FINANCIAL DEVELOPMENT, TRADE LIBERALIZATION
AND ENDOGENOUS GROWTH IN TURKEY

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Abstract

This paper investigates the relationship among economic growth, investments,
financial development, degree of openness and human capital for Turkey. The
purpose of this paper is to examine the long-run relationship between these variables
using annual data for the period 1960-2002 and applying the cointegration analysis as
suggested by Johansen and Juselious. Then a multivariate autoregressive vector model
(VAR) is used to estimate the short-run and the long-run relationships of variables of
this model. The results of this paper suggested that the investments growth, the degree
of openness and the human capital have a positive effect on Turkey's economic
growth. Therefore, according to the endogenous growth theory there is a positive
long-run equilibrium relationship between the examined variables.

keywords: financial development, trade liberalization, cointegration

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1. Introduction

This paper empirically examines the effects of financial liberalization and trade liberalization using endogenous growth theory. The endogenous growth theory provides a more convincing and rigorous conceptual framework for the analysis of the relationship between trade liberalization and economic growth. In recent years, the relation between trade liberalization and economic growth in developing countries has become a central topic of debate among development economists.

Financial liberalization implies the removal of restrictions on interest rates. It has been argued that negative real interest rates resulting from financial repression in the form of ceilings on interest rates below the rate of inflation reduce financial saving and hence deter economic growth (Shaw, 1973; Fry, 1995). Contrarily, financial liberalization in the form of interest rates deregulation encourages financial saving and hence facilitates financial development.

Trade liberalization implies the removal of quantitative and qualitative restrictions including tariffs and quotas on foreign trade. Trade liberalization presupposes also the removal of restrictions on participation in foreign exchange markets.

It has been argued that both financial and trade liberalization policies reduce inefficiency in the production process and positively influence economic growth. This argument is strengthened by the fact that growth rates in countries with liberalized trade and financial services outperform those with restrictive financial and trade policies (Darrat 1999, Levine 1997, Shaw 1973, World Bank 1989).

According to endogenous growth theory it is possible to establish long-run relationships between trade orientation and economic growth in a number of ways:
• The imports liberalization is expected to promote technology transfer through the import of advanced capital goods.
• The foreign direct investments (FDI) bring export technology from industrial countries to developing ones.
• An export-oriented development strategy generally leads to higher growth. This is because there are some strictly economic factors, such as returns to scale and the impact of competition that probably produce a more satisfactory economic performance under an export-oriented strategy than under import substitution Dritsakis (2003).
• The openness of an economy is likely to speed up the rate of economic growth leading to wider scale economies in production.

It is most common that liberalization policies influence positively the economic growth. Most developing countries, which formerly followed restrictive economic policies have started liberalizing their financial and trade sectors in order to increase economic growth. Thus, the empirical investigation of the impact of financial and trade variables on economic growth in a developing country such as Turkey is important in order to examine the effectiveness of such liberalization policies.

However, the case studies on developing countries using time series or associated techniques relative to endogenous growth theory have been carried out in order to explore the joint impact of both financial and trade policies on economic growth. It is argued that the costs of restrictive policies on the Turkish economy have been enormous and are reflected in a low level of financial saving, investment and economic growth (Ahmed and Ansari, 1995; Hossain, 1996; and Siddiki, 2000). The main purpose of both financial and trade liberalization policies is to increase
economic growth. The joint impact of both variables is initially highlighted in the Roubini and Sala-I Martin’s (1991) model, which has extended the Barro’s (1991) growth model by incorporating both factors.

Blackburn and Hung (1998) using endogenous growth theory in their theoretical model predict that economic growth rates in the presence of financial intermediation tend to be higher than those under direct lending and borrowing.

The model hypothesis predicts that both financial development and trade liberalization jointly facilitate the rate of economic growth.

This paper has two aims:

- To examine the endogenous growth theory according to Blackburn and Hung’s model and to test for the joint impact of financial and trade liberalization in conjunction with investment in human and physical capital on economic growth.
- To apply the Johansen cointegration method in order to examine the long-run and the short-run relationship of the examined variables.

The remainder of the paper proceeds as follows: Section 2 describes the data and the specification of the multivariate VAR model that is used. Section 3 employs with Dickey-Fuller tests and examines the data stationarity. Section 4 presents the cointegration analysis and the Johansen cointegration test. Section 5 analyses the estimations of error correction models, while section 6 summarizes the final conclusions of this paper.
2. Data and specification of the model

In this study the method of vector autoregressive model (VAR) is adopted to estimate the effects of gross fixed capital formation, money supply, degree of openness and human capital on economic growth. The use of this methodology let us recognize the cumulative effects taking into account the dynamic response between economic growth and the other variables (Pereira and Hu 2000).

In time series analysis the appropriate differential is significant, because the most algorithms estimations fail when time series are not stationary. Also efficient benefits may exist in their 1st differences. In small samples the distributions of the coefficients may be improved by the estimation of (VAR) vector autoregressive model in their 1st differences (Hamilton 1994). Also, the use of 1st differences in econometric studies facilitates the results interpretation, since the first differences of logarithms of initial variables represent the growth rate of the original variables.

For cointegration analysis of Blackburn and Hung’s (1998) model and endogenous growth theory we examine the relationships among economic growth, investments, financial development, degree of openness and education using the following multivariate VAR model:

\[
\text{GDPN} = f \left( \text{INVG}, \text{HC}, \text{FD}, \text{OP} \right) \quad (1)
\]

where:

\[
\text{GDPN} = \frac{\text{GDP}}{\text{N}} \quad \text{per capita GDP}
\]

\[
\text{INVG} = \frac{\text{INV}}{\text{GDP}} \quad \text{the ratio of gross fixed capital formation to GDP}
\]

\[
\text{FD} = \frac{\text{M}_2}{\text{GDP}} \quad \text{the ratio of money supply to GDP}
\]
$$\frac{\text{OP}}{\text{GDP}} = \frac{\text{EXP} + \text{IMP}}{\text{GDP}}$$ the ratio of exports plus imports to GDP

HC = the human capital
N = the population

The variable of economic growth (GDPN) is measured by real GDP adjusted by GDP deflator. The variable of investments (INVG) is measured by gross fixed capital formation adjusted by GDP deflator. The variable of openness, which is the proxy for trade liberalization, is measured by the sum of exports plus imports adjusted by GDP deflator. The variable of financial development (FD) is measured by the broad money supply (M2) adjusted by GDP deflator, while the tertiary school enrolment level is the proxy for the human capital (HC).

The data that are used in this analysis are annual, cover the period 1960-2002 and are obtained from Statistics Indicators, which is published by Turkish State Institute Statistics (SIS), National Accounts of OECD, International Monetary Fund (IMF) and UNSESCO.

All data are expressed in logarithms in order to include the proliferative effect of time series and are symbolized with the letter L preceding each variable name. If these variables share a common stochastic trend and their first differences are stationary, then they can be cointegrated.

Economic theory scarcely provides some guidance for which variables appear to have a stochastic trend and when these trends are common among the examined variables as well. For the analysis of the multivariate time series that include stochastic trends, the Augmented Dickey-Fuller (1979) (ADF) test is used for the estimation of unit root existence and the cointegration analysis, which tests for the cointegration relationship between the examined variables.
3. Unit root test

The cointegration test among the variables that are used in the above model requires previously the test for the existence of unit root for each variable and specifically, for economic growth, investments, financial development, degree of openness and education using the augmented Dickey-Fuller (ADF) (1979) test on the following regression:

\[ \Delta X_t = \delta_0 + \delta_1 t + \delta_2 X_{t-1} + \sum_{i=1}^{k} \alpha_i \Delta X_{t-i} + u_t \]  \hspace{1cm} (2)

The ADF regression tests for the existence of unit root of \( X_t \), namely in the logarithm of all model variables at time \( t \). The variable \( \Delta X_{t-i} \) expresses the first differences with \( k \) lags and final \( u_t \) is the variable that adjusts the errors of autocorrelation. The coefficients \( \delta_0, \delta_1, \delta_2, \) and \( \alpha_i \) are being estimated. The null and the alternative hypothesis for the existence of unit root in variable \( X_t \) is

\[ H_0 : \delta_2 = 0 \quad H_e : \delta_2 < 0 \]

The results of these tests appear in Table 1. The minimum values of the Akaike (AIC) (1973) and Schwartz (SC) (1978) statistics have provided the better structure of the ADF equations as well as the relative numbers of time lags, under the indication “Lag”. As far as the autocorrelation disturbance term test is concerned, the Lagrange Multiplier LM(1) test has been used. The MFIT 4.0 (1997) econometric package that was used for the estimation of ADF test, provides us the simulated critical values.
The results of Table 1 suggest that the null hypothesis of a unit root in the time series cannot be rejected at a 5% level of significance in variable levels. Therefore, no time series appear to be stationary in variable levels. However, when the logarithms of the time series are transformed into their first differences, they become stationary and consequently the related variables can be characterized integrated order one, I(1). Moreover, for all variables the LM(1) test first differences shows that there is no correlation in the disturbance terms.

4. Cointegration and Johansen test

If the time series (variables) are non-stationary in their levels, they can be integrated with integration of order 1, when their first differences are stationary. These variables can be cointegrated as well, if there are one or more linear combinations among the variables that are stationary. If these variables are being cointegrated, then there is a constant long-run linear relationship among them. Granger (1986) argued that ‘A test for cointegration can thus be thought of as a pre-test to avoid “spurious regression” situations’.

Since it has been determined that the variables under examination are integrated of order 1, then the cointegration test is performed. The testing hypothesis is the null of non-cointegration against the alternative that is the existence of cointegration using the Johansen (1988) maximum likelihood procedure, Johansen and Juselious (1990, 1992). An autoregressive coefficient is used for the modelling of
each variable (that is regarded as endogenous) as a function of all lagged endogenous variables of the model.

Given the fact that in order to apply the Johansen technique a sufficient number of time lags is required, we have followed the relative procedure, which is based on the calculation LR (Likelihood Ratio) test statistic (Sims 1980). The results showed that the value $\rho=3$ is the appropriate specification for the above relationship.

The order of $r$ is determined by using the likelihood ratio (LR) trace test statistic suggested by Johansen (1988).

$$\lambda_{\text{trace}(q,n)} = -T \sum_{i=q+1}^{\hat{\lambda}_i} \ln(1 - \hat{\lambda}_i)$$

for $r = 0, 1, 2, \ldots, k-1$,

$T$ = the number of observation used for estimation

$\hat{\lambda}_i$ = is the $i$th largest estimated eigenvalue.

Critical values for the trace statistic defined by equation (3) are 39.81 and 36.69 for $H_0: r = 0$ and 24.05 and 21.46 for $H_0: r \leq 1$ at the significance level 5% and 10% respectively as reported by Osterwald-Lenum (1992).

The maximum eigenvalue LR test statistic as suggested by Johansen is:

$$\lambda_{\text{max}(q, q+1)} = -T\ln(1 - \hat{\lambda}_{q+1})$$

The trace statistic either rejects the null hypothesis of no cointegration among the variables ($r=0$) or does not reject the null hypothesis that there is one cointegrating relation between the variables ($r\leq1$).

INSERT TABLE 2
The results that appear in Table 2 suggest that the number of statistically significant cointegration vectors is equal to 1 and are the following:

\[ \text{LGDPN} = 1.18 \text{LINV} + 1.136 \text{LHC} - 0.32466 \text{LFD} + 2.1872 \text{LOP} \]

The coefficients estimations in equilibrium relationships, which are basically the long-term estimated elasticities relatively to economic growth, suggest that investments, human capital, openness are elastic, while financial development is inelastic with negative sign. For the estimation of the cointegrated vector without the variable of financial development, we use the following model

\[ \text{LGDPN} = 1.1739 \text{LINV} + 0.97235 \text{LHC} + 1.9830 \text{LOP} \]

According to the signs of the vector cointegration components and based on the basis of economic theory the above relationships can be used as an error correction mechanism in a VAR model.

5. VAR model with an error correction mechanism

After determining that the logarithms of the model variables are cointegrated, we must estimate then a VAR model in which we shall include a mechanism of error correction model (MEC). The error-correction model arised from the long-run cointegration relationship and has the following form:

\[ \Delta \text{LGDPN}_t = \text{lagged}(\Delta \text{LGDPN}_t, \Delta \text{LINV}_t, \Delta \text{LHC}_t, \Delta \text{LOP}_t) + \lambda u_{t-1} + V_t \quad (3) \]
where $\Delta$ is reported to all variables first differences

$u_{t-1}$ are the estimated residuals from the cointegrated regression (long-run relationship)

$-1<\lambda<0$ short-run parameter

$V_t$ is the white noise disturbance term

One difficulty confronting a researcher in estimating a VAR model is the appropriate specification of the model. In particular, the researcher has to decide what deterministic components should be included as well as the number of time lags that should be used Dritsakis (2004). Since arbitrarily chosen specifications of a VAR model are likely to produce unreliable results, we use a data based model selection criterion to specify the VAR model for the economy of Turkey.

Among various model selection criteria the one proposed by Schwartz (1978), known as Schwartz Bayesian information criterion (SBC), is shown to outperform other alternatives (Mills and Prasad 1992). Therefore, our specification of the VAR model are based on Schwartz Bayesian information criterion. Schwartz’s criterion selected a first order VAR specification with constant and time trend as well.

The final form of the Error-Correction Model was selected according to the approach suggested by Hendry, (Maddala 1992). The initial order of time lag for the model is 2 years, because it is large enough to enclose the system’s short-run dynamic. We also apply a number of diagnostic tests on the residuals of the model. We apply the Lagrange test (LM) for the possible existence of autocorrelation and heteroscedasticity, the Bera-Jarque (C) normality test and the Ramsey’s Reset test for the functional form of the model. The Error Correction Model appears in table 3.
We do not reject the estimations, which are based on the results of table 3 according to the statistical and diagnostic tests. The percentage of the total variation of the dependent variable that is described in our model is high enough (39%). The Error Correction Term is statistically significant and has a negative sign, which confirms that there is not any a problem in the long-run equilibrium relation between the independent and dependent variables in 5% level of significance, but its relatively value 0.040707 (-3.3964) shows a satisfactory rate of convergence to the equilibrium state per period.

From the results of Table 3 we can see that a short-run increase of investments per 1% induces an increase of economic growth per 0.69%, an increase of human capital per 1% induces an increase of economic growth per 0.66%, while an increase of openness per 1% induces an increase of economic growth per 0.23%.

6. Conclusions

This paper employs with the relationship among economic growth, investments, financial development, degree of openness and human capital for Turkey, using annual data for the period 1960-2002. The empirical analysis suggested that all variables that determine economic growth in Turkey present a unit root. On this basis the cointegration analysis has been used as suggested by Johansen and Juselious to arise a long-run equilibrium relationship among the examined variables. The results of this analysis showed that there is a positive relationship among economic growth, investments, degree of openness and human capital.

Then an error correction model’s methodology was used to estimate the short-run and the long-run relationships of the variables. The results of this model suggested
that the error correction term proved to be negative and statistically significant in 5% level of significance. This means that the adjustment of the short-run dynamic of the variables in the examined model is very efficient.

Final, this paper validates the hypothesis of Blackburn and Hung’s (1998) model, namely that both financial development and trade liberalization enhance economic growth according to the endogenous growth theory.
References


### Table 1 – DF/ADF unit root tests

<table>
<thead>
<tr>
<th>Variables (X&lt;sub&gt;t&lt;/sub&gt;)</th>
<th>In levels</th>
<th>1&lt;sup&gt;st&lt;/sup&gt; differences</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lag</td>
<td>Test statistic (DF/ADF)*</td>
</tr>
<tr>
<td>LGDPN</td>
<td>1</td>
<td>-1.2866</td>
</tr>
<tr>
<td>LINV</td>
<td>0</td>
<td>-2.5861</td>
</tr>
<tr>
<td>LHC</td>
<td>1</td>
<td>-1.7814</td>
</tr>
<tr>
<td>LFD</td>
<td>1</td>
<td>-2.7474</td>
</tr>
<tr>
<td>LOP</td>
<td>1</td>
<td>-1.7587</td>
</tr>
</tbody>
</table>

*Critical value: - 3.5279  
**The numbers in brackets show the levels of significance (for serial correlation test)

### Table 2. - Johansen and Juselious Cointegration Tests

**Variables** LGDPN, LINV, LHC, LFD, LOP  
**Maximum lag in VAR = 3**

<table>
<thead>
<tr>
<th>Eigenvalues</th>
<th>Critical Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Null</td>
<td>Alternative</td>
</tr>
<tr>
<td>r = 0</td>
<td>r = 1</td>
</tr>
<tr>
<td>r = 1</td>
<td>r = 2</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Trace Statistic</th>
<th>Critical Values</th>
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</thead>
<tbody>
<tr>
<td>Null</td>
<td>Alternative</td>
</tr>
<tr>
<td>r = 0</td>
<td>r &gt; 0</td>
</tr>
<tr>
<td>r ≤ 1</td>
<td>r &gt; 1</td>
</tr>
</tbody>
</table>
Table 3. Error correction model

\[
\Delta LGDPN_t = 0.086574 + 0.35603 \Delta LGDPN_{t-2} + 0.06935 \Delta LINV_{t-1} + 0.0664 \Delta LHC_{t-2} \\
+ 0.02314 \Delta LOP_{t-1} - 0.040707 u_{t-1}
\]

\[
(3.9406) \quad (2.8109) \quad (2.5515) \quad (1.8780)
\]

\[
[0.000] \quad [0.008] \quad [0.016] \quad [0.074]
\]

\[
\overline{R}^2 = 0.39 \quad F(5,33) = 5.9105 \quad DW = 2.0444
\]

\[
\text{A: } X^2[1] = 0.0342 \quad \text{B: } X^2[1] = 0.0183 \quad \text{C: } X^2[2] = 1.7676 \quad \text{D: } X^2[1] = 1.5920
\]

\[
[0.853] \quad [0.892] \quad [0.413] \quad [0.207]
\]

Notes:

\( \Delta \): Denotes the first differences of the variables.

\( \overline{R}^2 \): Coefficient of multiple determination adjusted for the degrees of freedom (d.f).

DW: Durbin-Watson statistic.

F(n, m): F-statistic with n, m d.f respectively.

A: X^2(n) Lagrange multiplier test of residual serial correlation, following \( \chi^2 \) distribution with n d.f.

B: X^2(n) Ramsey’s Reset test for the functional form of the model, following \( \chi^2 \) distribution with n d.f.

C: X^2(n) Normality test based on a test of skewness and kurtosis of residuals, following \( \chi^2 \) distribution with n d.f.

D: X^2(n) Heteroscedasticity test, following \( \chi^2 \) distribution with n d.f.

( ) = We denote the t-ratio for the corresponding estimated regression coefficient.

[ ] = We denote prob. Levels.