are supply and demand channels following currency appreciation (depreciation). On the supply side, appreciation decreases the cost of intermediate imports and increases the output supply. On the demand side, appreciation decreases competitiveness, decreasing demand for exports and increasing demand for imports. The supply channel would suggest an increase (decrease) in export growth, following currency appreciation (depreciation), while the demand channel would lead to reduction (increase) in exports. Asymmetry, would depend on which channel dominates with respect to currency appreciation (depreciation).

The experience of Turkey is interesting for the analysis of exchange rate fluctuations on the export sector. Turkey underwent major structural reforms and moved to a flexible exchange rate system with an objective to enhance competitiveness and stimulate export growth. The analysis of this paper focuses on performance of sectoral export growth in response to exchange rate fluctuations over time. To anticipate the results, the evidence indicates that before 2003, the supply channel dominates with respect to currency appreciation, resulting in higher export growth. Further, the demand channel dominates with respect to currency depreciation before 2003, resulting in higher export growth. The combined effects of exchange rate variability (movement in the exchange rate around its equilibrium) have a net positive effect on export growth during the sample period 1996-2002. In contrast, starting in 2003 the evidence indicates that the demand channel dominates with respect to currency appreciation, shrinking export growth in response to unexpected exchange rate appreciation.

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Further, post-2002 the supply channel dominates with respect to currency depreciation, shrinking export growth in response to higher cost of imported intermediate goods. The combined effects indicate that random fluctuations in the exchange rate away from equilibrium have a net negative effect on export growth in the later period post 2002 in Turkey.

The results will help policy makers in Turkey to identify the sectors that are most vulnerable to exchange rate misalignments. As the objective of the exchange rate policy is to mitigate the adverse effects of exchange rate fluctuations on exports and growth, the design of such policies could be better informed by building on microeconomic strategies that are best suited to address potential vulnerabilities in sectoral growth.

The remainder of the paper is organized as follows. Section II provides a theoretical background for the empirical investigation. Section III provides an overview of major economic developments in the sample period under investigation. Section IV lays out the details of empirical investigation. Section V describes the results. Section VI concludes.

Theoretical background

In the real world, stochastic uncertainty may arise on the demand or supply sides of the economy. The paper builds on a macro-economic model that incorporates exchange rate fluctuations of the domestic currency (see Kandil and Mirzaie (2002)). Fluctuations are assumed to be realized around a steady-state trend that is consistent with variation in macro-economic fundamentals over time.

In theory, the combination of demand and supply channels indicates that real output depends on unanticipated movements in the exchange rate, the money supply, and government spending in the short-run.[1] These movements define fluctuations in economic variables around full-equilibrium. In addition, supply-side channels establish that output varies with anticipated changes in the exchange rate, which enters the full-equilibrium definition of real output.

The complexity of demand and supply channels may determine the results of exchange rate fluctuations as follows:

- In the goods market, a positive shock to the exchange rate of the domestic currency (an unexpected appreciation or overvaluation) will make exports more expensive and imports less expensive. As a result, the competition from foreign markets will decrease the demand for domestic products, decreasing domestic output and price.[2]
- In the money market, a positive shock to the domestic currency (an unexpected temporary appreciation) relative to equilibrium, prompts agents to hold less domestic currency and decreases the interest rate. This channel moderates demand contraction and, therefore, the reduction in output and price in the face of a positive exchange rate shock.
- On the supply side, a positive shock to the exchange rate (an unanticipated appreciation) decreases the cost of imported intermediate goods, increasing domestic output and decreasing the cost of production and, hence, the aggregate price level.
- On the supply side, a positive shock to the exchange rate (an unanticipated appreciation) decreases competitiveness and, therefore, producers' outlook of external demand. Plans for the output supply decrease as a result.

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[1] Exchange rate shocks (misalignments) are assumed to develop in response to domestic economic conditions or in response to external vulnerability, e.g., capital mobility or fluctuations in foreign reserves.

[2] Similarly, a depreciation of the exchange rate stimulates demand for exports, which triggers capital accumulation to produce tradable goods. The elasticity of supply to cope with the increased demand determines the allocation of the exchange rate shock between output growth and price inflation.

The net effect of currency appreciation on output growth and price inflation is determined by the dominant effect of demand or supply channels. Similarly, export growth will be affected by the relative responses on the demand and supply sides of the economy.

Economic developments in Turkey

This section outlines developments over the sample period that shaped economic developments in Turkey.

As Turkey engaged in the economic program with the IMF in 1994, a series of reforms and stabilization policies were in place and economic recovery was underway. Following integration into the Customs Union in 1996, trade liberalization was accelerated, resulting in an increase in both exports and imports. The continued increase in capital inflows in 1996-1997 provided external resources to finance the current account deficit. Concurrently, foreign reserve accumulation contributed to a loose monetary policy, which supported the growth of investment and the economy. Unfortunately, inflation increased as well.

Starting with the economic program in 1994, the exchange rate policy was designed to stabilize the real exchange rate. The Central Bank of Republic of Turkey (CBRT) depreciated the nominal exchange rate parallel to inflation expectations.

In 1998, the Russian crisis hit the Turkish economy and private investment and consumption, as well as capital inflows, decreased sharply. Nonetheless, Turkey experienced a positive growth rate, boosted by export growth and the increase in public spending on consumption and investment.

In 1999, the economy experienced a recession due to the earthquake and deterioration in public finance. In December 1999, Turkey adopted another disinflation program with the support of the IMF. The aim of the program was to decrease inflation to a single digit at the end of 2002. The program established the exchange rate regime as a crawling peg. The CBRT declared an exchange rate basket path consisting of 1 US$+0.77 Euro, and announced a daily depreciation rate, which added up to a cumulative of 20 percent by the end of 2000.

The implementation of the 1999 program gave positive signals. The nominal Treasury bond auction interest rates fell from 96.4% in November 1999[3] to 34.1% in January 2000. Consistently, inflation expectations decreased. The economy realized high capital inflows, which supported a high growth rate reaching 4.8% in the first half of 2000. However, higher growth resulted in an increase in consumption and investment spending, which stimulated an increase in import growth. Subsequently, the current account deficit deteriorated and the external balance became fragile. Despite crawling depreciation, capital inflow and high domestic spending led to a real exchange rate appreciation, which adversely affected export growth. Subsequently, the banking sector increased its foreign currency denominated debt to a level that became risky for the system. With the sudden capital outflow in November 2000, the banking sector crises broke out, which led to a significant loss of foreign reserves at the CBRT.

In February 2001, political instability further contributed to a deterioration of economic conditions. As the economic crisis deepened, the crawling exchange rate regime was abandoned. The nominal exchange rate depreciated 94% (the annual increase of the second quarter of 2001) and the output response was detrimental, declining by 9.4%.

In May 2001, a new program based on a floating exchange rate regime, tight fiscal policy and structural reforms was implemented. Signs of recovery were observed in 2002; output grew

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[3] There was no Treasury auction in December, 1999.

by 7.8%, underpinned by export growth and public expenditures[4]. In 2002-2005, Turkey managed to diversify exports, which resulted in a significant increase in export growth, despite real appreciation of the Turkish lira. In support of economic reform, fiscal policy was tight, which contributed to a reduction in the inflation rate and interest rates. During 2006-2008, external shocks, like fluctuations in international financial markets and the increase in oil and food prices adversely affected disinflation and economic performance.

The primary engine of growth between 2002 and 2008 was export growth (see Figure 1) and the growth of domestic private absorption (private investment and consumption).

Empirical investigation

Developments in Turkey over time illustrate that changes in the exchange rate have played a major role in shaping up economic conditions. Our investigation will aim at providing a thorough analysis of the interaction between exchange rate fluctuations and the export sector in Turkey.

The analysis is based on monthly data and covers two separate periods: 1996-2002 and 2003-2008. The starting point of the first sample period marks Turkey's integration to EU Customs Union. Subsequently, Turkey's export profile changed. After the crisis in 2001, a number of structural reforms were introduced in 2002 to speed up recovery. As the reform agenda paid off, evidence of structural break warrants truncating the sample period in 2002.[5]

The data and sources are given in Appendix A. Appendix B, Table B1 presents detailed sectoral data under consideration and sectoral shares of total exports. Sectors are divided into four groups: capital goods, intermediate goods, consumption goods, and others. Consumption goods account for the largest share of exports (49%), followed by intermediate goods (42%), capital goods (8.7%), and others (0.33%), for the period 1996-2007. There has been a surge of exports of capital goods, and to lesser extent intermediate goods, in the later period, shrinking the share of consumer goods of total exports.. *Empirical Models*

The results of the unit root test suggest that all of the variables include a unit-root, but their first differences are stationary[6].

To identify the anticipated (equilibrium) and unanticipated (misalignments) components of the exchange rate, we construct a model for the real exchange rate. To decide on the explanatory variables in the equation, we follow a formal causality test in Granger sense[7]. The exchange rate is defined as the real effective exchange rate, a weighted average of the real bilateral exchange rate with major trading partners. Using monthly data, the change of the exchange rate is regressed on its lags as well as lagged values of all variables that may be relevant to movements in the exchange rate in theory: government spending, openness, and international reserves. The lag structure is determined by Final Predictive Error Criteria. The final exchange rate equations for the two sample periods under consideration are presented in Appendix B, Table B2[8].

The residual of the exchange rate equation is the unanticipated component of the exchange rate, i.e., the exchange rate shock measuring the size of misalignment in the observed

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[4] Although tight fiscal policy was targeted in 2002, public expenditures could not be prevented due to elections held at the end of 2002.

[5] The later sample period starts in 2003 as a new series of exports, incorporating changes in definitions was introduced in 2003.

[6] The results are available upon request.

[7] The results are available upon request.

[8] The necessary diagnostic tests are performed for the exchange rate model and the following models. Results are available upon request.

exchange rate relative to its equilibrium. The residual satisfies conditions for rationality, i.e., it is serially uncorrelated and orthogonal to all variables (fundamentals) that determine agents' forecasts of the exchange rate, as they appear in the empirical model. Coefficients on the right-hand side indicate determinants of movements in the exchange rate.

Causality test results support the relevance of government spending to movement in the exchange rate in the earlier period. The signs of the distributed lag support initial appreciation of the exchange rate in response to higher government spending. Higher spending accelerates price inflation, triggering appreciation of the real effective exchange rate. Persistent increase of government spending would increase, however, imports, forcing a depreciation of the exchange rate over time.

The real exchange rate depreciates in a more open economy.[9] This relationship is statistically significant, albeit with a lag, in the later sample period. In 2007, the share of imports to GDP reached 30 percent, while the share of exports to GDP reached 22 percent. Given the relatively higher share of imports, compared to exports, more openness depreciates the exchange rate significantly.

Causality test results support the relevance of movements in international reserves to the exchange rate in the later period. The evidence indicates significant depreciation of the exchange rate in response to higher accumulation of international reserves. The accumulation increases liquidity in the financial system, forcing a reduction in the interest rate and currency depreciation.

Given that data are monthly, we introduce three seasonal dummies into the empirical model, one for each quarter. The structural break points, captured by the dummies on the right-hand side, indicate a significant change in the real effective exchange rate that could not be explained by the explanatory variables.[10] In February 2001, Turkey experienced a serious crisis that forced a change in the exchange rate regime from fixed to floating, resulting in significant depreciation. In June 2006, the international financial turbulence hit the Turkish economy, which was evident by currency depreciation and a surge in the interest rate and price inflation.

To analyze the asymmetric effects of exchange rate shocks on sectoral export growth, we decompose the exchange rate shock (misalignments around equilibrium) to its positive and negative components, as defined for joint estimation, following the suggestions of Cover (1992):

$$negr_t = -0.5 \{ abs(Drs_t) - Drs_t \} \tag{1}$$

$$posr_t = 0.5 \{ abs(Drs_t) + Drs_t \} \tag{2}$$

Drs_t is the exchange rate shock and $negr_t$ and $posr_t$ are the negative and positive components of the shock or, to express it differently, unexpected depreciation and appreciation of the exchange rate.

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[9] Openness is defined as the sum of exports and imports to GDP. If imports are more binding, the exchange rate depreciates in response to a higher degree of openness. In contrast, if exports are more binding, e.g., in Korea, Japan, and China, openness would lead to an appreciation of the exchange rate.

[10] Dummies are introduced based on visual observation of major breaks in the dependent variables. If significant the estimated models account for these dummies.

Over time, it is assumed that sectoral export growth fluctuates in response to changes in aggregate domestic demand, and exchange rate shocks.[11] The model specification is based on the results of the test for non-stationarity of sectoral exports:[12]

$$D\exp_t = A_0 + A_1 Ds_t + A_2 Dm_t + A_3 Dg_t + A_4 Dy_t^{TP} + A_4 E_{t-1} Drs_t + A_5 posr_t + A_6 negr_t + v_t \quad (3)$$

The test results are consistent with non-stationary sectoral exports. Given these results, the empirical model of exports is specified in first difference form where $D(.)$ is the first-difference operator.[13] Accordingly, all variables in the model enter in first-difference form. The unexplained residual of the model is denoted by v_t.[14]

To capture seasonality, the empirical model includes dummy variables. Seasonal dummies take the value 1 for the quarters they represent (s_i is for the ith quarter) and 0 otherwise. For the last quarter, seasonality is captured by the constant. The empirics show that exports are increasing for the last quarter. This finding suggests that $A_1 < 0$ and $A_0 > 0$. This may be due to the structure of the main exporting sectors that benefit by higher demand in importing countries during the holiday season.

Two sources of domestic policies, government spending and the money supply, approximate demand shifts, where g_t and m_t denote their log values, respectively. An increase in the money supply and/or government spending stimulates an increase in aggregate demand. The allocation between real growth and price inflation is likely to determine the effect of domestic policies on export growth. An increase in real growth is likely to contribute to capacity building and export growth. In contrast, binding capacity constraints could escalate inflationary pressures, with adverse effects on export growth.

In addition to domestic conditions, exports in a small open economy are likely to fluctuate with external demand in major importing partners. To capture this channel, the empirical model includes a measure that captures capacity to import in major trading partners, where y_t^{TP} is the log value of world import in the first sample period or output in EU countries in the later sample period.

Anticipated appreciation of the real exchange rate determines the cost of the output supplied and relative competitiveness. Let rs_t be the log value of the real exchange rate.[15] Accordingly, a rise in the exchange rate indicates real appreciation of the domestic currency. As producers anticipate a lower cost of imported intermediate goods, in the face of currency appreciation, they increase the output supplied, including for tradables. Nonetheless, anticipated appreciation may trigger anticipation of loss in competitiveness and, therefore, a decline in external demand, forcing producers to slowdown export growth.

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[11] Government spending and the money supply isolate the direct effects from indirect effects attributed to changes in the exchange rate with domestic policies.

[12] For details, see Kwiatkowski et. al. (1992). Non-stationarity indicates that, real output follows a random-walk process. Upon first-differencing, the resulting series is stationary, which is the domain of demand and supply shifts, as specified in theory. Shocks to the exchange rate are stationary, by construction, and therefore, are not cointegrated with non-stationary dependent variables, ruling out the need for an error correction term.

[13] Given non-stationarity of dependent variables, the empirical models are estimated in first-difference form.

[14] Having accounted for the endogeneity of the exchange rate, attempts to include trade shocks in the empirical model proved insignificant. There is no evidence of structural break in the truncated sample periods.

[15] This measure captures shifts attributed to the nominal exchange rate and the foreign price of imports in theory.

Unanticipated currency fluctuations (exchange rate misalignments) determine both aggregate demand and supply. Unanticipated currency appreciation,[16] a positive shock to the exchange rate, decreases the cost of buying intermediate goods, increasing the output supplied. Concurrently, appreciation decreases demand for exports. The relative strengths of demand and supply channels determine the net effect of exchange rate fluctuations on export growth. A dominant supply channel would result in an expansion of export growth, despite currency appreciation.

To shed light on the role of demand and supply channels, we study asymmetry in the effects of exchange rate fluctuations on sectoral export growth. Accordingly, the empirical model includes separate shocks for unanticipated currency appreciation (*posr*) and depreciation (*negr*). The parameters that measure their separate effects will be contrasted to evaluate the direction and degree of asymmetry.

Methodology and Analysis

The analysis employs sectoral export data for Turkey. As a small open economy with liberal financial markets, the behavior of financial variables in Turkey is market-determined and exposed to exogenous external shocks. Moreover, since the 2001 crisis, Turkey has entered a period of structural change. During the period of 2002-2007, Turkey's growth rate was around 5.5 percent and growth was mainly driven by exports, despite a marked appreciation of the exchange rate. The combined effects of these factors render the case of Turkey rather unique to assess the asymmetric effects of real exchange rate fluctuations on exports.

The analysis employs a two-step procedure to analyze the asymmetric effects of exchange rate fluctuations, following the methodology suggested by Cover (1992). In addition, the model will account for major sources of domestic policies, the money supply and government spending. In the first step we will estimate a forecast model to identify the endogenous component (equilibrium) of the real effective exchange rate. The residual of the forecast equation is interpreted as the innovation (misalignment) in the policy variable. Further, exchange rate shocks are separated into negative (undervalued) and positive (overvalued) components.

Negative and positive policy shocks are included in a model that approximates the cyclical behavior of sectoral export growth. Using Wald test, we test for equal coefficients of negative and positive shocks to establish evidence of asymmetric effects.[17] Available sectoral data are monthly and cover the period 1996-2008.

The structure of the Turkish economy has changed considerably after 2002, signifying higher real exchange rate appreciation and higher export growth. Our study will analyze the data pre and post-structural break in 2002. Of particular interest is to detect the effect of the higher appreciation in the latter period on sectoral export growth. For that purpose, the data will be comprehensive, covering all exporting sectors, according to the breakdown in BEC classification.

Empirical results

The paper studies the effects of exchange rate fluctuations on the export sector in Turkey over two sample periods (1996-2002) and (2003-2008). The beginning of the first period

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[16] Unanticipated currency appreciation may be the result of unanticipated shock that moves the exchange rate relative to its expected value. Alternatively, unanticipated appreciation may be consistent with an overvalued currency compared to agents' expectations that have adjusted downward in view of underlying macroeconomic fundamentals.

[17] For related references, see Kandil (2000), Kandil and Mirzaie (2002) and Kandil, Berument and Dincer (2007).

marks the date of Turkey's integration to EU Customs Union, triggering a change in export profile. Further, the 2001 crisis forced a series of structural reforms, starting in 2002.

Sample Period: 1996-2002

Table 1 summarizes performance of exports in the early sample period. Seasonal dummies are jointly significant and negative in five sectors, implying a seasonal slowdown of export growth in the first three quarters of the year, relative to an increase in the last quarter.

Fluctuations in exports appear to be random for the most part. This is evident by the cumulative negative significant response of exports to its lag in twenty sectors, implying fast reversal in cyclical fluctuations.

Monetary growth is expected to revive economic conditions and stimulate competitiveness. Exports may improve on account of higher growth. In support of this evidence is the significant increase in export growth in three sectors, contributing 80% of total exports. On the other hand, the inflationary effect of monetary growth could be detrimental to export competitiveness. Accordingly, monetary growth has a cumulative negative effect, shrinking export growth in two sectors, accounting for a small share; 5% of total exports. *Clearly, the stimulus effect of monetary growth dominated export growth in the earlier period.*

Government spending is likely to stimulate growth, which could be beneficial to export industries. Three sectors exhibit a cumulative positive response to the growth of government spending for a share that equals 31% of total exports. Failure to stimulate growth would accelerate price inflation in the face of higher growth of government spending, adversely affecting competitiveness and export growth. In support of this channel is the negative cumulative response of export growth to higher growth of government spending in three sectors, accounting for 47% of total exports. *Clearly, the adverse effect of government spending dominated export growth in the earlier period.*

Export performance in Turkey appears to be primarily driven by economic conditions in major trading partners. Higher growth in major destinations stimulates export growth in eleven sectors. *Accordingly, growth in trading partners stimulates growth of total exports and the growth of exports of intermediate and consumption goods.*

Export competitiveness is highly dependent on exchange rate fluctuations in Turkey. Anticipated appreciation in the equilibrium exchange rate results in contraction of exports, as evident by the cumulative negative and significant response in nine sectors, accounting for 25% of total exports. There is no evidence of significant increase in export growth in the face of anticipated exchange rate appreciation in any sector, ruling out an increase in the supply of tradables on account of anticipated lower cost of imported inputs.

The evidence remains robust with respect to short-term fluctuations (random overvaluation) in the exchange rate. Unanticipated currency appreciation has a negative significant cumulative effect on export growth in three sectors, accounting for 9% of total exports. Faced with deteriorating competitiveness, producers shrink export growth. Consistent with the effect of unanticipated currency appreciation in reducing the cost of the output supplied, there is evidence of a significant increase in export growth of intermediate and consumption goods, accounting for a share that equals 93% of total exports[18]. *Clearly, the supply-side channel was dominant in the face of currency appreciation in the earlier period. Accordingly, the net effect of currency appreciation was positive, facilitating output expansion and export growth on account of lower cost of imported inputs.*

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[18] The sum of the sectoral share is more than 100, because we have the effect on the aggregated sectors in some of our analyses.

Unexpected depreciation (random undervaluation of the exchange rate) could stimulate export growth via improved competitiveness. The cumulative significant negative response supports these predictions in four sectors. Moreover, *the stimulating effect of unexpected depreciation is evident by the negative significant sign in explaining total export growth. There is no evidence of significant reduction in export growth (supply-side effect) with respect to unanticipated depreciation and higher cost of imported intermediate inputs.*

Overall, the evidence supports the significance of exchange rate policy to export growth in Turkey in the period 1996-2002. *The significant response is predominantly positive (higher capacity to produce tradables) in the face of currency appreciation, and predominantly negative (higher demand for exports) in the face of currency depreciation.* To formalize the asymmetric effects, Table 1 reports the difference between export response to positive and negative exchange rate shocks. This difference is positive and significant on total exports and exports of intermediate and consumption goods.

Clearly, export growth is dependent on exchange rate anticipation. *Anticipated appreciation deteriorates the outlook for competitiveness, forcing producers to revise plans for exports downward.* Transitory shocks, both appreciation and depreciation, could have significant bearing on competitiveness. *Asymmetry indicates, however, that the variability of the exchange rate had a net positive effect on export growth, benefiting from unexpected appreciation to expand supply and unexpected depreciation to capitalize on higher demand.*

Sample Period: 2002-2008

Seasonality is important for export sectors. The joint significance of the seasonal factors indicates reduction in export growth in the first three quarters of the year, compared to an increase in the last quarter.

The erratic movement in exports remains evident in the recent sample period. The cumulative response of export growth to its lag is negative and significant in seventeen sectors, signifying lack of persistence in cyclical fluctuations.

Monetary growth appears more detrimental to export growth in the recent period, compared to the earlier sample period. Higher monetary growth has a significant negative cumulative effect on export growth in five sectors. Moreover, the significant negative response is evident for total exports and exports of capital goods. *The inflationary effect of higher monetary growth decreases competitiveness and, therefore, exports growth.*

An increase in government spending may stimulate export growth. Similar to 1996-2002, the significant cumulative positive response to an increase in government spending is limited to two sectors, accounting for 35% of total exports. *To the extent that government spending is conducive to growth, its effect remains limited across exporting sectors of the Turkish economy.* Further, the adverse significant effect of government spending is evident in one sector, accounting for 9% of total exports.

The evidence remains robust regarding the positive effect of growth in major trading partners on export growth. The significant positive cumulative response is evident in nine sectors, totaling 75% of exports. *The evidence highlights the role of exogenous shocks to economic conditions in Turkey.* The significant spillover effect is robust in the estimated model for total exports.

The adverse effect of exchange rate appreciation on competitiveness and export growth remains pervasive across sectors. An anticipated appreciation of the equilibrium exchange rate has a negative cumulative effect on export growth in nine sectors, accounting for 68% of total exports. Consistent with the earlier sample period, there is no evidence of expansion in output growth (supply-side effect) in the face of anticipated appreciation. Moreover,

anticipated appreciation has a significant negative effect on the growth of total exports and exports of capital and consumer goods.

Significant adjustment in export growth during 2003-08 is evident with respect to unanticipated movements (random misalignments) in the exchange rate. *The adverse effect on competitiveness is pervasive in the face of unanticipated exchange rate appreciation (overvaluation)*; the cumulative negative response is evident and significant on the growth of exports of capital, intermediate, and consumption goods, accounting for 99.5% of total exports. In contrast to the earlier sample period, the increase in export growth in response to unanticipated currency depreciation is limited to one sector, accounting for a small share, 6%, of total exports. *Failure to capitalize on the benefits of unanticipated currency depreciation in the later period signifies increased competitiveness in a more integrated global environment.*

The supply-side channel appears more operative in the face of unanticipated currency depreciation during 2003-08. In support of this channel is the positive and significant cumulative response to negative shocks (undervaluation of the exchange rate) in five sectors, accounting for a share of 23% of total exports, *implying reduction in export growth forced by the higher cost of imported inputs.*

Consistent with the earlier sample period, export growth is dependent on anticipation of the equilibrium exchange rate that guides planned exports, building on key competitiveness indicators. In contrast to the earlier sample period, asymmetry spells out more pervasive response in the face of unanticipated currency appreciation, relative to depreciation. *The significant response is predominantly negative (lower demand for exports) in the face of currency appreciation and predominantly positive (lower capacity to produce tradables) in the face of currency depreciation.* To formalize asymmetric effects, Table 2 reports the difference between the response of sectoral export growth to positive and negative shocks. This difference is negative and significant in five sectors and for the aggregate measures of total exports and the exports of consumption goods.

As the world has witnessed a surge in trade liberalization, exporting sectors in Turkey are faced with higher competition during the 2003-08 period and exchange rate adjustments have become more relevant. *A sudden appreciation could worsen competitiveness with pronounced adverse effects on export growth.* In contrast, *depreciation may not boost growth, absent other criteria for quality and market access that are necessary to reinforce competitiveness.*

Summary and Conclusion

The analysis has focused on the effects of exchange rate fluctuations using monthly data for export sectors in Turkey between 1996 and 2008. To that end, the empirical investigation builds on detailed implications in a theoretical rational-expectation model that decomposes movements in the exchange rate into anticipated equilibrium and unanticipated deviations that represent random misalignments.

The exchange rate is the real price of the domestic currency in terms of a weighted average of the currencies of major trading partners. A positive shock to the exchange rate, an unanticipated appreciation (overvaluation) of the domestic currency, decreases net exports and increases the output supplied. Based on the relative strengths of each channel, *the combined effects of demand and supply channels may determine the direction of export adjustments in the face of currency fluctuations.*

In addition to fluctuations in the exchange rate, the empirical model accounts for the growth of government spending, the growth of the money supply, growth in major destinations for

Turkish exports, and a number of dummy variables for structural break. The dependent variables under investigation are sectoral exports in two different samples of 1996:01-2002:12 and 2003:1-2008:5. Estimation results across separate samples untangle the effects of the structural break in 2002 on export growth and underlying determinants.

The analysis employs sectoral data that comprise exporting sectors for capital, intermediate and consumption goods. The performance of export growth indicates vulnerability to domestic and external shocks. *Monetary growth stimulated export growth in the earlier period. In contrast, money growth, via the inflationary channel, proved to be detrimental to export growth post-2002. The adverse effects of government spending on export growth were more pronounced in the earlier sample period, reflecting persistent drive for fiscal consolidation over time.*

Nonetheless, the dominant effects on export growth in Turkey are external. Growth in importing countries is a key determinant of sectoral export growth. Additionally, the export sector in Turkey is highly dependent on competitiveness and developments in the exchange rate are a key determinant of growth performance. *Agents' expectation of developments in the equilibrium exchange rate is a major determinant of competitiveness and export growth. In general, anticipated appreciation of equilibrium exchange rate shrinks export growth, as the outlook for competitiveness gets bleak. The effect of anticipated movement in the equilibrium exchange rate dominates the effects of transitory misalignments on export growth, signifying the role of expectations in guiding production plans.*

Random fluctuations around the equilibrium exchange rate produce asymmetric results on sectoral export growth in Turkey. *The degree and direction of asymmetry have varied over time.* Specifically, *the adverse effects of unexpected currency appreciation (overvaluation) are more pervasive in the later period, 2002-2008*, compared to the earlier sample period, 1996-2002. *The evidence indicates increased competitiveness in the face of a higher degree of trade liberalization* post-2002 and, therefore, more sensitivity of export demand to currency appreciation over time. In contrast, *the effects of unexpected currency depreciation in stimulating export growth has lost momentum over time, indicating more challenge to boost competitiveness via exchange rate undervaluation, absent complementary measures* to improve quality and market access. Given recent asymmetric effects post-2002, *high variability of the exchange rate, around its equilibrium, is likely to produce net negative contribution decreasing export growth in various sectors of the Turkish economy.*

The significance of exports to real growth in Turkey may warrant policy intervention. While adhering to a flexible exchange rate policy to boost competitiveness, *managing fundamentals underlying equilibrium exchange rate to reduce excessive volatility impinging on the economic system over time should top the policy agenda.* Domestic policies should be geared to anchoring agents' expectations of the equilibrium exchange rate in line with the underlying fundamentals and countering the adverse effects of random misalignments.

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Figure 1: Contribution of Exports to Growth*
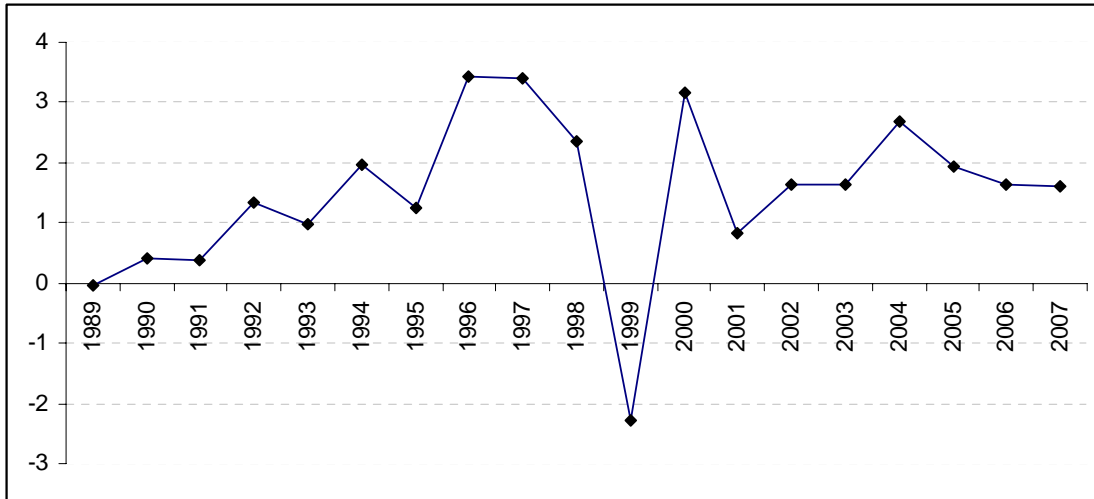
* Exports of goods and services relative to GDP in 1987 prices

Table 1: Asymmetric Effects of Unexpected Exchange Rate Fluctuations on Sectors of Exports for 1996-2002 sample period

	Const.	Seas.	X_i	M2y	G	y*	Erer	Posr	Negr	R^2	Diff.	# obs
X-General	0.07	-0.20	-1.83*	-0.07	-0.28	1.24*	-0.54	0.71	-0.87*	0.79	1.58*	60
	(0.69)	(0.72)	(0.00)	(0.90)	(0.73)	(0.03)	(0.42)	(0.33)	(0.01)		(0.03)	
#lags			4	3	8	0	0	0	0			
Redun. Var.	0.69	0.83	0.00	0.04	0.18	0.03	0.42	0.33	0.01			
X₁-Capital Goods	0.32*	-0.51*	-3.31*	-2.21	0.09	0.36	-3.30*	-2.12	-0.11	0.65	-2.01	71
	(0.04)	(0.03)	(0.05)	(0.37)	(0.38)	(0.24)	(0.08)	(0.31)	(0.95)		(0.47)	
#lags			12	0	1	0	1	0	0			
Redun. Var.	0.04	0.14	0.00	0.37	0.59	0.24	0.09	0.31	0.95			
X₁₁-Capital Goods	0.05	0.22	-0.98*	-1.59	0.45	2.44*	-1.32	-3.61	-0.93	0.69	-2.68	70
Except Transportation Vehicles	(0.72)	(0.36)	(0.09)	(0.48)	(0.30)	(0.00)	(0.41)	(0.19)	(0.41)		(0.27)	
#lags			8	2	2	1	0	1	0			
Redun.Var.	0.72	0.90	0.00	0.18	0.77	0.02	0.41	0.34	0.41			
X₁₂-Transportation Vehicle	0.17	0.26	-1.87*	-5.22	3.56*	1.05*	-5.85*	-5.41	-0.42	0.61	-4.99	66
Incidental to Industry	(0.62)	(0.79)	(0.00)	(0.14)	(0.09)	(0.03)	(0.04)	(0.10)	(0.88)		(0.29)	
#lags			4	0	4	0	1	0	0			
Redun. Var.	0.62	0.00	0.00	0.14	0.18	0.03	0.13	0.10	0.88			
X₂-Intermediate Goods	0.07	-0.48*	-2.56*	1.57	-0.88*	0.32*	-0.31	4.18*	-0.04	0.72	4.14*	71
	(0.38)	(0.05)	(0.00)	(0.22)	(0.09)	(0.08)	(0.80)	(0.04)	(0.95)		(0.02)	
#lags			5	3	5	0	1	2	0			
Redun.Var.	0.38	0.03	0.00	0.79	0.19	0.08	0.19	0.08	0.95			
	Const.	Seas.	X_i	M2y	g	y*	Erer	Posr	Negr	R^2	Diff.	#obs
X₂₁-Unprocessed Materials	0.07	0.39	-1.89*	-5.01*	1.85	0.51	-3.20*	-3.07	-0.58	0.19	-2.49	71
Incidental to Industry	(0.80)	(0.64)	(0.01)	(0.09)	(0.42)	(0.73)	(0.09)	(0.19)	(0.82)		(0.45)	
#lags			6	0	3	2	0	0	0			
Redun.Var.	0.80	0.62	0.07	0.09	0.69	0.77	0.09	0.19	0.82			
X₂₂-Processed Materials	0.05	-0.63*	-2.77*	3.45*	-1.43*	0.73*	-0.58	5.18*	0.48	0.74	4.70*	70

	Const.	seas.	X_i	M2y	g	y*	Erer	Posr	Negr	R^2	Diff.	#obs
Incidental to Industry	(0.61)	(0.01)	(0.00)	(0.00)	(0.01)	(0.00)	(0.47)	(0.00)	(0.38)		(0.00)	
#lags			5	2	4	2	1	2	0			
Redun.Var.	0.61	0.07	0.00	0.07	0.01	0.36	0.05	0.01	0.38			
X_{24}-Parts of Investment Goods	-0.22	0.86*	-0.51*	-1.16	1.47	0.26*	-1.05	3.84	0.44	0.62	3.40	70
	(0.22)	(0.07)	(0.00)	(0.68)	(0.17)	(0.07)	(0.55)	(0.37)	(0.63)		(0.39)	
#lags			1	3	3	0	0	5	0			
Redun.Var.	0.22	0.11	0.00	0.73	0.46	0.07	0.55	0.11	0.63			
X_{25}-Parts of Investment M.	2.25*	-8.98*	-1.60*	-1.26	1.61	0.28	-2.79*	1.46	-1.03	0.65	2.49	69
	(0.00)	(0.00)	(0.00)	(0.49)	(0.55)	(0.57)	(0.03)	(0.28)	(0.26)		(0.10)	
#lags			4	0	12	0	1	0	0			
Redun.Var.	0.00	0.00	0.00	0.49	0.01	0.57	0.06	0.28	0.26			
X_{26}-Unprocessed Materials Of Foods and Beverages	-1.92 (0.24)	8.78 (0.12)	-1.87* (0.01)	-18.92* (0.03)	6.90 (0.11)	93.50* (0.01)	-11.29* (0.07)	-6.95 (0.21)	-15.79 (0.04)*	0.43	8.84 (0.36)	69
#lags			7	0	2	9	0	0	3			
Redun. Var.	0.24	0.09	0.13	0.03	0.09	0.04	0.07	0.21	0.31			
X_{27}-Processed Materials Of Foods and Beverages	-0.53 (0.44)	2.20 (0.39)	-1.08* (0.00)	-1.34 (0.62)	1.26 (0.49)	2.05* (0.08)	-7.81 (0.12)	-4.08* (0.07)	-4.48 (0.14)	0.74	0.40 (0.84)	69
#lags			3	0	12	1	2	0	9			
Redun.Var.	0.44	0.09	0.00	0.62	0.02	0.02	0.09	0.07	0.16			
X_{28}-Processed Fuels and Oils	0.59*	-1.02	-0.74*	-4.35	0.01	0.48	-3.87*	0.62	8.90	0.57	-8.28	60
	(0.04)	(0.13)	(0.00)	(0.29)	(0.90)	(0.81)	(0.07)	(0.88)	(0.11)		(0.26)	
#lags			2	0	0	1	0	0	2			
Redun. Var.	0.04	0.37	0.00	0.29	0.90	0.63	0.07	0.88	0.08			
	Const.	**seas.**	**X_i**	**M2y**	**g**	**y***	**Erer**	**Posr**	**Negr**	**R^2**	**Diff.**	**#obs**
X_3-Consumption Goods	-0.18	0.33	-2.89*	1.15*	0.73	1.37*	-0.14	3.38*	-0.84	0.75	4.22*	64
	(0.24)	(0.50)	(0.00)	(0.05)	(0.329	(0.00)	(0.83)	(0.00)	(0.17)		(0.00)	
#lags			6	3	7	1	0	2	0			
Redun. Var.	0.24	0.68	0.00	0.26	0.08	0.02	0.83	0.15	0.17			
X_{31}-Automobiles	0.31	0.73	-2.17*	-7.12	0.01	5.99	-5.40*	-6.57*	-1.04	0.30	-5.53	70
	(0.31)	(0.49)	(0.01)	(0.21)	(0.95)	(0.36)	(0.06)	(0.06)	(0.71)		(0.26)	
#lags			7	1	0	3	0	0	0			
Redun. Var.	0.31	0.65	0.02	0.39	0.95	0.48	0.06	0.08	0.71			

	Const.	seas.	X_i	M2y	g	y*	Erer	Posr	Negr	R^2	Diff.	#obs
X$_{32}$-Resistant Consumption	-0.41	1.29	-2.53*	0.78	1.68	0.24	-2.22*	3.39	-1.44*	0.79	4.83	70
	(0.19)	(0.21)	(0.03)	(0.60)	(0.35)	(0.49)	(0.08)	(0.30)	(0.09)		(0.10)	
#lags			11	2	6	0	0	5	0			
Redun. Var.	0.19	0.03	0.00	0.22	0.11	0.49	0.08	0.48	0.09			
X$_{33}$-Semiresistant Consumption	-0.58*	2.18*	-2.07*	-1.42	1.99*	2.53*	-0.60	0.25	-1.98*	0.78	2.23	70
	(0.03)	(0.02)	(0.00)	(0.20)	(0.05)	(0.09)	(0.45)	(0.77)	(0.02)		(0.11)	
#lags			9	0	10	1	0	0	0			
Redun. Var.	0.03	0.02	0.00	0.20	0.01	0.27	0.45	0.77	0.02			
X$_{34}$-Non-resistant Consumption	-0.00	0.11	-0.69*	-0.46	0.00	0.08	-0.57	-0.14	-0.98*	0.56	0.84	64
	(0.97)	(0.13)	(0.00)	(0.68)	(0.84)	(0.58)	(0.38)	(0.90)	(0.06)		(0.53)	
#lags			0	2	0	0	0	0	0			
Redun. Var.	0.97	0.00	0.00	0.63	0.84	0.58	0.38	0.90	0.06			
	Const.	**seas.**	**X_i**	**M2y**	**g**	**y***	**Erer**	**Posr**	**Negr**	**R^2**	**Diff.**	**#obs**
X$_{35}$-Unprocessed of Food & Beverages	-0.50	2.01	-1.32*	-3.29	4.35*	3.18*	-4.37	-8.41*	-5.65*	0.91	-2.76	68
	(0.42)	(0.35)	(0.00)	(0.11)	(0.05)	(0.07)	(0.13)	(0.04)	(0.06)		(0.37)	
#lags			3	4	9	0	5	7	0			
Redun. Var.	0.42	0.56	0.03	0.21	0.00	0.07	0.15	0.13	0.06			
X$_{36}$-Processed of Food & Beverages	0.34*	-1.14*	-1.81*	0.97*	-2.51*	0.87	-1.04	-0.00	-0.73	0.69	0.73	68
	(0.00)	(0.00)	(0.00)	(0.02)	(0.01)	(0.00)	(0.96)	(0.99)	(0.32)		(0.64)	
#lags			5	3	4	2	0	0	0			
Redun. Var.	0.00	0.00	0.00	0.08	0.04	0.00	0.96	0.99	0.32			

Note: The methodology used in the analysis is TSLS. The coefficients for various export sectors are the sum of the coefficients of the lags, which are determined by the FPE criteria, and the current values of the explanatory variables. The figures in the parentheses are the probabilities of the cumulative significance tests and * denotes significance at 10 % level. In the #lags row, 0 stands for the current value of the variable. Redundant variable test is for determining the joint significance of the explanatory variables and their lags. Symmetry test is the Wald test for the equality of rer+ and rer-. Diff. is the difference between positive and negative unanticipated shocks.

Table 2: Asymmetric Effects of Unexpected Exchange Rate Fluctuations on Sectors of Exports for 2003-2008 sample period

	Const.	Season.	X_i	M2y	G	y*	Erer	Posr	Negr	R^2	Diff.	#obs
X-General	0.26*	-0.33*	-6.48*	-3.81*	0.12	0.39*	-1.96*	-3.21	2.91	0.94	-6.12*	50
	(0.00)	(0.00)	(0.00)	(0.06)	(0.16)	(0.08)	(0.00)	(0.10)	(0.18)		(0.04)	
#lags			8	4	2	0	1	1	4			
Redun. Var.	0.00	0.00	0.00	0.14	0.40	0.08	0.02	0.19	0.06			
X_1-Capital Goods	0.41*	-0.63*	-1.25*	-9.03*	-0.03	0.58	-3.75*	-6.07*	2.00	0.79	-8.07	51
	(0.00)	(0.00)	(0.00)	(0.05)	(0.94)	(0.86)	(0.03)	(0.09)	(0.68)		(0.19)	
#lags	--	--	2	1	9	0	0	0	4			
Redun. Var.	0.00	0.01	0.00	0.14	0.02	0.86	0.03	0.09	0.09			
X_{11}-Capital Goods Except Transportation Vehicles	0.11*	-0.00	-2.61*	-4.03*	0.36	4.41*	-1.66*	2.94	2.27	0.92	0.67	48
	(0.00)	(0.97)	(0.00)	(0.09)	(0.41)	(0.05)	(0.05)	(0.47)	(0.67)		(0.92)	
#lags			4	0	3	0	0	9	4			
Redun.Var.	0.00	0.03	0.00	0.09	0.02	0.05	0.05	0.09	0.25			
X_{12}-Transportation Vehicle Incidental to Industry	0.34*	-0.75*	-2.35*	-6.28*	0.86	3.38	-2.35*	-5.12	-5.11	0.80	-0.01	46
	(0.00)	(0.03)	(0.00)	(0.03)	(0.66)	(0.88)	(0.06)	(0.28)	(0.16)		(0.99)	
#lags			5	0	9	3	0	0	0			
Redun. Var.	0.00	0.01	0.00	0.03	0.25	0.75	0.06	0.28	0.16			
X_2-Intermediate Goods	0.09	0.01	-3.86*	-0.75	0.10	0.52	-0.87	-3.95*	-1.54	0.85	-2.41	49
	(0.33)	(0.30)	(0.00)	(0.82)	(0.36)	(0.79)	(0.67)	(0.06)	(0.47)		(0.42)	
#lags			5	6	0	0	6	0	0			
Redun.Var.	0.33	0.30	0.01	0.62	0.36	0.79	0.24	0.06	0.47			
	Const.	season.	X_i	M2y	g	y*	Erer	Posr	Negr	R^2	Diff.	#obs
X_{21}-Unprocessed Materials Incidental to Industry	0.00	-0.30	-1.18*	4.26	0.47	1.19*	-1.05	-4.80	-6.31	0.90	1.51	47
	(0.97)	(0.18)	(0.00)	(0.22)	(0.51)	(0.08)	(0.44)	(0.31)	(0.45)		(0.86)	
#lags			2	0	7	0	6	2	6			
Redun.Var.	0.97	0.28	0.00	0.22	0.17	0.08	0.17	0.49	0.07			
X_{22}-Processed Materials Incidental to Industry	0.01	0.20*	-1.73*	-1.89	0.18*	0.64*	-0.97	-3.32*	-2.51	0.88	-0.81	49
	(0.88)	(0.02)	(0.01)	(0.57)	(0.04)	(0.03)	(0.29)	(0.08)	(0.43)		(0.79)	
#lags			5	6	0	0	1	0	5			
Redun.Var.	0.88	0.10	0.17	0.08	0.04	0.03	0.51	0.08	0.17			

	constant	Season.	X_i	M2y	g	y*	Erer	Posr	Negr	R^2	Diff.	#Obs.
X₂₄-Parts of Investment Goods	0.27*	-0.08	-3.54*	-4.97*	-0.07	6.84	-2.14*	-2.29	13.89*	0.89	-16.18*	48
	(0.00)	(0.45)	(0.00)	(0.08)	(0.90)	(0.32)	(0.08)	(0.30)	(0.00)		(0.00)	
#lags			4	1	3	3	1	1	6			
Redun.Var.	0.00	0.43	0.00	0.12	0.90	0.30	0.04	0.50	0.29			
X₂₅-Parts of Investment M.	0.11*	-0.10	-2.53*	-1.58	0.14	0.58*	-1.29*	-0.40	2.85	0.83	-3.25	50
	(0.07)	(0.39)	(0.00)	(0.55)	(0.24)	(0.01)	(0.06)	(0.84)	(0.17)		(0.23)	
#lags			5	1	1	0	0	0	3			
Redun.Var.	0.07	0.37	0.00	0.59	0.08	0.01	0.06	0.84	0.35			
X₂₇-Processed Materials Of Foods and Beverages	0.29	-0.31	0.02	-6.85	0.73	1.55*	-3.92*	-5.84	9.82	0.72	-15.66	46
	(0.12)	(0.11)	(0.94)	(0.22)	(0.17)	(0.03)	(0.08)	(0.80)	(0.14)		(0.45)	
#lags			1	2	2	0	0	5	6			
Redun.Var.	0.12	0.28	0.94	0.43	0.12	0.03	0.08	0.07	0.52			
X₂₈-Processed Fuels and Oils	0.29	-0.13	-2.44*	1.07	-0.07	0.29	-3.48*	-0.56	27.56*	0.61	-28.12*	51
	(0.19)	(0.78)	(0.00)	(0.88)	(0.75)	(0.67)	(0.07)	(0.94)	(0.01)		(0.06)	
#lags			5	0	0	0	0	2	6			
Redun. Var.	0.19	0.98	0.03	0.88	0.75	0.67	0.07	0.87	0.58			
	constant	Season.	X_i	M2y	g	y*	Erer	Posr	Negr	R^2	Diff.	#Obs.
X₃-Consumption Goods	0.41*	-0.77*	-6.85*	-4.95	-0.05	0.07	-3.77*	-4.64*	5.16	0.93	-9.80*	46
	(0.00)	(0.00)	(0.00)	(0.12)	(0.59)	(0.99)	(0.02)	(0.06)	(0.12)		(0.03)	
#lags			6	4	0	5	4	0	4			
Redun. Var.	0.00	0.00	0.00	0.51	0.59	0.85	0.15	0.06	0.74			
X₃₁-Automobiles	-0.72*	0.36	-3.05*	18.03	0.83*	30.42*	-0.18	6.87	-37.91*	0.95	44.78*	45
	(0.05)	(0.30)	(0.00)	(0.13)	(0.06)	(0.02)	(0.95)	(0.65)	(0.00)		(0.04)	
#lags			4	6	0	1	4	6	4			
Redun. Var.	0.05	0.00	0.00	0.27	0.06	0.05	0.09	0.69	0.07			
X₃₂-Resistant Consumption	0.38*	-1.19*	-3.33*	0.11	-0.59*	1.37*	-0.25	-0.80	8.60*	0.94	-9.40*	49
	(0.00)	(0.00)	(0.00)	(0.97)	(0.01)	(0.00)	(0.89)	(0.70)	(0.01)		(0.01)	
#lags			5	0	3	0	0	0	4			
Redun. Var.	0.00	0.00	0.00	0.97	0.00	0.00	0.89	0.70	0.02			
X₃₃-Semiresistant Consumption	0.07	0.04	-1.71	-2.33	0.08	0.48*	-1.60	-1.46	3.77	0.96	-5.23	43
	(0.51)	(0.84)	(0.17)	(0.45)	(0.64)	(0.08)	(0.14)	(0.43)	(0.33)		(0.22)	
#lags			8	6	1	0	1	0	5			
Redun. Var.	0.51	0.00	0.01	0.13	0.07	0.08	0.23	0.43	0.16			

X34-Non-resistant Consumption	0.17	-1.60	-1.06*	-7.20*	0.21	1.12	-1.62*	-0.05	12.09*	0.93	-12.14*	42
	(0.08)	(0.27)	(0.00)	(0.09)	(0.28)	(0.75)	(0.05)	(0.98)	(0.08)		(0.03)	
#lags			3	7	1	6	0	0	5			
Redun. Var.	0.08	0.59	0.09	0.19	0.05	0.46	0.05	0.98	0.16			

	Const.	**Season.**	**X_i**	**M2y**	**g**	**y***	**Erer**	**Posr**	**Negr**	**R^2**	**Diff.**	**#obs**
X_{35}-Unprocessed of Food & Beverages	0.50*	-1.05	-1.75*	-10.73	-0.71	2.19	-4.45*	-8.76*	-2.36	0.64	-6.40	52
	(0.03)	(0.11)	(0.03)	(0.66)	(0.23)	(0.66)	(0.06)	(0.09)	(0.50)		(0.26)	
#lags			4	0	8	0	1	0	0			
Redun. Var.	0.03	0.04	0.01	0.66	0.01	0.66	0.40	0.09	0.50			
X_{36}-Processed of Food & Beverages	0.25*	-0.65*	-2.83*	-0.44	0.09	0.68*	-0.94	-0.53	9.72*	0.97	-10.25*	43
	(0.02)	(0.00)	(0.00)	(0.87)	(0.26)	(0.08)	(0.16)	(0.68)	(0.00)		(0.00)	
#lags			5	9	0	0	2	0	7			
Redun. Var.	0.02	0.00	0.02	0.08	0.26	0.08	0.08	0.68	0.07			

Note: The methodology used in the analysis is TSLS. The coefficients for various export sectors are the sum of the coefficients of the lags, which are determined by the FPE criteria, and the current values of the explanatory variables. The figures in the parentheses are the probabilities of the cumulative significance tests and * denotes significance at 10 % level. In the #lags row, 0 stands for the current value of the variable. Redundant variable test is for determining the joint significance of the explanatory variables and their lags. Symmetry test is the Wald test for the equality of rer+ and rer-. Diff. is the difference between positive and negative unanticipated shocks.

Appendix A: Data Description and Sources

The analysis is based on monthly data and covers two separate periods: 1996-2002 and 2003-2008. The first period marks Turkey's integration to EU Customs Union and subsequent changes in export profile. After the serious crisis in 2001, the recovery period witnessed major structural changes, building on a series of major reforms introduced in 2002.[1].

The real effective exchange rate is the trade-weighted real exchange rate from the Central Bank of Republic of Turkey (CBRT). Money is represented by M2Y. Government expenditures cover total public expenditures. Openness is the sum of exports and imports, as a share of GDP. International reserves are the reserves of the CBRT in million of dollars. All data are taken from the database of the CBRT.

Exports data are announced by the Turkish Statistical Institute. The first data set, 1996-2002, analyzes the export volume series (1994=100) in BEC classification. For the second period, 2002-2008, the export volume series (2003=100) is used. In Table A1, details of sector classification are presented.

The weighted average of GDP in major trading partners represents foreign demand. However, GDP data are not available monthly. For the sample period 1996-2002, foreign demand is approximated by world import demand, available from IMF-IFS database. In the sample period, 2003-2008, the Euro Area has become the main export partner of Turkey. The production index of EU, available from ECB website, approximates foreign demand in the later period.

1A new series of exports, reflecting changes in definition were introduced in 2003. Therefore, the later sample period starts in 2003

Table A1: Explanation of the Sectors of Exports

General	X
Capital Goods	**X1**
Capital Goods (Except Transportation Vehicles)	X11
Transportation Vehicles Incidental to Industry	X12
Intermediate Goods	**X2**
Unprocessed Materials Incidental to Industry	X21
Processed Materials Incidental to Industry	X22
Unprocessed Fuel and Oils	X23
Parts of Investment Goods	X24
Parts of Transportation Vehicles	X25
Unprocessed Materials of Food and Beverages	X26
Processed Materials of Food and Beverages	X27
Processed Fuel and Oils	X28
Consumption Goods	**X3**
Automobiles	X31
Resistant Consumption Goods	X32
Semi-resistant Consumption Goods	X33
Non-resistant Consumption Goods	X34
Unprocessed of Food and Beverages	X35
Processed of Food and Beverages	X36
Gasoline	X37
Others	**X38**

Note: The instruments variables for estimation include world import prices, taken from IMF-IFS database, and interest rate spread (difference between interbank interest rate of Turkey and LIBOR).

Appendix B

Table B1. Weights of Export Sectors in Total Exports (BEC)

Export Sectors (BEC)	Codes	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1996-2002	2003-2007
TOTAL	**x**	100	100	100	100	100	100	100	100	100	100	100	100	100	100
CAPITAL GOODS	**x1**	4.82	5.05	5.23	6.76	7.83	8.48	7.74	9.19	10.34	10.88	11.02	12.82	6.56	10.85
Capital goods (Except transportations vehicles)	x11	2.91	2.92	3.20	3.22	3.67	3.89	3.71	4.11	4.36	4.64	4.77	5.22	3.36	4.62
Transportation vehicles incidental to industry	x12	1.91	2.14	2.03	3.53	4.16	4.59	4.03	5.08	5.98	6.25	6.24	7.60	3.20	6.23
INTERMEDIATE GOODS	**x2**	42.05	42.07	41.46	40.77	41.64	42.66	40.65	39.14	41.07	41.22	44.18	46.05	41.62	42.33
Unprocessed materials incidental to industry	x21	5.28	4.68	4.28	4.34	3.61	3.00	2.63	2.54	2.34	2.33	2.65	2.61	3.98	2.49
Processed materials incidental to industry	x22	28.88	29.38	27.86	27.54	28.98	30.30	29.05	27.26	29.54	28.14	30.05	30.48	28.85	29.09
Unprocessed fuels and oils	x23	0.00	0.00	0.01	0.02	0.02	0.02	0.01	0.01	0.00	0.02	0.00	0.01	0.01	0.01
Parts of investment goods	x24	1.65	1.58	2.09	1.95	2.07	2.08	2.02	2.06	2.15	2.36	2.61	2.95	1.92	2.43
Parts of transportation vehicles	x25	2.94	3.01	3.70	3.81	4.35	4.97	4.99	5.19	4.90	5.08	5.33	5.74	3.97	5.25
Unprocessed materials of food and beverages	x26	0.65	0.78	1.41	0.98	0.93	0.78	0.39	0.25	0.12	0.25	0.33	0.17	0.84	0.22
Processed materials of food and beverages	x27	1.69	2.05	1.34	0.95	0.89	0.65	0.66	0.74	0.75	1.00	0.76	0.79	1.18	0.81
Processed fuels and oils	x28	0.95	0.60	0.77	1.19	0.78	0.87	0.90	1.09	1.27	2.05	2.43	3.29	0.87	2.03
CONSUMPTION GOODS	**x3**	53.04	52.78	53.26	52.25	50.36	48.71	51.21	51.06	48.29	47.41	44.18	40.73	51.66	46.33
Automobiles	x31	1.16	0.45	0.52	2.59	2.26	3.10	3.60	4.65	6.23	5.95	6.60	6.38	1.96	5.96
Resistant consumption goods	x32	4.10	4.89	6.37	6.57	7.40	7.01	9.08	9.21	9.50	9.40	8.87	7.98	6.49	8.99
Semi-resistant consumption goods	x33	23.35	22.66	23.15	20.36	20.65	19.01	20.01	18.71	15.57	14.03	12.28	11.60	21.31	14.44
Non-resistant consumption goods	x34	9.74	10.49	10.59	11.56	10.51	9.13	9.44	9.33	8.22	7.94	7.23	6.37	10.21	7.82
Unprocessed of food and beverages	x35	7.28	7.34	6.70	5.98	4.91	5.30	4.57	4.30	4.08	4.41	3.85	3.55	6.02	4.04
Processed of food and beverages	x36	7.09	6.69	5.65	5.06	4.16	4.52	3.40	3.76	3.57	3.99	3.47	3.25	5.23	3.61
Gasoline	x37	0.22	0.12	0.18	0.04	0.35	0.50	0.99	0.95	0.98	1.49	1.66	1.45	0.34	1.31
OTHERS	**x38**	0.08	0.09	0.06	0.22	0.17	0.15	0.41	0.61	0.30	0.48	0.62	0.39	0.17	0.48
Other goods not elsewhere specified	x38	0.08	0.09	0.06	0.22	0.17	0.15	0.41	0.61	0.30	0.48	0.62	0.39	0.17	0.48

Table B2. Real Exchange Rate Models [+]

Period	(1996:01-2002:12)	(2003:1-2008:5)
Constant	0.01	0.02*
	(1.62)	(2.21)
Seasonal Dummy$_1$	0.02	0.01
	(1.14)	(1.00)
Seasonal Dummy$_1$	-0.05*	-0.00
	(-3.76)	(-0.31)
Seasonal Dummy$_1$	-0.00	0.03*
	(-0.43)	(2.56)
Drs$_{t-1}$	0.48*	0.16
	(4.68)	(1.52)
Drs$_{t-2}$	-0.22*	-0.23*
	(-2.37)	(-2.25)
Dg$_{t-1}$	0.01*	--
	(1.76)	--
Dg$_{t-2}$	0.02*	--
	(2.05)	--
Dg$_{t-3}$	-0.01	--
	(-1.65)	--
Dg$_{t-4}$	-0.02*	--
	(-2.86)	--
Dopen$_{t-1}$	0.02	0.02
	(0.43)	(0.47)
Dopen$_{t-2}$	-0.09	0.03
	(-1.65)	(0.47)
Dopen$_{t-3}$	--	-0.06
	--	(-0.91)
Dopen$_{t-4}$	--	-0.20*
	--	(2.57)
Dopen$_{t-5}$	--	-0.21*
	--	(-3.08)
Dopen$_{t-6}$	--	-0.12*
	--	(-2.88)
Dir$_{t-1}$	--	-0.19*
	--	(-1.88)
D1	-0.16*	--
	(4.68)	--
D2	--	-0.12*
	--	(-6.09)
R^2	0.54	0.62

Notes: (+) Here, Drs$_t$ is the first-difference of the real exchange rate. The change in the government expenditures is denoted by Dg$_t$. The change in the sum of exports and imports to GDP, which is an indicator for openness, is denoted by Dopen$_t$. The change in the international Reserves is denoted by Dir$_t$. The dummy variables, d1 and d2 take 1 in February 2001, the crisis period for Turkey, and in June 2006, marking the international financial turbulence, respectively and 0 elsewhere