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CAUSAL RELATIONSHIP BETWEEN EXPORT EXPANSION AND ECONOMIC DEVELOPMENT IN TURKEY: AN EMPIRICAL INVESTIGATION

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Abstract: *The effect of export expansion on economic growth is examined through econometric analysis. The hypothesis that the relationship under the consideration is significantly affected by the level of development is tested. Our purpose is to reconsider the causality issue with the aid of co-integration and unit root tests for the periods of 1923-1969 and 1970-1992. Contrary to conventional macroeconomic analysis, this study implies that Gross Domestic Product (GDP) and Export expansion (EXP) of Turkey are not cointegrated, implying the lack of any long-run equilibrium relations and causality between two variables. Rest of the paper is organised as follows. Section 2 addresses a methodological procedures and alternative testing methods. Section 3 reports the empirical results and section 4, finally, concludes the paper and suggests possible directions for the future research.*

1. Introduction:

The importance of export expansion as a key factor is promoting economic growth has been much emphasised among the advocates of export oriented policies. According to this line of argument export expansion raises factor productivity and leads to economic growth by giving rise to various benefits, such as more efficient use of resources and adaptation of technological innovations, resulting from foreign competition, greater capacity utilisation and gains of scale effects associated with large international markets. A substantial relationship between export expansion and economic growth in terms of export expansion alone, thus ignoring the role of other important sources of growth.

A worrisome aspect of this procedure is that it may yield biases due to omitted variables and hence superiors correlations. An additional and related issue which has been addressed is whether there exist a certain threshold level of development below and above which the relationship between export expansion and economic growth differ. In this context some economists have concluded that «growth is affected by export performance development», a view which has also been adopted by Tyler (1981, p.124) who has argued that «a basic level of development is necessary for a country to most benefit from export oriented growth» Kovoussi (1984, p.249) in low income countries too export expansion tends to be associated with better economic performance, but that «the contribution of export to factor productivity is greater among the more advanced developing countries». Several economists claimed that export is the key factor during the process of economic development and export performance has direct and indirect impacts on the level of Gross Domestic Product GDP. Several studies proved that the existence relationship between GDP and export performance (EXP) for many developed and developing countries.

A radical reform package has been implemented in Turkey in the post 1980 era involving an export-oriented one, the Turkish economy exhibits a mixed record. Achievement in impressive growth in exports and resumption of the GDP growth are the areas for which the economic policies pursued in the past fourteen years should be, and frequently credited for. In more specific, the purpose of this research is to examine and evaluate the causal relationship between two variables, GDP and EXP, of Turkish economy.

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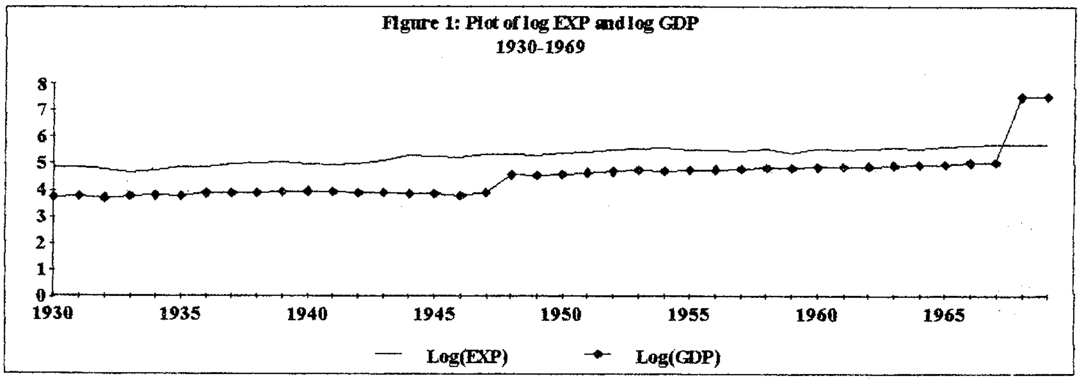
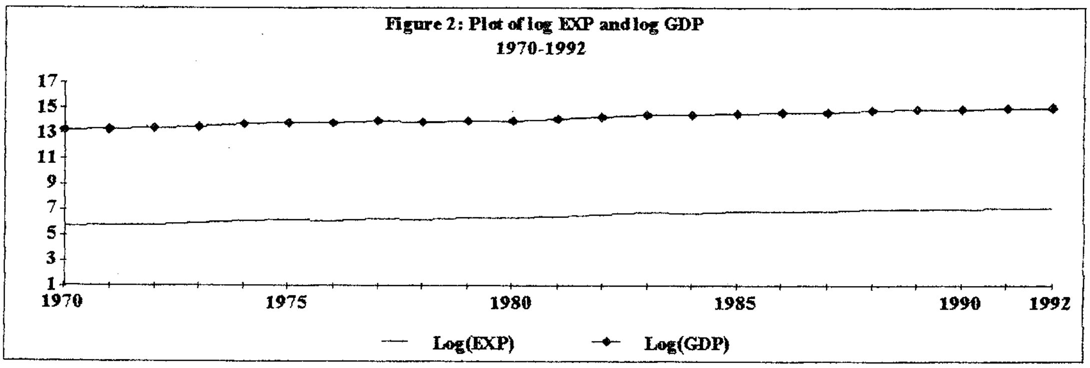
2. Framework of Analysis





From the figures 1 and 2 we can see the distributions of GDP and export over the periods of 1930-1969 and 1970-1992. In order to see how these two variables trade each other and converge for the related periods, recent statistical developments in the literature needs to be applied. The Engle and Granger (1987) co-integration technique is employed to establish the long-run relation between export and GDP. As a matter of fact Granger (1986, p.213) made reference to the variables which the co-integration technique could be applied. Section 2.1. outlines briefly Engle-Granger technique.

2.1. Co-integration and Unit Root Tests

Granger and Engle (1984) propose several tests for co-integration. We use two of the tests they suggest. All of these tests first involve estimating the so-called «*equilibrium regression*» of

$$X_t = c + bY_t + u_t \quad (1)$$

where a time series variable such as X_t is said to be integrated of order d if it achieves stationary after being differenced d times. This notion is usually denoted by $X_t \sim I(d)$. According to Granger and Engle (1986), and Granger (1987), two $I(d)$ variables are cointegrated if in the simple OLSQ regression of one on the other, the residuals (as a proxy for a linear combination) are integrated of any order less than *d*. For example, *if* $X_t \sim I(1)$ and $Y_t \sim I(1)$, in order for X_t and Y_t to be cointegrated, the residuals from OLSQ regression of X_t on Y_t or Y_t on X_t should be $I(0)$. In equation (1) X_t and Y_t are the series tested for co-integration, c is the estimated constant term, b the estimated co-integration factor, and u_t the estimated residuals.

The first and second test use Dickey-Fuller regression (Dickey and Fuller, 1971, 1981) to test whether the estimated time series of residuals from the equilibrium regression has a unit root. The first step is to determine whether the variables in question contains a unit root using the DF procedure. Briefly, we regress the first difference of, say, the GDP on its lagged level, in addition to a constant, a time trend, and a lagged dependent variable. A significant coefficient on the lagged level of the variables implies rejection of the null hypothesis that the variables contains a unit root. The critical values are modified t-values reported in Fuller. having established the presence of unit root in the level of each variable, we can proceed to test whether the system of the two variables has unit roots (non-cointegrated) one it shares one unit root (co-integrated). In other words, If there is a unit root, X_t and Y_t are not co-integrated. The Dickey-Fuller test estimates the regression,

$$U_t = -pU_{t-1} + \varepsilon_t \quad (2)$$

and examines the significance of the p coefficient. If p equals zero, then U_t is non stationary and X_t and Y_t are not co-integrated. However, if p is significantly different from zero, U_t residuals from the equilibrium equation are stationary so that the hypothesis of co-integration is accepted. The ADF is similar to the SDF except that additional lags of U_t are used as regressor (in our work, we used 2 and 4 lags). Engle and Yoo (1987) recommended to utilise a standard Dickey-Fuller (SDF) and Augmented Dickey Fuller (ADF) test. If the residuals prove to be stationary using these two tests, then the two variables can be considered co-integrated.

Each time series is first examined for the probable order to difference stationary, because co-integration equations require the use of non-stationary (stationary) variables. All variables require a first difference of log transformation to attain stationary. Table 1 reports our non-stationarity test for all time series, using conventional Dickey-Fuller test and its augmented version (see the note to Table 1). we include a constant but no time trend in these tests as recommended by Dickey, William and Robert, (1986).

In testing for co-integration, there is no a prior choice of X_t and Y_t. Thus, we conducted each test twice, once with GDP as the X_t variable and EXP as Y_t, and once with the designations reversed.

2.2. Causality Test

The concept of causality followed in this paper is based on Granger's definition of causality. According to this, a variable x causes another variable y if future values of y can be better linearly predicted with values of x than without them, all other information being included in making the predictions. In this study we utilise Granger's statistical technique to test whether there is evidence of causality within a system of two variables (EXP and GDP) using regression equations with both lagged and 1st. differenced terms of entering two variables. The granger's causality between x and y at times t can be tested with the set of following equations

The evidence of no causal linkage between x and y maybe given credence if two variables do not possess any reliable long-run relationship. On an intuitive level, the standard Granger causality test examines whether past changes in one variable, y, help to explain current changes in another variables, x, over and above the explanation provided by past changes in x. If not, then one concludes that y does not Granger cause x. To determine whether causality runs in the other direction, from x to y, one simple repeats the experiment, but with y and x interchanged. Four findings are possible: (1) neither variable Granger cause the other; (2) y causes x, but not vice versa; (3) x causes y, but not vice versa; and (4) y and x Granger cause each other.

In more formal terms, the standard Granger causality test is based on the regression:

$$\Delta X_t = \alpha_0 + \sum_{i=1}^{p} \beta_{xi} \Delta X_{t-i} + \sum_{i=1}^{p} \beta_{xi} \Delta Y_{t-i} + \varepsilon_t \quad (3)$$

where Δ is the first-difference operator and Δx and Δy are stationary time series. ε_t are the two error terms The null hypothesis is that y does not Granger cause x is rejected if the coefficients, β'_{yi}, in equation (3) are jointly significant, based on a standard F-test. The null hypothesis that x does not Granger cause y is rejected if the β_{xi} , are jointly significant in equation (3), when Δx_t replaces Δy_t as the left-side dependent variables.

The causality test and the direction of causality in the GDP and EXP process, the following regression models are considered.

$$\Delta GDPt = \sum_{i=1}^{p} \alpha i \Delta GDPt-i + \sum_{i=1}^{p} \beta i \Delta EXPt-i + \varepsilon t \quad (4)$$

$$\Delta EXPt = \sum_{i=1}^{p} \delta i \Delta EXPt-i + \sum_{i=1}^{p} \gamma i \Delta GDPt-i + \varepsilon t \quad (5)$$

Where coefficients α_i, β_i, δ_i, γ_i are the unknown are to be estimated. Dealing with the regression model (equation 4), if the null hypothesis that β_i's for i=1,2,3,......n are jointly equal to zero can not be rejected, then the past value of EXP has no effect in the prediction of

GDP and therefore EXP does not cause GDP in Granger's sense. In the same way, using (the regression) equation 5, one can investigate whether GDP cause EXP. The null hypothesis which is described above can be tested by using the F-statistics. The values of F-statistic, when are calculated using Granger's procedure and are reported in the section of empirical results.

On the effects of lag structure:

It is well known that an inadequate selection of lag can in some cases causes biased estimates. Regarding these points, it is evidently very important to study the effects of lag lengths on the results of causality tests (Jones,1989). In the selection of lag length for the Granger's causality test we applied Akaika criteria. FNP (p,q) = [(n+p+q) / (n-p-q)] [(SSR(p,q) / n]. Here, n is the number of observation, p is the number of lags of y variable and q is the that of the x variables and SSR(p,q) is the sum of squared error. Maximum lag length over which the search is carried out minimum FNP correspond to the optimal lengths.

On the Autocorrelation Problem of he Error Terms:

Using the LS estimation method, one obtains unbiased estimates for the F-statistic if the error terms are not autocorrelated. Due to this, the examination of error terms for serial correlation is very important. Since equation 1-2 include lagged dependent variables, the D-W statistics of autocorreltion with regard to these points, the Q-statistics, which is more adequate in such situations, was used. The Q-statistics was developed by Ljung and Box (1978) has the form

$$Q = N(N+2)\sum_{i=1}^{K}(N-i)^{-1}\hat{r}_i^2$$

and Q is distributed $\chi^2_{k(m-p-q)}$.

Where $\hat{r}_i^2$ is the estimate of autocorrelation coefficient r_i, N is the number of observations, K is the number of considered autocorrelations and assuming that error terms are white noise.

After the 1st. differenced data, autocorrelation in residuals does not seem to be problem for most of the equations since Q statistic does not usually get close to 10% significance level.

2.3. Impulse Response Function

An alternative way to explain the dynamic relationship between two variables is to derive impulse response functions (IRFs) Fischer (1981) has described IRFs as a type of dynamic multiplier that gives the current and subsequent effects on each variable of a shock to one of those variables. IRFs are reported in Table 4. The figures in each column represent the responses in EXP to a one-standard deviation shock to the shocked variable. The responses are expressed in percent of change.

3. Empirical Results

From the unit root test results it is concluded that for both GDP and EXP over the periods 1923-1969 and 1970-1992, we reject null hypothesis of there is unit root at 5% and 10% levels for the variable GDP (1970-1992) according to SDF test, and for the variables GDP (1923-1969) according to ADF. In other cases, t-statistics are smaller than critical values implying we can not reject null hypothesis that there is unit root.

Having established the presence of unit root in the level of each variables, we can proceed to test whether the system shares one unit root (co-integrated). Co-integrated variables, if they are distributed, will not drift away from each other and thus process a long-run equilibrium relationship.

We applied SDF and ADF tests as described in section 2.1, and Table 3 reports the results and statistics for the granger causality test..

Table 1: Unit Root Test

Variable	SDF	ADF(2)
EXP(1923-1969)	-1.197	1.041
GDP(1923-1969)	-3.039	-3.312**
EXP(1970-1992)	1.675	1.536
GDP(1970-1992))	4.105**	1.592

Notes: The critical values of the ADF statistics for the residuals and for 50 observations at the 10% ,5% and 1% levels are -2.90, -3.29 and -4.12 . The critical values of SDF statistics at the 10% ,5% and 1% levels are -3.28, -3.67 and -4.32 . This value is from Engle and Yoo (1987, pp. 157-158). ** means significant at 5% and 10% levels.

Table 2: Tests Applied for the Residuals of the Cointegration Equations

Dependent Variable	Independent Variable	SDF	ADF(2)	ADF(4)
EXP(1923-1969)	GDP(1923-1969)	-6.533*	0.574	0.979
GDP(1923-1969)	EXP(1923-1969)	-6.432*	0.243	-0.050
EXP(1970-1992)	GDP(1970-1992)	-4.116**	-0.276	1.409
GDP(1970-1992)	EXP(1970-1992)	-2.950***	0.394	1.235

Notes: The critical values of the ADF statistics for the residuals and for 50 observations at the 1% ,5% and 10% levels are -2.90, -3.29 and -4.12 . The critical values of SDF statistics at the 1% ,5% and 10% levels are -3.28, -3.67 and -4.32 . This value is from Engle and Yoo (1987, pp. 157-158).

* means significant at 1%, ** means significant at 5%, ***means significant at 10%.

Table 3: Granger-Causality Test, F-statistics on Causal Variables*

Regression	d. f.	F-Statistics[1]	Time Period
GDP→EXP	F(2, 40)	0.376	1923-1969
EXP→GDP	F(2, 40)	0.318	1923-1969
GDP→EXP	F(2,18)	1.944	1970-1992
EXP→GDP	F(2,18)	1.139	1970-1992

Notes: (d.f.) is degrees of freedom. [1] $F = ((SSR_C - SSR_U/SSR_U)*(n-2m)/m) \sim F(m, n-2m)$ where SSR_C means sum of the squared residuals from constrained model; SSR_U is from unconstrained model; m is the number of lags; n is the number of observations.*means for the 1st. differenced-logged data.

For the granger causality test, arbitrary lag lengths are also selected for differenced-logged data. It is found that for the period of 1923-1969, there are no any causal relationships between two variables in any direction. On the other hand, for the 1970-1992 period, there also seems to be a no any causal relationship between EXP and GDP. In addition, arbitrary selected lag lengths for differenced-logged data imply that there is no any causal relationship between two variables in any direction. The same regression analysis is also replicated for the only 1st differenced but not logged data and it is found that there is only a causal relationship between EXP and GDP running from EXP to GDP for selected lag length (1,2), though not reported here. Other than in other lag lengths, there is no any causal relationship between them for the period 1970-1992. Table 4 presents the results of the cumulative responses of GDP on EXP and EXP on GDP for both periods.

Table 4: Impulse Responses to One-Standard Deviation Shock Innovations

	1923 - 1969		1970 - 1992	
Time	GDP on EXP	EXP on GDP	GDP on EXP	EXP on GDP
1	0,0000	0,0000	0,0000	0,0000
2	0,0075	0,0285	0,0236	-0,0019
3	0,0231	0,0361	0,0086	0,0057
4	0,0020	0,0056	0,0131	0,0019
5	0,0038	0,0062	0,0090	0,0030
6	0,0013	0,0029	0,0078	0,0021
7	0,0014	0,0023	0,0064	0,0018
8	0,0004	0,0009	0,00517	0,0016

Figure 3: One Standard Deviation Shock to GDP on EXP, 1923-1969

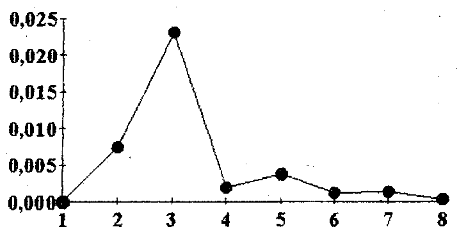


Figure 4: One Standard Deviation Shock to EXP on GDP, 1923-1969

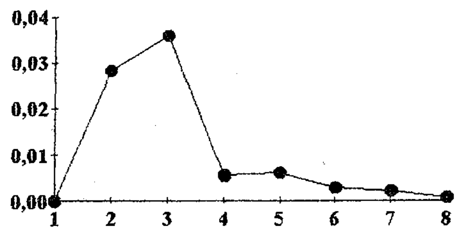


Figure 5: One Standard Deviation Shock to GDP on EXP, 1970-1992

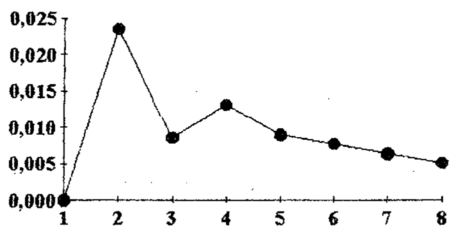
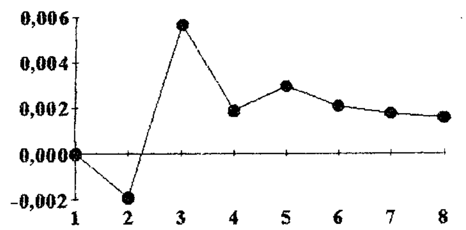


Figure 6: One Standard Deviation Shock to EXP on GDP, 1970-1992



In Table 4, the cumulative responses of EXP to GDP are positive in Turkey. That is, an increase in EXP will unambiguously lead to an increase in GDP. Results in Figures 3-6 seem to support the hypothesis that there is no long-term convergence between EXP and GDP. In fact the graph of the impulse response coefficients provides a better device to analyse the shocks and therefore, we presented graphs of IRFs in order to capture the dynamic effects, we considered responses over 8 years to a one-standard deviation shock in each variable. Following is a summary of the results of impulse responses: (1) Inspection of Fig. 3 and 5 reveals that one-standard deviation shock to GDP does not produce a strong positive impact on EXP in the long-run (for the period 1923-1969 and 1970-1992). In other words the impact of an initial increase in GDP does not significantly influence EXP in the long-run.

This result produced by the impulse response function are also very interesting and seem to be consistent with the other statistical results in this study. Initial impact of GDP on EXP appears to be positive and only after 2, 3 years EXP rapidly starts to decline (in both periods of time). The long-run impact of GDP is much weaker on the EXP; (2) Inspection of Fig. 4 and 6: A one-standard deviation shock to EXP also produces similar results, long-run impact of EXP results a weak response of GDP for the periods 1923-1969 and 1970-1992.

Initial impact of EXP on GDP appears to be positive in the long-run and only after 3 years GDP starts to decline (in both periods of time).

4. Summary and Concluding Remarks

Our purpose in this study is to determine whether Turkey's export and import have a tendency to converge towards an equilibrium in the long-run analysis. Using Engle-Granger co-integration technique we were able to show that Turkey's export and GDP are indeed not co-integrated according to ADF test, indicating that there is no any long-run equilibrium between them. This finding was interpreted as Turkey's macroeconomic policies have been not effective enough to make export and GDP converge toward an equilibrium in the long-run. This paper has found that there is no any Granger causality type of relationship between GDP and EXP for the period of 1923-1969. On the other hand, this study determined little evidence, at 10% level of significance according to SDF test (with the selected lag length (1,2), and only in 1st. differenced data) that export expansion causes an increase in GDP for the period 1970-

1992. Although contrary toconventional macroeconomic analysis, this findings is consistent with several recent studies in this area. Within this framework of this results obtained on the basis of available data do not support the view that the positive significant effects of export expansion on economic growth in the long-run.

These results are not altered by adopting different lag structure and by utilising only differenced but not logged data. However, the conclusions reached in this study base on availability of data, and employing alternative models such as, a more general VAR (Vector Autoregressive) model and reconsidering the causality issue with the aid of error-correction model can determine causality relationship which may be neglected in standard Granger causality test.

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Appendix

The data employed in this study are yearly 1923-1992. They are deflated by the consumer price index (1985=100). Variables are EXP (export of goods and services, billions of Turkish Lira) and GDP (gross domestic product, billions of Turkish Lira). Data source for GDP series is SIS (State Institute of Statistics), 1994, Statistical Indicators 1923-1992, Issue number: 1682, pp. 426-427, and for EXP is the News Letter of SIS- Statistics of Foreign Trade, January, 1995, p.3. In this study, RATS (Regression Analysis in Time Series) Doan, A., and Litterman, B. R., VAR Econometrics (version 4.10) software is utilized for the econometric analyses.