DOES TRADE POLICY MATTER IN AN ISOLATED ECONOMY? A CASE STUDY

1. Introduction

The main question of concern is whether foreign trade can have a driving role in a country's economic growth in small island economies (SIEs henceforth) or can foreign trade make an effective contribution to a country's economic growth in such economies? This nexus between trade policy and economic growth is an old and controversial issue for SIEs, which has long been of interest and has been empirically investigated in a number of recent studies in the literature. Aggregate economic growth in SIEs in the last two decades has indicated that some small countries achieved their own development objectives. They even created an economic miracle in their post independence in the early 1960s, despite their economies having been characterized by small size[1] and narrow resource base.

Notwithstanding special problems or characteristics in SIEs, they find themselves more concentrated on products in which they have a comparative advantage. In the last few decades, some small states have been important service centers in banking, financial and trade services such as Singapore, Hong Kong, Bahrain, Bermuda, Malta, Jersey and Cyprus (South). The tourism sector has also been a locomotive industry for some SIEs and the sole source to provide a comparative advantage. Bermuda is a good example in the sense that it has emerged as a tourism center, exploiting successfully the ability to take advantage of a favourable climate and location. The strategic location of small states also serves as an important factor for providing banking and financial services such as Cyprus (South) (see Bowe *et al.*, 1998)[2].

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[1] Small size is not always a constraint on economic growth and development for SIEs (see Mehmet and Tahiroglu, 2002).

[2] Streeten (1993) also mentions the importance of comparative advantages

The aim of this paper is to empirically investigate the role of trade policy on economic growth in North Cyprus (NC) over the period 1978Q1-2002Q4 in order to evaluate whether the NC economic growth during this period is better explained in an 'old' or 'new' growth modelling framework. The island of Cyprus was divided in two parts following Turkey's intervention in 1974 and Turkish Cypriots formed their own state in the Northern part of the island in 1975. However, this part is a non-recognized state and has political and economic relationships only with Turkey[3]. The main motivation in writing this paper lies in the fact that this kind of study has not been undertaken before on such an isolated economy. A dynamic, rigorous time-series investigation of the role of trade policy and the other variables such as human capital on the NC economic growth is the first of its kind to the best of our knowledge.

In economic growth studies, most authors assume that population (labour), physical, and human accumulations do not vary over time and consider that the relevant variables used under consideration are not stochastic variables. As a necessary fact, those factors should be assumed to vary over time and the steady-state path for output growth in an individual country should be considered as stochastic. A number of recent papers have empirically investigated economic growth from a cross-section regression point of view (see Baumol, 1986; Barro 1991; Mankiw *et al.*, 1992). On the other hand, physical and human capital accumulations as well as population influence the steady state level of *per capita* growth (or output) in the time series context (see Cellini, 1997). This situation allows us to apply multivariate co-integration techniques for analysing the growth model, which contains policy proxies.

Our empirical results such as Augmented Dickey-Fuller indicate that the variables embodied within the model is integrated of order one. This means that the old growth modelling framework (i.e. Solow model) can satisfy a co-integration relationship between the

in small state economies such as Mauritius: sugar production, tourism and export, Fiji: sugar and tourism, the Caribbean islands: tourism and banana, Malta: textiles and shipping, Lesotho and Botswana: mines (especially diamond), Taiwan: electronic industry, and Cyprus: tourism and financial services (i.e. off-shore banking).

[3] There exist currently more than 30 small states around the world lacking formal recognition from the international arena (Bartman, 1998).

variables under investigation. In the recent studies, Cellini (1997) is the only one who takes error correction mechanism as the main issue of neo-classical exogenous growth theory to investigate the short-run dynamics among others[4]. We therefore used an error correction model to capture the short-run dynamics in accordance with the modelling used in Cellini's paper (1997).

The rest of the study is organised as follows: section 2 provides a brief overview of the North Cyprus economy. Section 3 describes the modelling framework. In section 4 and 5, the model, data description, methodology, and the empirical results are presented respectively. Section 6 provides conclusions.

2. North Cyprus economy

The NC state is a non-recognized state with a considerably small economy and limited natural resources. Having a small internal market, NC is widely vulnerable to the external economic changes like the other SIEs. The political and economic isolation of the NC state created a substantial burden in terms of its foreign trade with countries around the world other than Turkey. At the beginning of foundation years, Turkish Cypriots suffered the lack of international assistance, and inexperience in managing the economy prior to 1974; most of the economy was controlled by Greek Cypriots.

NC adopts a liberal trade policy and conducts its trade relations with more than 60 countries over the world. The major trade partner of the country is Turkey and the U.K. (United Kingdom). The U.K. was the first major trading partner until 1994, in which a decision of European Court of Justice (ECJ) imposed restrictions on imports of the U.K. and the other European countries from NC. Nevertheless, the trade and tourism relations with EU were changed dramatically with the 1994 ECJ decision based on the Cyprus conflict. This forced NC to export its own goods via Turkey and has brought a great burden to NC's foreign trade and economy in general (Yesilada and Bicak, 1995).

[4] (see Knight *et al.*, 1993; Bernard and Durlauf, 1995; King *et al.*, 1991; Easterly *et al.*, 1993; Jones, 1995).

TABLE 1 - *Main Economic Indicators (Million US$)*

	1980	1985	1990	1995	2000
GDP	230.5	236.3	587.5	745.7	1037.6
GDP per capita (US $)	1540.9	1474.9	3427.5	4113.3	4967.4
Real GDP Growth rate (%)	0.9	7.5	5.7	2.6	-0.6
Exports	44.5	46.3	65.5	67.3	50.4
Imports	94.4	143	381.5	366.1	424.9
Trade Deficit (-)	49.9	96.7	316	298.8	374.5
Fixed capital formation	34.4	39.8	90.2	91.2	170.1

Source: Economic and Social Indicators, SPO, Nicosia, NC, 2002.

In Table 1, the foreign trade statistics illustrates a persistent trade deficit which rose from 49.9 million US$ in 1980 to 374.5 million US$ in 2000. There were huge declines in export from 67.3 million US$ to 50.4 million US$ especially to the U.K. and other European countries. Imports jumped from 94.9 million US$ in 1980 to 424.9 million US$ in 2000. The current account deficit however, was controlled partly by foreign aid from Turkey and partly by both growing tourist revenues and trade relations with European Union (EU), despite the exports of NCE received a major blow by EJC decision[5].

The NCE was also deteriorated by both Turkish military regime which happened in 1981 and the collapse of the multinational company Polly Peck International (PPI) in 1991. PPI invested in many sectors, i.e. fruit, exporting, newspapers, banking, clothing, and tourism. With PPI, however, NC attracted foreign capital to invest in technology; hence export-oriented activities were boosted over this period. This phenomenon was reflected in the gross fixed capital formation, which reached from 34.4 million US$ in 1980 to 90.2 million US$ in 1990. Since the collapse of the PPI in 1991, the cost to the NCE in terms of output and employment loss has been high indeed.

[5] In 2002, 37% of NC total exports went to Turkey and goods imported from the same country totalled 64.2 % (SPO, 2002).

3. Theoretical modelling. An extended version of the augmented Solow growth model

In this section, we analyze the impact of trade policy[6] along with physical and human capital investments on economic growth. Recently, many development economists' and researchers' attention has centered on the relationship between trade policy and economic growth in developing countries (see Tyler, 1981; Feder, 1982; Balassa, 1985; Ram, 1985; Dollar, 1992 and Edwards, 1992). In the light of the success experiences in the Asian NIC countries, the more outward economies tend to grow faster than the closed ones (see Edwards, 1993; Sengupta, 1991, 1993 and Greenaway and Sapsford, 1994). On the other hand, this issue has also been analyzed in the framework of endogenous growth models, which assume constant or increasing return to capital. In this framework, outward-oriented trade policies promote competition, encourage learning-by-doing, utilize positive externalities, and allow access to improved technology (see Romer, 1990; Grossman and Helpman, 1991a, 1991b and Aghion and Howitt, 1992).

Here, we adopt the frameworks introduced by Solow (1956) Mankiw *et al*. (1992), Knight *et al*. (1992 and 1993) and Ghura and Hadjimicheal (1996) to investigate the role of trade policy in economic growth.

Let us consider the following Cobb-Douglas production function:

$$Y_t = D_t^{\alpha} H_t^{\beta} (A_t L_t)^{1-\alpha-\beta} \tag{1}$$

where Y is real output, K is the stock of physical capital, H is the stock of human capital, L is the raw labor, A is a labor-augmenting factor reflecting the level of technology and efficiency in the economy and the subscript t indicates time.

We assume that $\alpha+\beta< 1$, so there are constant returns to factor inputs jointly and decreasing returns separately. Raw labor and labor-augmenting technology are assumed to grow according to the following functions:

$$L_t = L_0 e^{nt} \tag{2}$$

$$A_t = A_0 e^{gt+P\theta} \tag{3}$$

where n is the exogenous rate of growth of the labor force, g is the exogenous rate of technological progress, P is a vector of policy and the other factors that can affect the level of technology and efficiency

[6] The relevant literature is largely uninformative whether the policy proxies are appropriate for the measures of trade policy or trade volume (Rodriguez and Rodrik, 2000).

in the economy, and θ is a vector of coefficients related to this policy and other variables.

In this model, variable A depends on exogenous technological improvements, the degree of openness of the economy and the level of other variables such as public infrastructure. It is obvious that A in this study differs from A used by Mankiw *et al*. (1992). This modification is more likely to be particularly relevant to the empirical cases of economic growth in developing countries. In these countries, technological improvements are encouraged by using exports plus imports of capital goods and the level of infrastructure, which tend to increase the productive sector's efficiency (Knight *et al*., 1993).

Furthermore, in the steady state, output per worker grows at the constant rate g (the exogenous component of the growth rate of the efficiency variable A). This outcome can be obtained directly from the definition of output per effective worker as follows:

$$\frac{Y_t}{A_t L_t} = (k_t)^{\alpha} (h_t)^{\beta}$$

$$\frac{Y_t}{L_t} = A_t (k_t)^{\alpha} (h_t)^{\beta} \tag{4}$$

Let $y_t^* = \left(\frac{Y_t}{L_t}\right)^*$

Taking logs both sides of equation (4), we get equation (5):

$$\ln\left(\frac{Y}{L}\right)^* = \ln A + \alpha \ln k^* + \beta \ln h^* \qquad (t \text{ is omitted})$$

where $A_t = A_0 e^{(gt+P\theta)}$

$$\ln\left(\frac{Y}{L}\right)^* = \ln A_0 + gt + \theta \ln P + \frac{\alpha}{1-\alpha-\beta}\ln s^K + \frac{\beta}{1-\alpha-\beta}\ln s^H - \frac{\alpha+\beta}{1-\alpha-\beta}\ln(n+g+\delta) \tag{5}$$

Equation (5) indicates steady-state output per worker or labour productivity where a vector of policy and the other variables exist.

To determine the extended version of augmented Solow growth model, we need to find the transitional dynamics by using a log-linearization around the steady-state[7]. This gives the following growth equation:

[7] The linearization of the transition path around the steady state is derived in Knight *et al*.'s working paper (1992).

$$\ln y - \ln y(0) = g + \left(1 - e^{-\lambda t}\right)\Bigg[\ln A_0 + gt + \theta \ln P + \frac{\alpha}{1-\alpha-\beta}\ln s^K + \frac{\beta}{1-\alpha-\beta}\ln s^H - \frac{\alpha+\beta}{1-\alpha-\beta}\ln(n+g+\delta) - \ln y(0)\Bigg] \tag{6}$$

where P is a vector of policy and the other factors that can affect the level of technology and efficiency in the economy.

If we rearrange equation (6), we have the following equation, which indicates steady-state output per worker, or labour productivity evolving around the steady-state path.

$$\ln y_{t+1} - \ln y_t = g + \left(1 - e^{-\lambda_t}\right)\Bigg[\ln A_0 + gt + \theta \ln P + \frac{\alpha}{1-\alpha-\beta}\ln s_t^K + \frac{\beta}{1-\alpha-\beta}\ln s_t^H - \frac{\alpha+\beta}{1-\alpha-\beta}\ln(n_t + g + \delta) - \ln y_t\Bigg] \tag{7}$$

where $\lambda_t = (n_t + g + \delta)(1 - \alpha - \beta)$

According to the notion in Engel-Granger (1987) second step model, equation (7) can be expressed as follows, omitting the log notation:

$$\begin{aligned} \Delta y_t &= c + \mu\left[y - A_0 - A_1 P - A_2 T - A_3 s^K - A_4 s^H - A_5(n+g+\delta)\right]_{t-1} \\ \Delta y_t &= c + \mu\left[y - y^*\right]_{t-1} \end{aligned} \tag{8}$$

Equation (8) leads an error correction mechanism; we therefore, construct our modified ECM as follows:

$$\Delta \ln y_t = c_0 + \mu e_{t-1} + \sum_{i=0}^{m}\phi_i \Delta \ln s_{t-i}^K + \sum_{j=0}^{p}\eta_i \Delta \ln s_{t-j}^H + \sum_{k=0}^{r}\pi_i \Delta \ln(n_{t-k} + g + \delta) + \sum_{z=0}^{s}\delta_i \Delta \ln \mathrm{P}_{t-z} + \varepsilon_t \tag{9}$$

where *P* stands for a vector of policy and other factors that can influence the level of technology and efficiency in the economy.

4. The model, data and methodology

Empirical studies to analyse the impact of trade policy on economic growth rates have largely been undertaken on cross-country growth regression and much of the existing empirical literature is based on the Solow growth model. However, the literature has devoted very little attention to the effect of trade policy (or openness) on economic growth within the context of time series analysis. The modelling framework of this study is based on the Solow growth model by adding some policy variables (i.e. openness) within the time series context.

In the light of the modelling developed in the previous section, we apply co-integration analysis and Error Correction Mechanism (ECM henceforth) in the model represented by equation (10) to investigate both the long-run and short-run influences of trade policy on the economic growth rate of NC. We use *OP* (exports plus imports relative to GDP) as openness and *MTAR* (import duties relative to the value of imports) as trade policy proxies to examine the relationship between real GDP per worker and the policy proxies. The long-run relationship is investigated using multivariate cointegration techniques, while the short-run dynamics are captured within an error correction modelling (ECM) framework.

First, we apply integration and cointegration tests in the Engle Granger (EG henceforth) sense (Engle and Granger, 1987) to the following multivariate growth model for the NCE over the period 1978Q1-2002Q4.

$$LCAP_t=a_0+a_1T+a_2LKR_t+a_3LHR_t+a_4LNGD_t+a_5VPV_t+a_6VD_t+u_t \quad (10)$$

where $LCAP_t$ is GDP per worker at constant prices of 1977, (million Turkish Lira)[8]; LKR_t is the real gross domestic fixed capital formation to GDP ratio at constant prices of 1977 (mn T.L.); LHR_t is measure of human capital proxied by number of post-secondary institutes to the total number of workers. These institutes include vocational, technical, commercial and tourism institutes which are below the university degree level. LNGD is the empirical counterpart of log $(n+g+\delta)$. That is the log of the sum of labour growth rate plus the estimation of technological progress rate plus the depreciation rate ($g+\delta=0.05$ is assumed)[9]. LOP_t is the openness index of the NCE defined as real exports plus real imports relative to real GDP expressed in million T.L. at constant prices of 1977 and the other index ($LMTAR_t$) for trade policy used in this study is import tariffs which is defined as the ratio of imports duties to the value of imports expressed in million T.L. at constant price of 1977. VD is a vector of dummy variables which contains D91 and D81 respectively. The former takes the value of one for both Gulf and Polly Peck crises in 1991 and zero otherwise. The latter captures the effects of coup (i.e., may capture the effects of the military take over) in Turkey

[8] In the existing literature, it is believed that GDP per worker has more explanatory power than GDP *per capita* because it reflects working population rather than whole population.

[9] We follow Mankiw *et al*. (1992) in assuming that $g+\delta$ is equal to 0.05.

taking the value of one for 1981 and zero otherwise; u_t is serially uncorrelated with zero mean and constant variance disturbance and L denotes the natural logarithm[10].

The Augmented Dickey-Fuller (ADF henceforth, 1979) and the residual based ADF tests are utilised respectively to test the integration level of each variable and the possible cointegration between the variables. In order to examine the type of trend (i.e. stochastic or deterministic) in a time series, we apply the Dickey-Fuller LR joint test (or F-test) (see Dickey and Fuller, 1981). We then employ Perron's additive outlier test to analyse the existence of any (exogenous) outlier. In other words, we test whether the order of integration is changed by potential breaks (see Perron, 1990).

On account of the results estimated by the Engle-Granger (1987) and the Johansen (1988) co-integrating procedures, we use the Johansen (1990) method to test a number of restrictions on the estimated coefficients of the relevant factors of production after normalising the coefficient on output to -1.

Before going one step further to model an ECM, we check our explanatory variables to see if they are weakly exogenous or not by using Engle-Hendry-Richard (EHR) framework. We then conduct an error correction mechanism (ECM) estimated by ordinary least square (OLS) and derive the ECM using the residuals from the co-integrating regression equation (10) for the short-run relationship among the variables embodied within equation (11).

Thus,

$$\Delta LCAP_t = a_0 + a_1 u_{t-1} + \sum_{i=0}^{m} a_i \Delta LKR_{t-i} + \sum_{j=0}^{p} a_j \Delta LHR_{t-j} + \sum_{k=0}^{r} a_k \Delta LNGD_{t-k} + \sum_{z=0}^{s} a_z \Delta LP_{t-z} + \sum_{l=0}^{v} a_l \Delta D_{t-l} + \varepsilon_t \qquad (11)$$

where

Δ denotes the first difference operator, L is natural logarithms, U_{t-1} is the lagged estimated residual from equation (10), P is a vector of policy and the other factors that can affect the level of technology and efficiency in an economy, D is the vector of Dummy variables and other variables are defined in equation (10).

Finally, we employed three different methods: namely, the Engle and Yoo (1991) three-step correction method, the Inder (1993) fully

[10] The data are provided by the State Planning Organisation (SPO), Nicosia, NC, 2002.

modified error correction method and the Saikkonen (1991) time domain correction method to obtain unbiased long-run elasticity estimates to confirm the results estimated by the EG cointegration procedure.

5. Empirical results[11]

Before we estimate long-run relationship, we first investigate the stationarity properties of the policy variables employing the ADF unit root test. The sequential testing results in table 1a (see appendix) confirm that the policy proxies, namely LCAP, LKR, LHR, LNGD, LOP, and LMTAR are non-stationary in levels but stationary in differences. This situation is denoted as LCAP ~ I(1), LKR ~ I(1), LHR ~ I(1), LNGD ~ I(1), LOP ~ I(1), and LMTAR ~ I(1).

Following the LR joint test (Dickey-Fuller, 1981 and Maddala, 1992), we check the type of trend of the policy variables whether they are characterised by stochastic or deterministic trends. Table 2 (see appendix) suggests that the test statistics, (i.e. 2.84, 6.27, and 2.85) imply a different stationary (DS) dominant mixed process.

The results in tables 1 and 2 are validated by applying the Perron test (AOM) because of the structural change occurring in both 1981 and 1991. Table 3 (see appendix) suggests that there is no 'spurious unit root' resulting from changing means as far as the technique is concerned.

There are a number of criticisms to the potential endogeneity of the measure for openness (or trade policy) proxies within a growth regression. In this context, Grossman and Helpman (1995) point out that trade policy itself is not free of endogeneity problems. Proudman and Redding (1997) also emphasize that the choice of the appropriate measure of openness (i.e. exports plus imports to GDP) is likely to be endogenous and it may be true for a measure of trade policy (i.e. imports tariffs). However, it is possible to use econometric techniques to minimize any potential biases (see Proudman and Redding 1997). Hence, we use a procedure to investigate if the policy variables are weakly exogenous (or endogenous). Table 4 (see appendix) reports the weak exogeneity test results estimated by the EHR framework. Our calculations illustrate that LOP and LMTAR are weakly exogenous (for applications of this test, see Ghatak *et al.*, 1995).

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[11] All our empirical tests have been carried out by Microfit 4.0 Wv (Pesaran and Pesaran, 1997).

In accordance with the estimated results so far, all variables used in this paper are stationary and weakly exogenous (i.e. except output). This is a necessary condition for the variables to be cointegrated and placed on the right hand side of the model represented by equation (10). Tables 5 and 6 (see appendix) show that the residual based ADF test results for cointegration appear to be conclusive with the dummy variables[12] used for the years 1981 and 1991. However, the policy variables embodied in the model represented by equation (10) are statistically significant with incorrect signs at the conventional levels. In other words, the coefficients of openness and trade policy proxies (namely, LOP and LMTAR) do not seem to be consistent with the predictions of the model. The negative sign of the openness proxy and the positive sign of trade policy proxy indicate the inability of the NCE to gain access to the world trade market due to its political isolation[13].

The results above indicate that our model may not be correctly specified[14] because of the incorrect signs; however we would like to make sure that this situation is confirmed by the other techniques employed in this paper. We therefore, continue to test a unique vector assumption by using the Johansen (1988) procedure.

Table 7 (see appendix) confirms that there is a unique co-integrating vector among the variables for both models when the Reimers (1992) method[15] is applied. In actual fact, the trace statistics indicate two co-integrating vectors among the variables.

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[12] Without the dummies, a co-integration relation between variables was not established. This situation provides a justification for the inclusion of the dummy variables for the models (see Jackson *et al.*, 1999).

[13] Due to the lack of international recognition and the imposition of trade embargoes, it has been difficult for the NC economy to develop its trade relations with the rest of the world. Under this situation, NC's main trade relation is very limited with Turkey. See also Ghatak and Fethi (1999) for a similar comment.

[14] We are in a situation to conclude that the extended version of augmented Solow growth model may not be justified compared with the augmented Solow growth model.

[15] Reimers (1992) finds that the Johansen procedure over-rejects when the null-hypothesis is true in the case of small samples. Thus he suggests that (T-P) version is the corrected statistics for the small samples and this can be corrected by using (T-P) log $(1-\lambda_i)$ rather than T log $(1-\lambda_i)$. In this test, p=nk takes account of the number of estimated parameters and T is the number of usable observations. (See also Doornik and Henry, 1994, p. 278, Banerjee *et al.*, 1993, p. 286 and Walter, 1995, p. 391).

One can ask whether adding variables to the augmented Solow growth model are consistent in terms of number of co-integrating vectors among the variables when the Johansen (1988)[16] and the Reimers (1992) methods are applied. However, one co-integrating vector is still found when we add other two variables compared with the earlier results found in the relevant empirical literature (See Cellini, 1997 and Knight *et al.*, 1993). The current results are still consistent because the additional variables, LOP and LMTAR, are statistically significant at conventional levels but they have incorrect sign (for a similar comment, see also Ghatak and Fethi, 1999).

Table 8 (see appendix) also reports the results which are based on the uniqueness assumption that all of the estimated coefficients, after normalising the output to -1, have the expected signs and a slightly different magnitude compared with the reported coefficients on the variables when the EG co-integration procedure is applied.

Table 9 (see appendix) shows the results for both models in favour of exogenous growth modelling[17] rather than endogenous growth modelling, notwithstanding the fact that the variables LOP and LMTAR are incorrectly statistically significant at the conventional levels. This view is supported by Romer (1993) who argues Mauritius' success which is explained by an 'old' rather than 'new' growth modelling perspective.

One drawback of the Engle-Granger approach is that estimates of the static co-integration regression may be biased and statistical inferences cannot be drawn on the t-statistics (i.e. they might not

[16] It is worth emphasising that the residual-based tests of a single co-integrating regression and system-based tests are grounded in different econometric methodologies. Charemza and Deadman (1997, p. 178) suggest that the Johansen method can be used for single equation modelling as a supplementary tool (or auxiliary tool). In this case, as pointed out by Charemza and Deadman this could be regarded as a confirmation of the single equation method to which the Engle-Granger method was employed.

[17] In order to test the equation (10) whether it is exogenous growth modelling or not, we put the restriction whether the sum of the coefficients is unity. Sala-i-Martin (1990) argues that *"in order to have endogenous growth model, there must be constant returns to the factors that can be accumulated"*. Mankiw *et al*. (1992) also point out that *"our model with physical and human capital would become an endogenous-growth model if* $\alpha + \beta = 1$*"*. In the light of this information, we have the restriction that the sum of the coefficients on LKR, LHR and LNGD for equation (10) is unity cannot be accepted. Table 9 shows model in favour of exogenous growth modelling rather than endogenous growth modelling (see also Coe and Moghadam, 1993).

be valid) because of non-normality of the distribution. This can be corrected through the Engle-Yoo (EY) three step procedures (Engle *et al.*, 1991). As can be seen from table 10 (see appendix), our results indicate the estimates obtained from the EY three step procedure; the policy proxy variables (LOP and LMTAR) are found to be significant with incorrect signs and these confirm the estimated results when the EG co-integration test is applied. In the same table, the results estimated by the Saikkonen and the Inder approaches are not different from the EY three step procedure (for applications of these tests, see Ghatak and Wheatley Price, 1997).

Since the series are found to be cointegrated, we use an ECM to test the existence of short-run movements in output per worker with regard to the extended version of the augmented Solow model (equation 11). The reason for carrying on is that the policy proxy variables might have a short-run effect. The results of the dynamic models are presented in table 11 (see appendix).

For both models, the error correction term's coefficient is negative and significant at the 1% level. The magnitudes of the corresponding coefficients show that 86% and 81% of last period's disequilibrium are corrected after one year. This implies that output adjusts to its equilibrium level quickly and the error correction terms provide further evidence that the variables in the equilibrium regression are co-integrated. However, the estimates for both models in table 11 confirm the earlier findings that policy variables LOP and LMTAR are significant with incorrect signs but they seem to be inconsistent with the assumptions that a country's trade policy always increases its openness to international trade due to trade embargoes imposed onto the NCE.

6. Conclusion

In this paper we have derived an extended version of the augmented Solow growth model and investigated the role of trade policy (openness) along with physical capital, human capital and labour force on economic growth of the NCE over the period 1978Q1 and 2002Q4.

The estimated results indicate that the variables are (or stochastic-deterministic) with unit roots (i.e. the relevant variables are integrated of order one), whereas the current and steady-state level of output must be stationary. This shows the model that contains the policy proxies can be investigated by using multivariate time series techniques for both the long-run and the short-run.

The empirical results also verify the view that physical capital, human capital and labour force have both the long-term and the short-term effects in which trade policy proxies have a perverse effect on economic growth due to political and economic isolation. This accords well with the prediction of the augmented Solow growth model rather than the extended version.

In an ultimate conclusion, our findings confirm that economic growth for the NCE is not fuelled by trade policy or openness factor. Consequently, further investigation is required to find out what other factors can better stimulate economic growth in the case of NCE.

7. Policy implications

Formulation of an economic policy package that is conducive to economic growth has always been the major concern of policy makers. Policy makers can select an appropriate policy or policies among alternative policy options based on empirical evidence. In our study on the North Cyprus economy, we can derive a number of policy implications that may help to improve the performance of the economies. We are aware of the fact that aggregate analysis cannot be used in policy formulation at the micro level but it definitely provides a general guidance in formulation of macroeconomic policies.

The findings of the study can be summarized as such: human capital, physical capital and labour are found to be closely related to the output growth of the economy. The empirical evidence[18] given carries a number of important economic policy implications that can be taken into consideration by policy makers as guidance in formulation of future economic policies.

First, considering trade policy proxies that have a perverse effect on economic growth, investment in tourism sector could play an important role in economic growth since physical investment[19] has positive impact on economic growth.

[18] Ghura and Hadjimichael (1996) use an extended version of the augmented Solow growth model and suggest a number of important policy implications that can be taken by policy makers for Sub-Saharan countries.

[19] Small island economies usually have tourism type of investment rather than other types of investment. Kammes and Salehi-Esfahani (1992) point out that tourism led to a major boom in the construction industry on Cyprus island.

Second, human capital proxy has remarkable influence on economic growth; therefore, the government education policy may be formulated to provide the high skilled labour needed for high-tech (i.e. high skill services such as financial sector, universities, tourism, banking, computer programming and software design).

And third, as increase in total investment promotes growth, the government should encourage not only government sector but also private sector development.

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ABSTRACT

This study empirically investigates the role of trade policy along with physical capital, human capital and labour force on economic growth in an isolated economy (i.e. North Cyprus). We use a sample of quarterly and seasonally adjusted data covering the period 1978Q1-2002Q4 to evaluate whether the North Cyprus economic growth during this period is better explained in an 'old' or 'new' growth modelling framework. Multivariate co-integration techniques are applied to test the validity of our model and the relative importance of different variables which may have an impact on both the long-run and the short-run growth of the North Cyprus economy (NCE henceforth). The empirical findings show that physical and human capital investments as well as labour force are the major causes of growth in the NCE, whereas the indices of trade policy proxies have a perverse effect on economic growth due to the peculiar economic and political position of North Cyprus.

Keywords: Exogenous and Endogenous Growth; North Cyprus; Co-integration Tests

JEL Classification: F31; F32; O11; O53

RIASSUNTO

La politica commerciale è importante in un'economia isolata? Analisi di un caso

Questo studio analizza empiricamente il ruolo svolto dalla politica commerciale, dal capitale, sia fisico che umano, e dalla forza lavoro nella crescita di un'economia isolata (l'economia Nord Cipriota, NCE). Si utilizza un campione di dati trimestrale/stagionale, che copre il periodo 1978Q1-2002Q4, per valutare se sia meglio interpretare la crescita di NCE secondo un modello di crescita "new" o "old". Sono state applicate tecniche di co-integrazione multivariate per verificare la validità del modello e l'importanza relativa di diverse variabili che possono avere un impatto sulla crescita di NCE, sia nel breve che nel lungo periodo. I risultati indicano che investimenti di capitale, fisico e umano, e la forza lavoro sono i maggiori fattori della crescita economica, mentre gli indicatori della politica commerciale hanno un effetto perverso sulla crescita stessa, a causa della peculiare posizione economico-politica di NCE.

APPENDIX

Table 1 - *Model Results*

ADF (Augmented Dickey-Fuller) Test for Unit Roots

Variables	Test statistics & Critical Values				Integration levels
	Levels		1st differences		
	ADF	C.V.(5%)	ADF	C.V.(5%)	
$LCAP_t$	-0.93 (0)	-2.89	-4.52 (0)	-2.89	I(1)
LKR_t	-2.67 (0)	-2.89	-4.81 (1)	-2.89	I(1)
LHR_t	-1.40 (1)	-2.89	-3.64 (0)	-2.89	I(1)
$LNGD_t$	-2.64 (0)	-3.61	-4.41 (0)	-3.45	I(1)
LOP_t	-0.54(0)	-2.89	-4.33(0)	-2.89	I(1)
$LTAR_t$	-0.73(0)	-2.89	-6.87(0)	-2.89	I(1)

Note: the corresponding critical values for 100 numbers of observations at 5% significance levels are obtained from Mackinnon (1991) and reported by MFIT 4.0. It is worth noting that the intercept terms are in the ADF equations. The numbers in the parenthesis indicate that zero, one and three augmentations are necessary to be sufficient to secure lack of auto-correlation of the error terms regarding the variables. We chose the Schwarz Bayesian Criterion to determine ADF values.

Table 2 - *Model Results*

DF Likelihood Ratio (LR) Joint Test for DSP vs. SP

Variables	Test Statistics	Critical Value
		5% (n=100)
$LCAP_t$	1.56	6.49
LKR_t	3.92	6.49
LHR_t	2.14	6.49
$LNGD_t$	2.45	6.49
LOP_t	4.93	6.49
$LTAR_t$	3.46	6.49

Note: the corresponding critical value obtained from Dickey and Fuller (1981, p. 1063, Table VI) for 100 number of observations. In all cases, an augmentation of one appeared to be sufficient to secure lack of auto correlation of the error terms.

TABLE 3 - *Model Results*

Perron Unit Root Test for Structural Break

Variables	Break Years	Test Statistics		Critical Value and Lambda
		Levels	1st Differences	(5%); λ_1=0.1; λ_2=0.5
$LCAP_t$	1981and1991	-1.61;-1.43	-7.51; -7.06	-3.16; -3.44
LKR_t	1981and1991	-0.21; -0.72	-9.11; -9.36	-3.16; -3.44
LHR_t	1981and1991	-0.22; -1.90	-6.65; -5.55	-3.16; -3.44
$LNGD_t$	1981and1991	-1.99; -1.86	-7.89; -7.51	-3.16; -3.44
LOP_t	1981and1991	-0.46; -0.81	-9.21; -9.67	-3.16; -3.44
$LTAR_t$	1981and1991	-0.11; -0.82	-10.52; -10.71	-3.16; -3.44

Note: we use the critical value reported by Rybinski (1994) instead of the original critical value reported by Perron. The corresponding break fraction for 100 number of observations are calculated easily with $\lambda = (T_b/T)$ (See Perron and Vogelsang, 1992). For 1981(1) and 1991(1), the relevant break year fractions are λ = 13/100=0.1 (-3.16) and λ = 53/100=0.5 (-3.44) respectively. In all cases, no augmentation appeared to be sufficient to secure lack of auto-correlation of the error terms.

TABLE 4 - *Model Results*

Testing for Weak Exogeneity Using Engle and Hendry and Richard (EHR) Framework

Variable	Test For Weak exogeneity (EHR)	
	t-statistics	Conclusion
LKR_t	F(1,86) = 0.57[0.45]	accept
LHR_t	F(1,86) = 0.81[0.37]	accept
$LNGD_t$	F(1,86) = 0.19[0.66]	accept
LOP_t	F(1,86) = 0.11[0.75]	accept
$LTAR_t$	F(1,86) = 1.62[0.21]	accept

Note: table 4 indicates the results that the hypothesis of weak exogeneity can not be rejected at both 5% and 10% level for explanatory variables under the study. The tabulated test statistics of F test are F (1, 86) = 2.77; 3.96 at the 10% and 5% significance level respectively.

Table 5 - *Model Results*

The Residual-based ADF Test for Co-integration

Co integration Regression	R^2	$\bar{R}^2$	CRDW	Calculated ADF residuals	Critical Value
					Mackinnon (10%)
LCAP= f (LKR LHR LNGD LOP D81 D91)	0.89	0.88	1.64	-4.46(3)	-4.31
LCAP= f (LKR LHR LNGD LTAR D81 D91)	0.88	0.87	1.63	-4.33(3)	-4.31

Note: the reported critical value is obtained from Mackinnon (1991) and reported by MFIT 4.0 (windows version). The numbers in parentheses indicate number of lags which were chosen by the Schwarz Bayesian Criterion. This means that one augmentation is necessary to be sufficient to secure lack of auto-correlation of the error terms for the relevant co-integration regression.

Table 6 - *Model Results*

Engle-Granger Static Long-run Regression

Explanatory Variables	Dependent Variable: $LCAP_t$	
	MODEL with OP	MODEL with TAR
C	0.29 (1.73)*	0.51 (2.51)
T	0.01 (7.48)	0.01 (5.25)
LKR_t	0.11 (1.82)*	0.09 (1.65)*
LHR_t	0.45 (6.25)	0.33 (4.44)
$LNGD_t$	-0.10 (-2.07)	-0.10 (-1.68)*
LOP_t	-0.17 (-4.45)	
$LMTAR_t$	-	0.14 (3.53)
D81	-0.05 (-2.09)	-0.06 (-2.51)
D91	-0.12 (-4.72)	-0.08 (-3.32)
R^2	0.89	0.88
$\bar{R}^2$	0.88	0.87
CRDW	1.64	1.63
ADF*	-4.46	-3.33
C.V.	-4.31	-4.31
SER	0.026	0.029
χ^2_{SC}	0.18 (prob=0.67)	1.12 (prob=0.29)
χ^2_{FF}	0.22 (prob=0.63)	0.57 (prob=0.44)
χ^2_{NORM}	1.17 (prob=0.55)	0.49 (prob=0.78)
χ^2_{HET}	1.25 (prob=0.26)	111 (prob=0.28)

Note: t-statistics are in parentheses and all diagnostics pass at 5% level of significance. * shows that the relevant variables are significant at 10% level. It is worth emphasizing that CRDW and CV are the cointegration Durbin-Watson statistics and the critical value for cointegration respectively. ADF* means three augmentations are necessary to remove autocorrelation from the error terms.

TABLE 7 - *Model Results*

Johansen Maximum Likelihood (ML) procedure

Co-integration likelihood Ratio (LR) Test to determine the number of co integration vectors (r) based on Maximal Eigen Value of Stochastic Matrix, Trace of the stochastic matrix and the (T-P) version is for the small sample suggested by Reimers (1992).

Cointegration Regression	H_0	H_1	λ_{max}	λ_{max} (T-P)	C.V. at 5%	λ_{Trace}	λ_{Trace} (T-P)	C.V. at 5%
LCAP= f (LKR LHR LNGD LOP) exogeneous: D81, D91	r = 0	r = 1	77.48	73.60	37.07	147.82	140.5	82.23
	r <= 1	r = 2	27.11	25.75	31.00	70.34	56.50	58.93
	r <= 2	r = 3	24.35	23.13	26.25	39.33	37.36	43.23
	r <= 3	r = 4	15.67	14.88	18.33	16.97	16.12	23.83
	r <= 4	r = 5	1.31	1.24	11.54	1.31	1.24	11.54
LCAP= f (LKR LHR LNGD LTAR) exogeneous: D81, D91	r = 0	r = 1	74.52	70.79	37.07	133.72	127.1	82.23
	r <= 1	r = 2	29.99	28.49	31.00	59.19	56.23	58.93
	r <= 2	r = 3	15.38	14.61	24.35	29.20	27.74	39.33
	r <= 3	r = 4	12.87	12.22	18.33	13.82	13.12	23.83
	r <= 4	r = 5	0.94	0.89	11.54	0.94	0.89	11.54

Note: r indicates the number of co integrating relationships. λ_{max} is the maximum eigen value statistics, λ_{trace} is the trace statistics. The (T-P) version is the corrected statistics for small samples suggested by Reimers (1992). Var2, based on SBC is used in the Johansen procedure and unrestricted intercepts and unrestricted trends in the VAR model are not rejected in all cases. D81 and D91 are considered as exogenous I(0) variables. The critical values are obtained from Osterwald-Lenum (1992).

TABLE 8 - *Model Results*

The Johansen Method

Coefficient in the long-run cointegration relationship between LCAP (output) and its determinants: coefficients normalised on output to -1.

Regression: LCAP= f (LKR LHR LNGD LOP D81 D91)				
Variables	LKR_t	LHR_t	$LNGD_t$	LOP_t
Coefficients	0.12	0.41	-0.13	-0.15
Regression: LCAP= f (LKR LHR LNGD LTAR D81 D91)				
Variables	LKR_t	LHR_t	$LNGD_t$	$LMTAR_t$
Coefficient	0.10	0.30	-0.15	0.12

Note: Table 8 reports the unique cointegrating vector for the relevant variables obtained after normalizing the coefficient of: $LCAP_t$ (output) to -1.

TABLE 9 - *Model Results*

Tests of Parameter Restrictions: Johansen's Method

Regression: LCAP= f (LKR LHR LNGD LOP D81 D91)		
Parameter Restrictions	Chi-squared test statistics	Critical value at 5% level
$a_1 + a_2 + a_3 = 1.0$	45.59(1)*	3.84
Regression: LCAP= f (LKR LHR LNGD LTAR D81 D91)		
$a_1 + a_2 + a_3 = 1.0$	33.91(1)*	3.84

Note: table 9 indicates the results of the co integrating vector reported in table 7 for a number of restrictions on the estimated coefficients of the relevant variables. * shows that χ^2-test rejects the null hypothesis that sum of the coefficients is equal to 1, for the equation mentioned above.

TABLE 10 - *Model Results*

Elasticity Estimates

Elasticity estimates of multivariate long-run relationship:
A comparison of different approaches:

MODEL WITH LOP				
Variables	Static OLS (Engle-Granger)	Engle-Yoo Three step corrected values	OLS with time domain correction (Saikkonen)	Fully modified ECM (Inder)
C	0.29 (1.73)*	0.19 (1.67)*	0.17 (1.69)*	0.18 (1.68)*
T	0.01 (7.48)	0.04 (6.67)	0.05 (6.80)	0.04 (7.04)
LKR_t	0.11 (1.82)*	0.12 (1.74)*	0.13 (1.66)*	0.12 (1.83)*
LHR_t	0.45 (6.25)	0.43 (4.96)	0.41 (4.11)	0.44 (4.71)
$LNGD_t$	-0.10 (-2.07)	-0.11 (-1.98)	-0.12 (-2.10)	-0.14 (-2.12)
LOP_t	-0.17 (-4.45)	-0.19 (-3.75)	-0.15 (-2.99)	-0.16 (-2.39)
D81	-0.05 (-2.09)	-0.02 (-2.06)	-0.03 (-2.12)	-0.04 (-2.08)
D91	-0.12 (-4.72)	-0.13 (-3.02)	-0.11 (-3.04)	-0.14 (-3.17)
MODEL WITH LTAR				
C	0.51 (2.51)	0.49 (2.37)	0.52 (2.30)	0.43 (2.23)
T	0.01 (5.25)	0.04 (4.14)	0.03 (5.34)	0.05 (5.50)
LKR_t	0.09 (1.65)*	0.12 (1.68)*	0.10 (1.71)*	0.13 (1.74)*
LHR_t	0.33 (4.44)	0.26 (3.32)	0.29 (3.75)	0.28 (3.48)
$LNGD_t$	-0.10 (-1.68)*	-0.13 (-1.72)*	-0.12 (-1.85)*	-0.14 (-1.78)*
$LTAR_t$	0.14 (3.53)	0.10 (2.78)	0.12 (2.69)	0.13 (2.49)
D81	-0.06 (-2.51)	-0.08 (-2.32)	-0.07 (-2.41)	-0.09 (-2.35)
D91	-0.08 (-3.32)	-0.10 (-2.16)	-0.09 (-2.72)	-0.11 (-2.30)

Note: different approaches have been run on the relevant regressions above and t-values are shown in parenthesis. * indicates that they are significant at 10% level and the rest are significant at conventional levels (5% and 1%).

Table 11 - *Model Results*

Error Correction Modelling: Short-run dynamics

Explanatory Variables	Dependent Variable: $\Delta LCAP_t$	
	Model with LOP	Model with LTAR
C	0.05 (1.99)	0.05 (1.98)
ECT(-1)	-0.79 (-4.31)	-0.73 (-3.21)
ΔLKR_t	0.11 (2.56)	0.10 (2.34)
ΔLHR_t	0.21 (2.34)	0.12 (2.19)
$\Delta LNGD_t$	-0.10 (-3.11)	-0.09 (-2.51)
ΔLOP_t	-0.18 (-3.87)	-
$\Delta LMTAR_t$	-	0.11 (3.26)
$\Delta D81_t$	-0.09 (-2.86)	-0.08 (-2.53)
$\Delta D91_t$	-0.12 (-6.29)	-0.10 (-4.79)
R^2	0.86	0.81
$\bar{R}^2$	0.79	0.72
DW	1.67	1.66
SER	0.021	0.023
χ^2_{SC}	0.11 (prob=0.73)	0.69 (prob=0.41)
χ^2_{FF}	2.20 (prob=0.13)	0.46 (prob=0.49)
χ^2_{NORM}	0.15 (prob=0.92)	0.06 (prob=0.97)
χ^2_{HET}	0.07 (prob=0.79)	0.04 (prob=0.84)

Note: t-statistics are in the parentheses and all diagnostics pass at 5% level of significance. It is worth noting that the unreported diagnostics suggest no evidence of misspecification at the 5% level of significance.