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Does Trade Liberalization Cause a Long Run Economic Growth in Turkey

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Abstract. Based on 'endogenous' growth theory, the paper examines the effect of trade liberalization on long-run income *per capita* and economic growth in Turkey. Although the presumption must be that free trade has a beneficial effect on long run growth, counter examples can also be found. This controversy increases the importance of empirical work in this area. Using the most recent data we employ multivariate cointegration analysis to test the long run relationship among the variables in hand. In a multivariate context, the effect of determinants such as increasing returns to scale, investment in human and physical capital are also included in both theoretical and empirical works. Our causality evidence between the long run growth and a number of indicators of trade liberalizations confirms the predictions of the 'new growth theory'. However, the overall effect of the possible breaks and/or policy change and unsustainability in the 1990s looks contradictory and deserves further investigation.

JEL Classification Numbers: F43, 024, 052, C5

Key words: economic growth, openness, Turkey

1. Introduction

Do trade liberalization and increased openness lead to a higher rate of economic growth? This has been one of the most controversial issues in international economics over the years. Since trade liberalisation in the early 1980s, the Turkish economy has experienced an unstable growth path characterised by boom and bust cycles. High mobility of international capital flows brought a number of major economic crises, which worsened the fluctuations in *per capita* income. Such developments have increased the scepticism over the positive effects of openness on economic growth in Turkey.

The basic neoclassical growth model sees no direct link with openness and economic growth. It explains that the sole determinant of long-run growth in *per capita* income is the exogenously determined technology, which suggests that the long run economic growth cannot be influenced by the interaction

with other countries. There may be effects of openness on the long-run level of welfare and the transition to steady state (convergence) but not on the long run economic growth.

The endogenous growth theories (Romer, 1990) generally imply that openness to trade should increase growth by increasing the scale of spillovers or available technology. Furthermore, openness and trade may stimulate economic expansion in some countries while reducing growth in others. It is clear that the given the tools of endogenous growth theory almost any policy choice can be shown to have growth effects through its effect on the accumulation or allocation of physical or human capital. This highlights that what is needed is more empirical evidence on the benefit of openness and trade policy.

The existing empirical literature shows that the effect of trade liberalization and increased openness on economic growth has four main channels; increased capital accumulation, factor price equalization, knowledge spillovers and the trade-mediated technology. The effect of trade on growth can be characterised by openness influencing technological change. Rivera-Batiz (1995) outlines several key mechanisms through which trade and innovation are related. The first effect is the re-allocation effect whereby the international trade can affect economic growth by reallocating resources among sectors and industries. For example, trade may increase the quantity of human capital in the production of manufacturing industries. Human capital is a key source in inducing innovations. The increase in skilled labour demand within the productive activities would drive human capital away from research and development. This may reduce innovation and growth. The second effect of international trade is about the transmission of knowledge and ideas across any two countries. Trade restrictions reduce flows of technological information across countries and this has a negative effect on long-run growth. Here, there is a counter-argument that the impact on economic growth is limited if the domestic innovation system is not able to handle productively the new knowledge, for example, if local resources are unable to use the new information generated by openness. Openness and international trade increase rivalry and competition among domestic firms and innovation stimulated growth would rise. This third type of effect called the competition effect, which is linked to the issue of imitation. Here the developed economy innovates and therefore the less developed economy imitates (Grossman and Helpman, 1991). Young (1991) argues that trade liberalization between developed and less developed countries may inhibit learning by doing and therefore the growth of general knowledge in developing countries. Trade liberalization can encourage specialization in product lines, which has not had very much learning by doing in developing countries. Young's model has interesting predictions about the trading partner countries. It suggests that the less sophisticated goods, which are assumed to be characterized by high

potential labour requirements, are produced in developing countries. The produce of developed countries reflects this difference in the stock of technological knowledge. Feenstra (1996) describes smaller countries as being smaller in labour force and in 'research and development' (R&D) efficiency units and so outlines that in the absence of international spillovers, free trade can lead to lower growth rates in smaller countries. Esterly and Levine (2001) review more than a decade of empirical work on growth. They concluded that national policies such as the trade regimes do affect growth, but to what extent is not clear.

The empirical literature has been critiqued for several reasons; the problem of measurement and the quality of data, problem of endogeneity, problem of omitted variable biased and the possible non-inclusion of other policies. The association between openness and growth performance is affected by a number of factors, including country, region and other attributes. Rodrik and Rodriguez (2000) have argued that trade plays a secondary role compared to more influential factors, such as institutions and geography. One of the main difficulties of this type of work is causality. Baldwin and Forslid (1998) confirm that measuring the impact of trade policy and/or openness or growth using cross country regression has generally proven but occasionally misleading exercise. There are a number of recent empirical studies in the area of growth and openness or trade policy. Firstly, Rodrik and Rodriguez (2000) emphasize that trade restrictions are not necessarily good for growth, but the converse has not been demonstrated. They questioned whether free trade generates technological and other positive spillovers to the rest of the economy. They emphasized some of the recent relevant research findings that firms in fact derive many technological or other benefits from exporting. Causality seems to be from productivity to exports, not the other way around. Rodrigues and Rodrik conclude that more research needs to be done to prove that free trade brings benefits. Hence, some empirical findings appear to contradict the existence of a positive link between free trade and growth.

There is, however, work supporting the link, such as Dollar (1992) Frankel et al. (1996), Edwards (1993, 1997, 1998), Levine and Raut (1997), Ben-David and Loewy (1998), Gwartney et al. (2000), Badinger (2001), Dollar and Kraay (2001) and Rutherford and Tarr (2003). It is clear that the jury is still out on whether trade and openness affects growth.

The aim of this paper is to empirically investigate the impact of trade liberalization on economic growth, using time series evidence for the Turkish Economy. For the Turkish openness and growth case we are extending the data sample used in Ghatak et al. (1995) for a further decade and re-examining the Turkish openness and growth issue. The paper is organised as follows. Section 2 outlines the most relevant new growth theories for the Turkish case. Section 3 gives a selective survey of the empirical literature in

the field. Section 4 reviews openness indices for Turkey. Section 5 provides the data and reports the results of the empirical work. The last section offers some conclusions and implications.

2. Endogenous growth models in open economies

There is a large theoretical literature on the relation between growth and trade openness. Two sets of formal models are going to be our main focus in this part. A key implication of these models is that it is no longer possible to draw conclusions *a priori* about the benefit or costs of free trade. The ambiguity in the theoretical conclusions reinforces the importance of empirical work.

The first line of models is about 'learning by doing' (LBD). Romer (1986) eliminates diminishing returns to (the reproducible factor) K by assuming that knowledge creation is a side product of investment. This is similar to Arrow's (1962) model of learning-by-doing. The central idea of learning-by-doing is that, as individuals produce goods, they inevitably think of ways of improving the production process. Improvements in productivity thus occur without any explicit innovations. The accumulation of knowledge is therefore a side effect of conventional economic activity. The simplest case of learning-by-doing is when learning occurs has a side-effect of the use of new capital. Then the stock of knowledge is a function of the stock of capital.

Consider Cobb–Douglas production function with labour-augmenting technical change for firm i:

$$Y_i = K_i^{\alpha}(B_i L_i)^{1-\alpha} \qquad 0 < \alpha < 1 \tag{1}$$

B_{i} is the index of knowledge available to the firm i and there are two inputs into production of the firm (Y_{i}) and one parameter: capital, symbolized by K_{i}, and labour, symbolized by L_{i}, the parameter α determines exactly how capital and labour combine to produce output. Now make two assumptions (following Arrow, 1962; Romer, 1986):

1. An increase in a firm's capital stock leads to a parallel increase in its stock of knowledge; i.e. B_i is a positive function of K_i
2. Each firm's knowledge is a public good that any other firm can access at zero cost. In other words, once discovered, a piece of knowledge spills over instantly across the whole economy; i.e. $\mathrm{B}_i = \mathrm{B}$.

These ideas can be put in a simple form as follows:

$$B_i = \lambda K_i^{\beta} \qquad \lambda > 0 \quad \beta > 0 \tag{2}$$

where λ determines the proportion of the capital, in total capital stock, allocated to the knowledge creation and β denotes the share of the capital, which is used for knowledge creation in total output. And thus the individual firm production function can be written (i.e. by substituting (2) into (1)) as

$$Y_i = \mathrm{K}_i^{\alpha}(\lambda K_i^{\beta} L_i)^{1-\alpha} \tag{3}$$

Hence, the aggregate production function

$$\begin{aligned} Y &= K^{\alpha}\lambda^{1-\alpha}K^{(1-\alpha)\beta}L^{1-\alpha} \qquad \text{and thus} \\ Y &= \lambda^{1-\alpha}K^{\alpha+(1-\alpha)\beta}L^{1-\alpha} \end{aligned} \tag{4}$$

The behaviour of the model crucially depends on the APK (average product of capital). In this model, the APK variation depends on the exponent n *K*. Whether APK is an increasing, decreasing or constant function of *K* thus depends on whether this exponent (=elasticity of APK with respect to *K*) is positive, negative, or zero. This, in turn, depends on whether β is bigger, smaller or equal to one.

(Since $(1-\alpha) > 0$), if $\beta > 1$ there is an increasing returns to scale. If $\beta = 1$ then there is constant returns to scale if population growth $(n) = 0$. If $\beta < 1$ there is decreasing returns to scale if $n = 0$. For increasing returns to scale, we have explosive growth. In case of constant returns to scale the production function simplifies to:

$$Y = \lambda^{1-\alpha}KL^{1-\alpha}$$

In case of decreasing returns to scale the long-run growth rate of the economy is a function of the rate of growth of population. As this theoretical model of LBD with three different returns to scale implies, the knowledge creation was a side product of investment. When a firm increases its physical capital it also learns simultaneously how to produce more efficiently.

The knowledge spill over effect of openness is one of the crucial debates in the openness and economic growth literature. Young (1991) examines the spillover effects in the development of knowledge across industries, and his examination considers the existence of strong diminishing returns in the LBD process. Young considers the effect of international trade between two economies, the developed (DC) and less developed (LDC). International trade is based on the difference in the stock of technological knowledge. Both economies may produce any one of an infinite number of goods but the

technology differs in terms of labour requirements. Two economies endowed with a single primary factor of skilled labour. The crucial assumption of Young's model is that the developed countries stock of knowledge is greater than the developing countries.

$$B_t^{\mathrm{DC}} > B_t^{\mathrm{LDC}} \tag{5}$$

Where, B_t is a total stock of technological knowledge at time t.

Young's model consequently implies that developed countries would most likely trade with their less developed counterparts while less developed countries would most likely trade between themselves. We do not think that this is the case for the Turkish economy.

The second line of models are along the lines of Grossman and Helpman (1991, 1996), which allow us to consider dynamic comparative advantage. The rate of technical progress and the pattern of international trade are jointly and endogenously determined.

This line of research compiles the Heckscher-Ohlin theory of international trade with a Schumpeterian model of endogenous growth. The main consideration of this type of model of growth is through rising product quality. (i.e. growth through profit seeking R&D). The model considers the effect of international trade between two economies. Each economy consists of three sectors; the final good production sector, intermediate input manufacturing sector and the research sector. It is endowed with two factors of production, skilled and unskilled labour. The final goods sector has a low technology and a high-technology good. High technology goods are produced under imperfect competition while low technology goods are produced under perfect competition. Each economy is incompletely specialized in the four activities; the low technology production, research, intermediate-input manufacture and the high technology production. Endogenous growth occurs as a result of improvements in the quality of intermediate inputs, which are used for the production of high technology goods. This multi sector high technology economies output is determined by,

$$\mathrm{Log}\, Y = \int_0^1 \log\left[\sum_{\Phi} g^{\Phi}(j).x_{\Phi}(j)\right] \mathrm{d}j, \qquad g > 1 \tag{6}$$

where, 'g' denotes the size of innovations and $x(j)$ denotes the quality of intermediate input j of quality Φ currently produced using high technology.[1]

Both theoretical approaches indicate that it is difficult to identify a priori the effect of trade policy on long run income *per capita* and growth. Hence empirical work is crucial. The empirical studies, in general, support the idea that openness is growth promoting, but it is controversial and subject to a variety of criticisms.

3. Empirical evidence on openness and growth

New growth theory provides a variety of suggestions about what actually determines the growth rate of output. It can be seen as an attempt to make technology endogenous. The most widely used approach is to run a regression of average growth in output over a period on a number of independent variables which are deemed to affect growth. Prime examples of such variables are trade-policies, government expenditure, and human capital. There have been numerous studies of this type.[2]

Levine and Renelt (1992) systematically assess the significance of variables used in the literature in explaining cross-country variations in growth rates. Levine and Renelt undertake this analysis by initially considering a large set of variables. They find that only a small number of variables such as initial level of income, Human capital and physical capital (Investment) are actually robustly related to economic growth across countries. None of the variables capturing the stance of fiscal policy, trade policy or macroeconomic stability appeared to be robustly related to growth. This clearly shows that previous findings cannot be generalised on the basis of the available data.

Human capital is one of the key variables in many new growth models (e.g. Lucas, 1988; Romer, 1990, and for Turkish case; Ghatak et al., 1995). In Lucas's model it is the variable which generates the externality necessary for endogenous growth. In Romer's paper it is the key input in the production of new technologies. However, it is also possible to set up a more sophisticated version of the neo-classical growth model, with human capital included as an additional factor or production. This is done in Mankiw et al. (1992).

The evidence on developing countries is also unclear. The World Bank in particular has argued for a long time now that trade liberalisation is a key ingredient to successful growth performance. However, as shown in Levine and Renelt (1992), this view is not strongly supported by the evidence. There seems to be a fairly strong consensus on one key ingredient: human capital. Investment in education and training is regarded as a key to growth in industrialised and developing countries.

Overall, the growth process appears to be extremely complex and not easily explained by simplistic models. There are many ingredients, such as institutions (e.g. the state of the legal system) which cannot readily be modelled (see North, 1991, for a discussion of the role of institutions). Young, A. (1992) has examined the economies of Hong Kong and Singapore more closely. Between 1960 and 1985, average growth in both countries was very similar. The differences come from the role of capital accumulation.

There are a large number of empirical studies focusing on the openness and growth literature. Esterly and Levine (2001) reviewed more than a decade of empirical work in this area. It is not possible to mention all of them here but there are a few worth mentioning. Rodriguez and Rodrik (2000),

Srinivasan and Bhagvati (2001) suggest that, as opposed to the cross country regression, country level studies may yield more robust conclusions. Some recent studies appear to conclude that trade and openness is growth promoting. Examples of this line of research include, Edwards (1997), Gwartney et al. (2000), Dollar and Kraay (2001), Ahmed (2003), Ruthford and Tarr (2003).

They all seem to conclude that there is a strong effect of trade on growth but they do not deal with the argument that financial openness leads to financial crises. After opening up, the Turkish economy has seen a number of financial crises, sudden stops in capital inflow, currency crashes and severe recession. This highlighted the issue of financial openness which provoked a further debate on the causality between openness to trade and financial trade. Some argued that greater trade openness would lead to greater financial openness and vice versa. Aizenman and Noy (2004) study the two-way feedback between de-facto financial and trade openness. Their definition of financial openness was determined as the sum of gross private capital inflows and outflows as percentage of GDP. They argued that the channel from finance to trade is stronger than the channel from trade to finance. Frenkel and Cavallo (2004) took a further step and emphasize the vulnerability to foreign shocks. Contrary to the general belief in Turkey, they found that openness, in general, makes countries less vulnerable, both to severe sudden stops and currency crashes.

The jury is still out as to which type of openness and trade policy affects economic growth empirically.

4. A review of the openness indices

In this study we consider five different types of openness indices. Baysan and Blitzer (BB), OPEN, MVOL, XVOL and ERDI indices.[3] Simple trade volumes (Export (X), GDP (Y), Import (M), Trade volume (X + M) or Trade/GDP ratios (M/Y, X/Y or (X + M)/Y) have often been employed as crude indicators of openness. The advantage of these indices is that the data are readily available. A higher value denotes a lower degree of policy intervention in trade. The main limitation of these indices is that they are not necessarily related to trade policy, i.e. a country can distort trade significantly, and still have a higher trade volume and/or trade intensity ratio. Comparisons across countries can of course be particularly misleading. This has led authors such as Leamer (1988) and Edwards (1992) to take differences between 'predicted' and actual trade intensity ratios to proxy the extent of trade barriers. The predicted trade flows are derived from Leamer's Heckscher–Ohlin model (Leamer, 1984), estimated from cross-country data on factor endowments. The unavailability of time series data on endowments for individual countries

prevents the use of this type of approach in the present work. We fall back by necessity on crude trade intensity ratios[4] and export volumes, and assume that such openness measures are directly related over time to the degree of trade liberalisation initiated.

Non-tariff barriers (NTBs) are often more important forms of protection in developing countries. Tariff-equivalence and the effective protection impact of such NTBs are likely to be available for 1 or 2 years at best. Data on the import coverage of NTBs is sometimes used as indicators of their severity, but such ratios are not good indicators of the restrictiveness of trade barriers. This problem and the desire to capture a wide range of price distortions have encouraged attempts at the constructing of composite indices of distortion (Agarwala, 1983). Subjectivity is required to rank the distortions from different sources. The Agarwala results are cross-country in nature, and inappropriate for the present work. Efforts to replicate the approach for time series work would be constrained by data availability, and would be open to inevitable criticisms concerning personal bias. In this work, we prefer therefore to use information on the black market and an exchange rate premium to capture the extent of distortions. The deviation between the black market rate and the official exchange rate, expressed as a proportion of the black market rate and named 'exchange rate distortion index' (ERDI), seeks to capture the effects of trade and other interventions (e.g. capital market); the greater the deviation the more distorted the economy while a declining deviation is interpreted as increased liberalisation. ERDI is a black market premium in the foreign exchange market used as a proxy for overall extent of distortions in the external sector. The advantage of this index is that it measures the extent to which government policy distorts trade. In this case, a higher value denotes a greater departure from free trade. The disadvantage of ERDI, however, is that it falls short of capturing the effects of tariffs and quantitative restrictions in measuring the country's overall protection level on trade.

We need some measure of the ratio of the exchange rate facing importers to that effectively faced by exporters (as effected by official exchange rates and any taxes and subsidies on traded goods). A detailed look at protection studies has given snap-shots at specific points of time of such measures of bias. There is also some cross-country information on the bias between non-tradeables and tradeables as a whole to be found in Dollar's work on real exchange rates (Dollar, 1992). The present work is investigating the possibility of constructing real exchange rates (as defined as the price of tradeables to non-tradeables) for importables and exportables separately on a time series basis, since this avoids the potentially ambiguous response of the real exchange rate for all tradeables to trade liberalisation (see Milner, 1994). At present the analysis is restricted to using an openness and distortion index only.[5]

A notable trade liberalization index is Baysan and Blitzer (BB) Index in Turkey. In the World Bank study on liberalising foreign trade, Baysan and Blitzer (1991) focus on developments in the Turkish foreign trade sector between 1950 and 1985. A BB index is compiled by expert authors and measures quantitative restrictions by ranking accordingly. Hence, the index can take values between 1, in the case of a highly protected/distorted trade sector, and 20 when trade is fully liberalized. They identify four dates over this period when marked attempts to reduce trade and other distortions were initiated, namely the years 1950, 1958, 1970 and 1980. In the first three cases the authors conclude that the liberalisation was not sustained, and the reforms were not part of a planned programme to establish a liberal trade regime. Indeed, in none of these brief liberalising episodes do Baysan and Blitzer assess the reforms to have been sufficient to merit the status of an 'outward-oriented' regime. By contrast the 1980 liberalisation is viewed as the start of a more fundamental and sustained liberalisation; the BB index is set at 6 (within the restrictionist trade regime range) in 1980 and rises steadily to 14 (well into the 'outward-oriented' range) by 1985 (see Figure 1). The series of reforms started a near 50% devaluation, increase in direct export incentives, demand stabilisation measures, and a declared intention to gradually liberalise the economy (dismantling the QR system, capital account liberalisation). Besides the introduction of direct export incentives at the start of the episode, the Bank's view was that relatively little was achieved in terms of import policy until 1984. Some commodities were shifted from the more restrictive to the less restrictive list, and in 1981 some licensed imports were

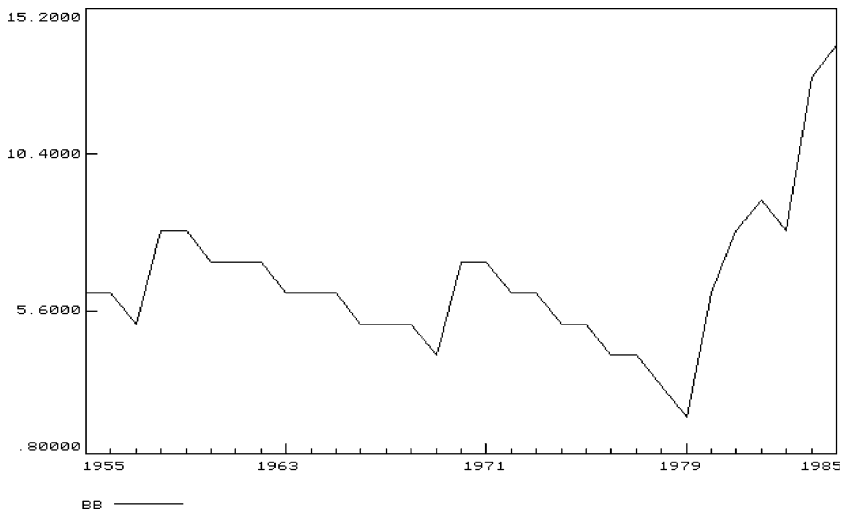

Figure 1. Baysan and Blitzer Index (BB) of liberalisation for Turkey (*Source*: Baysan and Blitser. (1991)).

liberalised and the explicit import quota system was abolished. The system remained dominated by licensing, QRs and a protective tariff structure until the beginning of 1984, when about 60% of previously licensed imports were liberalised. There were also changes in the administrative system; only goods explicitly listed as prohibited could not now be imported, where previously imports were banned if not explicitly listed as liberalised (for further details see Kazgan, 1993). There are noticeable disadvantages of the BB index. Despite the efforts of Michaely et al (1991) to tackle the difficulties in measuring trade orientation, the BB openness index is largely 'subjective', reflecting the personal judgement of the individual country (here Turkey) author. Due to this subjectivity, the BB index is not comparable across countries.

How does the 'Baysan-Blitzer' (BB) index of liberalisation for Turkey compare with the indices of openness and distortion used in the present work? Figure 2 plots the BB and openness indices alongside each other. There is in fact a fairly close correlation (+0.678) between the two indices (See Table IV for the correlation between various indices). The liberalisations of 1950, 1958 and 1970, and the subsequent reversals are captured. The timing and scale of the liberalisation episode starting in 1980 is also dramatically represented by our openness index. Note that the openness index continuously rises from 1979 (12.9) up to 2000 (65.2). By contrast the exchange rate distortion index or ERDI (see Figure 3) does seem to pick up the two steps (that is 1980 and 1984) in the post-1980 liberalisation; the black market premium falls sharply between 1979 and 1980 and falls further and sharply again between 1983 and 1984. Note also the re-emergence of the premium in the 1985–1988 period, a reversal which is not as evident from the

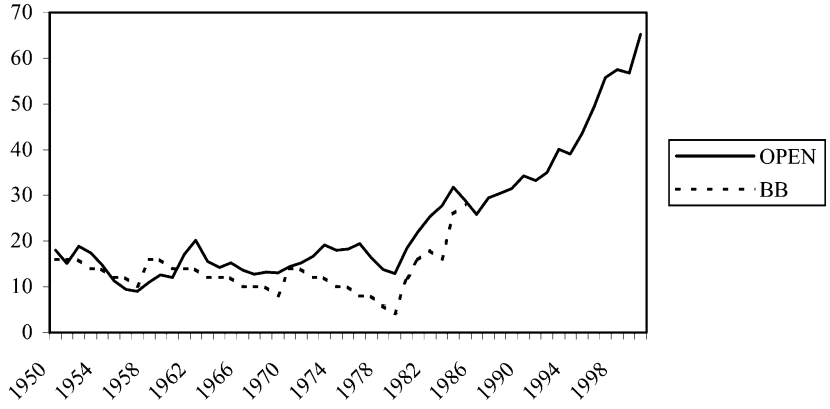

Figure 2. BB and Openness Indices (*Source*: BB is taken from Baysan and Blitzer (1991). Own calculation OPEN data taken from Penn-World Data and the calculation methodology is adopted from Penn-World data set Appendix).

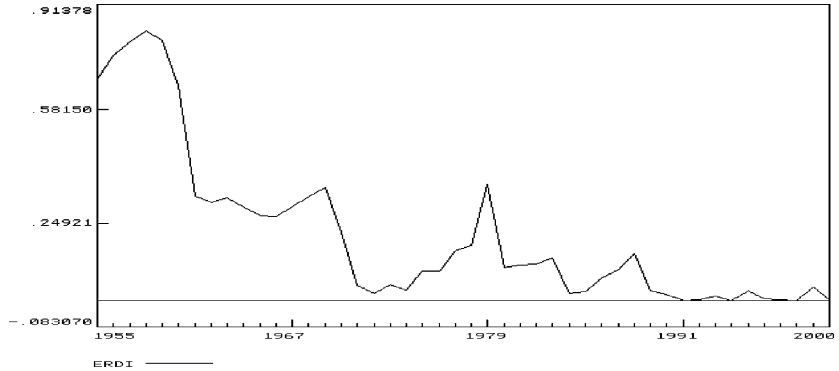

Figure 3. Exchange Rate Distortion Index (ERDI) for Turkey (*Source*: Own calculation ERDI data for official and black market rates are taken from World Currency Year Book. See Appendix 1 and 2 for further descriptions and method used about ERDI).

openness index. For the period (1955-1990), however, our two indices (ERDI and OPEN) correlate fairly closely (−0.68); the distortion index also captures the 1958 and 1970 temporary liberalisations fairly well. (The export and import volume indices, shown in Figure 4, also capture the transitory nature of the earlier liberalisation, but record a continuous liberalisation after 1980.) (Table I).

The consistency between openness and distortion indices and between these and the subjective index provided by Baysan and Blitzer is reassuring. If trade liberalisation does affect economic growth in the way hypothesised in

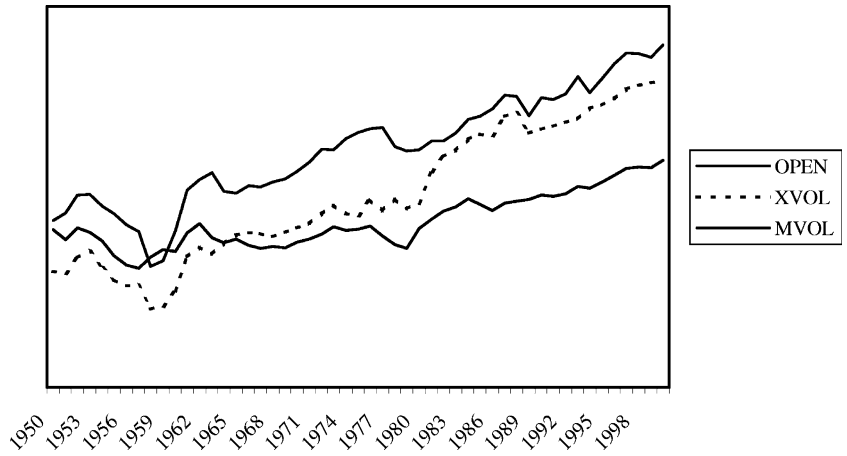

Figure 4. Export volume, import volume and Openness Indices for Turkey.[6]

Table I. Correlation between various openness indices

	BB	OPEN	ERDI	MVOL	XVOL
BB	1.0000	0.69628	−0.12593	0.29055	0.66969
OPEN	0.69628	1.0000	−0.69092	0.82406	0.95134
ERDI	−0.12593	−0.69092	1.0000	−0.81258	−0.59025
MVOL	0.29055	0.82406	−0.81258	1.0000	0.81244
XVOL	0.66969	0.95134	−0.59025	0.81244	1.0000

Section 2, then the indices appear to be sufficiently adequate measures of liberalisation to capture these growth effects in the subsequent econometric analysis.

5. Emperical findings and the data

In the light of the modern econometric methodology developed in recent years, we now apply co-integration analysis and Error Correction Models (ECM) to examine the relation between real GDP *per capita* and our openness index in Turkey. We examine two more relationships by replacing OPEN with our intervention index (i.e. exchange rate distortion index: ERDI) and volume of exports in Turkey using the same econometric methodology. We use annual data for the period 1950–2000 for our single equation multivariate cointegration analysis with ECM. In this multivariate case, the additional variables, in accordance with the 'endogenous' growth theory, are the measure of human capital (proxied by the secondary school enrolment rates) and the measure of physical capital proxied by real gross domestic investment (private and public) as percentage of real GDP *per capita*.[7] We use the natural logarithm of the relevant variables, thus their first differences reflect the rate of change of each variable.

We now examine the multivariate cointegration and causality issues among the variables considered by taking the 'new' growth theory and the modern econometric methodology into account. Accordingly, we include a measure of physical capital (PC) (i.e. real gross domestic investment as percent of real GDP *per capita*) and a measure of human capital (HC) in Turkey as additional explanatory variables in the cointegrating regression. We are mainly interested in analysing the following multivariate relationship:

$$\mathrm{YPC} = f(\mathrm{PC},\mathrm{HC},\mathrm{OPEN})$$

where YPC denotes the real GDP *per capita*.

Following the methodology for multivariate analysis in the standard econometrics literature, we now express this long-run relationship as a regression in natural logarithms:

$$\mathrm{LYPC}_t = \alpha_0 + \alpha_1 \mathrm{LPC}t + \alpha_2 \mathrm{LHC}t + \alpha_3 \mathrm{LOPEN}_t + \mu_t \tag{7}$$

where α_0 and μ_t are the intercept term and the residuals, respectively. The estimation of Equation (7) and the relevant standard Dickey–Fuller tests and the standard cointegration analyses confirm that the variables are $I\sim(1)$ and cointegrated. However it is well known that structural break may create spurious unit roots and this may affect integration–cointegration results. Therefore we first proceed the Zivot–Andrews unit root test and Gregory–Hansen cointegration test.

5.1. INTEGRATION (ZIVOT–ANDREWS) AND COINTEGRATION (GREGORY–HANSEN) WITH BREAK

The results of Zivot–Andrews (1992) test presented in Table II, report the minimum *t*-statistics and their corresponding break times. The results suggest that all the variables appear to be stationary in first differences, i.e. $I\sim(1)$. According to the results, there is a mean break at 1961 and a slope break at 1974.

Once the Zivot–Andrews test idendified the presence of a mean break at 1961 and a slope break at 1974, we test for cointegration with breaks using the methodology suggested by Gregory and Hansen (1996). This methodology examines the presence of cointegrated relationship under possible regime-shifts and suggests three different models. The results presented in Table III provide empirical support for the presence of a cointegration relationship. In particular, model C (mean model) reports that cointegration

Table II. Zivot-Andrews Unit root test

Variable	Model	Break Time	λ	α	K
LYPC	A	1961	0.235	−0.490 (−3.56)	1
	B	1974	0.490	−0.830 (−4.93)**	2
LPC	A	1961	0.235	−0.534 (−3.88)	2
	B	1974	0.490	−0.534 (−3.87)	2
LHC	A	1961	0.235	−0.092 (−1.60)	1
	B	1974	0.490	−0.431 (−4.65)**	1
LOPEN	A	1961	0.235	−0.256 (−3.15)	1
	B	1974	0.490	−0.405 (−3.81)	1

Notes: The numbers in parentheses are *t*-statistics. Number of lags in the modified unit root tests (k) was selected through the Akaike Information Criterion. Critical values were taken from Zivot and Andrews (1992, pp. 255–256). **denotes significance at 5% level.

Table III. Gregory–Hansen Cointegration test

Model	Statistics ADF*	Break Time
C	−6.24***	1961
C/T	−5.76**	1974

Notes: Critical values were obtained from Gregory and Hansen (1996, p.109).
ADF* = $\inf_{\tau \in \Gamma} Z_t(\tau)$. *** and **denotes significance at 1% and 5% level, respectively.

is present with a break point at 1961 while model C/T (slope model) indicates that cointegration is present with a break point at 1974.

5.2. UNIQUE COINTEGRATING VECTOR (JOHANSEN, VAR)

We now test if this is the only cointegrating vector or not by applying the Johansen ML VAR test procedure (Johansen, 1988). Our results confirm the unique cointegrating vector.[8] Relying on this evidence, we can reasonably be sure that we are estimating the unique cointegrating vector. It is also important to point out that in our empirical work we use different proxies for both openness/trade liberalisation, such as ERDI, XVOL, MVOL as defined earlier, to capture the different dimensions of the trade liberalisation. We then re-estimated cointegrating regressions. Different measures of trade liberalisation performed well, and results are available on request.

5.3. NUISANCE PARAMETERS (PHILLIPS–HANSEN), ENDOGENEITY (INDER), AND A COMPARISON OF DIFFERENT APPROACHES

However, the long-run OLS estimators are still biased if the explanatory variables are *not* weakly exogenous. Only if they are weakly exogenous can we assume away the 'endogeneity bias'. If not, an appropriate correction for OLS estimators will be necessary. Engle and Granger (1987) argue that a simple way to check the weak exogeneity of, say, explanatory variable X_t for the long run and short run parameters of interest is to estimate an ECM for X_t and test the statistical significance of the error correction term using a traditional t-test. If the t-statistics is significant, then X_t can no longer be treated as weakly exogenous. Our calculations show that LPC and LHC in Equation (7) are not weakly exogenous. Accordingly, we apply the fully modified ECM method to get the long-run estimators which are free from 'endogeneity' bias. Using the methodology suggested by Phillips and Hansen (1990) and ''the fully modified unrestricted ECM estimation'' by Inder (1993) to get the long-run estimators which are free from nuisance parameter effects and 'endogeneity' bias. Table IV reports the long-run estimates obtained by using different approaches. The results reported in Table IV suggest that our

Table IV. Estimates of our long-run relationship: a comparison of different approaches

Variable	Static EG OLS (Engle & Granger)	Fully Mod. Unr. ECM (Inder)	Fully Mod. OLS (Phillips & Hansen)	ML VAR (Johansen)	Dyn. OLS (Saikkonen)
LOPEN	0.10	0.13	0.16	0.13	0.19
LPC	0.11	0.15	0.13	0.22	0.06
LHC	0.29	0.26	0.25	0.22	0.25

long-run estimates are quite robust. For better comparison, we added the long-run estimates of the 'Johansen VAR maximum likelihood estimates' (Johansen, 1988) and 'the asymptotically efficient dynamic estimates' of the Saikkonen method (Saikkonen, 1991).

5.4. GRANGER CAUSALITY RESULTS WITH ERROR CORRECTION MODEL

To show the multivariate causal effect, we now apply the Granger causality test. Since, the EG OLS estimates were shown to be robust, the estimated lagged residuals may still be used in the ECM as the error-correction term. Table V shows the Granger causality test results from the ECM.

We have evidence that LPC, LHC and LOPEN Granger cause LYPC through two channels: first, they jointly Granger cause LYPC through the significant error correction term and second, each variable has a separate Granger cause effect (see the joint significance of the *F*-statistics in Table V). We have the long-run causal effect via the first channel while the second causal effect has a short-run character (Jones and Joulfaian, 1991).

5.5. ESTIMATION OF THE LONG-RUN RELATIONSHIP WITH BREAKS (STOCK-WATSON)

In this final step of the empirical work, we employ the methodology suggested by Stock and Watson (1993). The estimation is computed using OLS. Stock and Watson (1993) suggest that their long-run estimators (with breaks)

Table V. Granger causality test from error correction models: multivariate case

Dependent Variable	*t*-statistic for μ_{t-1}	*F*-Statistic for $\Sigma\Delta$LPC	*F*-Statistic for $\Sigma\Delta$LHC	*F*-Statistic for $\Sigma\Delta$LOPEN
ΔLYPC	−0.21**	7.65(3)***	3.45(1)**	6.78(1)***

Note: μ_{t-1} denotes the error correction term. Numbers in parentheses indicate the number of lags. Note that optimum number of lags are determined by applying general-to-specific methodology. Δ represent first differences.
***Significant at 1%; **significant at 5%.

Table VI. Stock-Watson OLS model with breaks[9]

$LYPC_t = \beta_0 + \beta_1 LOPEN_t + \beta_2 LPC_t + \beta_3 LHC_t + \beta_4 DU_t + \beta_5 S1_t + \beta_6 S2_t + \beta_7 S3_t + u_t$							
Parameter	β_1	β_2	β_3	β_4	β_5	β_6	β_7
	−0.075 (−1.62)*	0.185 (3.56)***	0.235 (5.72)*	−.0009 (2.68)*	0.127 (2.16)**	−.0101 (−1.65)*	0.187 2.18)**

Notes: The numbers in parantheses are the corresponding *t*-statistics. $DU_t = 0$ up to 1961 and 1 thereafter. $S1_t = 0$ up to 1974 and $S11_t$ *$LOPEN_t$ thereafter, with $S11_t = 0$ up to 1974 and 1 thereafter. $S2_t = 0$ up to 1974 and $S22_t$ *LPC_t thereafter, with $S22_t = 0$ up to 1974 and 1 thereafter. $S3_t = 0$ up to 1974 and $S33_t$ *LHC_t thereafter, with $S33_t = 0$ up to 1974 and 1 thereafter.
***Significant at 1%; **significant at 5%; *significant at 10%.

perform better compared to other asymptotically efficient estimators. Table VI reports the estimation results:

Results reported in Table VI suggest that the possible breaks in 1961 and 1974 are highly significant, i.e. the dummies β_4, β_5, β_6, β_7 have statistically significant *t*-statistics. Regarding their effects on the estimators, we have mixed evidence. For physical and human capital proxies, the estimated long-run coefficients are not only consistent with the earlier results computed by different long-run approaches (see Table IV) but also have significant *t*-statistics. However, the long-run parameter estimate for the openness variable, LOPEN, has a negative sign with relatively low *t*-statistic. This result is *not* in line with our earlier estimations from different methods. This result with the openness variable finds the sign of the variable to be negative and the relevant *t*-statistic turns out to be low when breaks are included. We have a possible explanation for negative sign of the openness variable: the negative sign may have resulted from the inclusion of the dummy variables in the regression.

6. Implications and conclusions

The analysis provides evidence to support the 'endogenous' growth theory for the Turkish case. The evidence indicates joint causality between the rate of growth of *per capita* income and a number of indicators of trade liberalisation or performance. A relationship between openness and growth is theoretically plausible, while a causal link from declining trade distortions to growth is also consistent with the hypothesised role of trade policy in the 'new' growth theory. Trade policy affects growth in both the short and long run. In the case of the long run, the effect is conditional upon or simultaneously (jointly) determined alongside both physical and human capital accumulation effects on growth. This evidence of a joint, long run effect of

trade policy and human capital on growth is particularly supportive of the 'new' growth models.

However, the policy change in the late 1980s and shocks in the 1990s might have caused instability in Turkish growth in the long-run. This is what we believe what might have happened since 1989, and in the 1990s: an unstable growth path with unsustainable deficits (external[10] and internal) and high inflation.[11] Indicators suggest that the sustainable increase in exports in the 1980s has not been sustained in the 1990s. The main factor in the export-oriented growth strategy is the requirement of sustainable increases in exports. The data, however, show that increases in imports have been sustained unlike exports, resulting in increasing and unsustainable trade deficits[12] in Turkey. The policy of persistent real depreciation until late 1988 has been an essential component of the high growth strategy Turkey opted for solving its debt problem. The spectacular growth of exports and outward orientation of the Turkish economy and expansion of production in tradables relative to nontradables are some of the achievements of the 1980 post-liberalisation period for which the exchange rate policy is to be credited for. Starting in late 1988, however, the Turkish government implicitly started to use the exchange rate as part of an anti-inflationary strategy. The major challenge for the new government is to put the macroeconomic balances in order, and to establish a credible strategy for achieving sustainable internal and external deficits with lower inflation in order to achieve sustainable economic growth.

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Appendix

A1. DATA SOURCES

The data used in this study are annual for the period of 1950–2000 and are taken from the following sources: openness indicator, OPEN, real GDP *per capita*, YPC and proxy for physical capital, PC are from Penn-World Tables.

Secondary school enrolment rates, i.e. proxy for human capital, XVOL and XVOL are from State Institute of Statistics (SIS). ERDI is from World Currency Yearbook.

A2. DEFINITIONS OF THE VARIABLES

YPC

Real GDP *per capita* of Turkey expressed in US dollars [source (vi)].

XVOL

Turkish exports of goods, volume index (1980 = 100) constructed on the basis of the formula XVOL = X$/PX$ where X$ where PX$ represent exports (fob) in US dollars and export price index in US dollar terms.

MVOL

Turkish imports of goods, volume index (1980 = 100) constructed on the basis of the formula MVOL = M$/PM$ where M$ where PM$ represent imports in US dollars and import price index in US dollar terms.

ERDI

Exchange rate distortion index of Turkey constructed on the basis of the formula ERDI = (BM$/OF$)/BM$ where BM$ and OF$ represent annual average black market and official exchange rates both expressed in Turkish Lira (TL) per US dollar. The ERDI, in this study, is used as a measure of 'intervention'.

OPEN

Openness index of Turkey [defined as [(exports + imports)/real GDP *per capita*] expressed in US dollars.

HC

Measure of human capital of Turkey proxied by secondary school enrolment rates: (number of students enrolled at secondary schools/total population).

PC

Measure of physical capital of Turkey proxied by real gross domestic investment (private and public) as percentage of real GDP *per capita*.

Notes

1. For technical details and the full treatment of the model see Grossman and Helpman (1991, 1996).
2. Examples Barro (1991), Levine and Renelt (1992).
3. See Appendix 1 and 2 for the descriptions of each index.
4. Exports plus imports relative to real GDP per head and taken from the Penn-World data set.
5. There is, in any case, some overlap between the alternative indices and the indices used here may also capture the effects of trade regime bias.
6. See Appendix 2 for the description of OPEN, XVOL, MVOL.
7. Data definitions, data sources and further information for YPC, OPEN, ERDI, XVOL, HC and PC are provided in Appendix 1.
8. For a comparison of long-run estimates by using different methods, see Table IV.
9. Results are validated irrespective of the choice of the break years, i.e. 1961 and 1974, 1976 and 1980, 1980 and 1989 or 1980 and 1994.
10. Real exports almost stagnated during the period.
11. The dynamics of the relationship merit further investigation.
12. Utkulu (1998) shows that there exists no long-run relationship between exports and imports, that is, growing (esp. in the 1990s) Turkish external deficits are not sustainable.

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