The Validity of the ELG Hypothesis in the MENA Region: Cointegration and Error Correction Model Analysis

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2001

Export-led Growth:
Empirical Evidence from the MENA Region

Summary

The paper examines the export-led growth (ELG) hypothesis for nine Middle East and North Africa (MENA) countries in three-variable vector autoregressive and error correction models. When considering total exports, our results reject the ELG hypothesis in almost all of the countries examined. However, when considering only manufactured exports, we find no causality for countries with relatively low shares of manufactured exports in total merchandise exports and a bidirectional causality for countries with relatively high shares. The findings suggest that promoting exports may contribute to economic growth only after a certain threshold of manufactured exports has been reached.

Keywords: ELG, MENA, Middle East and North Africa, economic growth, export promotion, Granger causality.

1. INTRODUCTION

Many studies have sought to test empirically the hypothesis that export promotion strategies accelerate the pace of economic growth, what has become known as the export-led growth (ELG) hypothesis.[1] Early work on the ELG hypothesis generally affirmed its validity because the export variable and the output variable are highly correlated. Recent empirical estimations have tended to focus attention on the direction of causality between exports and economic growth using Granger causality tests. However, the empirical evidence based on these tests is, at best, mixed and often contradictory.[2]

The advocates of the ELG hypothesis highlight several beneficial aspects of promoting exports on overall economic activity. The export sector uses more advanced technologies, which result in higher productivity and better allocation of resources. Further gains are realized through higher capacity utilization and greater economies of scale due to large markets. In addition they contend that the accumulation of foreign exchange from exports allows the import of high quality inputs, mainly capital goods, for domestic production and exports, thus expanding the economy's production possibilities.

This study investigates the nature of the relationship between economic growth and exports based on the experiences of several Middle East and North Africa (MENA) countries[3]. Our objective is to assess whether their experiences provide support for the ELG hypothesis. First we examine those MENA countries for which data are available in order to assess the impact of promoting exports in general and specific categories of exports, namely manufacturing, on enhancing economic growth. The distinction between a general and a particular approach can be crucial in designing policy schemes aimed at fostering growth. To our knowledge, only a few studies have made such a distinction in their attempt to identify a possible causal relationship between exports and economic growth. Second, we test for causality by applying cointegration tests and error correction models for all the countries in our sample. Most previous studies have failed to tackle issues such as unit root and lag length when testing for causality. Third, we draw all our data from a single data source, namely the *World Development Indicators* (WDI) of the World Bank. Only countries with at least twenty observations are investigated. Our sample includes the following countries: Algeria, Egypt, Iran, Israel, Jordan, Morocco, Sudan, Tunisia, and Turkey.

The paper proceeds as follows. Section 2 contains a description of the empirical methodologies for testing causality. Section 3 provides a survey of the time series empirical literature dealing with some of the MENA economies. Section 4 describes the data employed in this paper and presents our main findings. Concluding remarks and some policy suggestions are presented in Section 5.

2. Empirical Methodology

Early works that studied the relationship between exports and economic growth relied on rank correlation coefficients, simple Ordinary Least Squares (OLS) regressions, or informal growth regressions, along the lines of Barro

(1991), utilizing available cross-section data. A positive correlation between exports and growth or a significant positive coefficient of the exports variable in the growth equation, using a simple or a multiple OLS regression, have been considered as a confirmation of the ELG hypothesis (Kravis, 1970; Balassa, 1978, 1982, 1984; Feder, 1983; Kormendi and Meguire, 1985; Dollar, 1992; and many others). However, these methods provide no insights into the direction of causality, but merely measure an association between exports and economic growth. A positive correlation or coefficient of exports in the equation of economic growth can be equally compatible with causality from exports to growth (ELG), from growth to exports (known as the growth-led export (GLE) hypothesis) or a bidirectional causality between the two variables.

The improper assessment of the causal relationship in a static cross-section setting paved the way for the adoption of a more dynamic time series analysis of the experiences of individual countries aimed at determining whether exports promote economic growth or vise versa. Granger causality tests have been the principal tool for this investigation.

2.1. Standard Granger Causality (SGC)

According to the Granger (1969) causality approach, a variable *y*, say economic growth, is caused by *x*, say exports, if *y* can be predicted better from past values of *y* and *x* than from past values of *y* alone. For a simple bivariate model, we can test if x is Granger-causing y by estimating equation (1) and then testing the hypothesis in equation (2), using the standard F test.

$$y_t = \mu_1 + \sum_{j=1}^{p} \gamma_{11j} y_{t-j} + \sum_{j=1}^{p} \gamma_{12j} x_{t-j} + u_{1t} \tag{1}$$

$$\begin{aligned} &H_0 : \gamma_{12j} = 0 \quad \textit{for } j = 1,..., p \\ &H_1 : \gamma_{12j} \neq 0 \quad \textit{for at least one } j. \end{aligned} \tag{2}$$

where u_{1t} is a white noise process. Variable x is said to Granger-cause variable y if we reject the null hypothesis (2), where γ_{12} is the vector of the coefficients of the lagged values of the variable x. Similarly we can test if y causes x by estimating equation (3) and testing the null hypothesis (4) using the standard F test.

$$x_t = \mu_2 + \sum_{j=1}^{p} \gamma_{21j} x_{t-j} + \sum_{j=1}^{p} \gamma_{22j} y_{t-j} + u_{2t} \tag{3}$$

$$\begin{aligned} &H_0 : \gamma_{22j} = 0 \quad \textit{for } j = 1,..., p \\ &H_1 : \gamma_{22j} \neq 0 \quad \textit{for at least one } j. \end{aligned} \tag{4}$$

According to the narrow definition of ELG, rejecting hypothesis (2) but not (4) establishes evidence that supports the ELG hypothesis. However, in this study we adopt the broader definition of ELG, where ELG is supported if hypothesis (2) but not (4) is rejected (unidirectional causality from export to output growth) or if both hypotheses are rejected (bidirectional causality between output and export growth).[4] Alternatively, if hypothesis (4) but not (2) is rejected we conclude that causality is running from economic growth to exports growth and thus provide evidence for the validity of the GLE hypothesis. In the case that neither hypothesis is rejected, exports and output are said to be causally independent and have to be determined by other sets of variables.

Before conducting the causality tests, however, we have to ensure that the variable series are either stationary individually or non-stationary individually but cointegrated together.

2.2. Unit Root Tests

Since a causality test holds only for stationary variables, unit root tests have to be performed on all the variables involved. To test for unit roots in our variables, we used the Augmented Dickey Fuller (ADF) test. This test is based on the estimate of the following regression:[5]

$$\Delta x_t = a_0 + a_1 t + \beta x_{t-1} + \sum_{j=1}^{p} \delta_j \Delta x_{t-j} + \varepsilon_t \qquad (5)$$

where a_0 is a drift; *t* represents a time trend; and *p* is a large enough lag length to ensure that ε_t is a white noise process. The null hypothesis that the variable *x* is nonstationary $(H_0 : \beta = 0)$ is rejected if β is significantly negative, using the results of Dickey-Fuller (1979).[6]

If the series is not stationary, a transformation of the variables, usually in the form of differencing, is needed to produce a stationary series on which causality tests can be conducted. A more sophisticated approach that will be discussed later is testing for cointegration and using Error Correction Models (ECM) to test for causality. Since it has been shown that ADF tests are sensitive to the lag lengths chosen (Campbell and Perron, 1991), we determine the optimal lag length by using the General to Specific method suggested by Campbell and Perron (1991).[7] We start by selecting an upper bound on the lag order and run an autoregression of that order. If the last lag is significant we choose that lag order. Otherwise, we reduce the order by one and repeat this until the last lag is significant. If no lag order is detected as significant, we run equation 5 with no lags on the right-hand side by using the Dickey-Fuller (DF) test.

2.3. Cointegration and Vector Error Correction Models

It is well documented that most economic variables are non-stationary in their levels (integrated of order 1, *I(1)*) but stationary, *I(0)*, in their first difference. Engle and Granger (1987) introduced the concept of cointegration in which economic variables may reach a long-run equilibrium that depicts a stable relationship.

For the case of two variables, *x* and *y* are said to be cointegrated of order one (CI(1,1)) if both are integrated of order 1 and there exists a linear combination of the two variables that is stationary, *I(0)*. The linear combination is given by either equation (6) or (7):

$$y_t = \alpha_0 + \beta_0 x_t + \mu_{0t} \quad (6)$$

$$x_t = \alpha_1 + \beta_1 y_t + \mu_{1t} \quad (7)$$

Two major tests are generally used for cointegration, one by Engle and Granger (1987) (henceforth called the EG test), and the other by Johansen (1988). The latter test is considered superior to the former since it corrects for some of the shortcomings that the first test suffers from, mainly being a two-step test in which errors in the first step are carried over to the second step. In this paper we perform both tests, although we focus on the Johansen test.

The first step in the statistical investigation is to determine the order of integration of the variables in the model through unit root tests to assure that the necessary conditions for cointegration are satisfied. According to the EG test, once it is established that both *x* and *y* are integrated of the same order, one has to test the order of integration of the OLS regression residuals from (6) and (7).[8] If both *x* and *y* are *I(1)* and the residuals are *I(0),* we conclude that *x* and *y* reach a long run equilibrium from which they may deviate in the short run.

The EG test has been criticized on several grounds. First, we may get contradictory conclusions depending on which equation (6 or 7) we utilize to obtain the residuals for the unit root test. This is likely to occur in small samples. Furthermore, the problem is more significant when more than two variables are considered. Another serious defect of the EG test is that it relies on a two-step estimator. In the first step residuals are obtained, and in the second step a unit root test is used to test for cointegration. Hence, any error introduced in the first step is carried out to the second step. Finally, the method only allows for a single cointegration equation. However, if we have more than two variables, there is a possibility that more than one equation may depict the long-run relationships among the various variables.

By using Johansen's (1988) maximum likelihood estimators, the above pitfalls of the EG test can be avoided. Johansen's test enables estimating and testing for the presence of multiple cointegration relationships, *r*, in a single-step procedure.

A class of models that embodies the notion of correction has been developed and is referred to as the Error Correction Model (ECM). In general, an ECM derived from the Johansen test can be expressed as follows:[9]

$$\Delta y_t = \mu_{10} + \sum_{j=1}^{r} \alpha_{1j} \varepsilon_{t-1,j} + \sum_{i=1}^{p} \gamma_{11,i} \Delta y_{t-i} + \sum_{i=1}^{p} \gamma_{12,i} \Delta x_{t-i} + \xi_{1t} \qquad (8)$$

$$\Delta x_t = \mu_{20} + \sum_{j=1}^{r} \alpha_{2j} \varepsilon_{t-1,j} + \sum_{i=1}^{p} \gamma_{21,i} \Delta y_{t-i} + \sum_{i=1}^{p} \gamma_{22,i} \Delta x_{t-i} + \xi_{2t} \qquad (9)$$

where $\varepsilon_{t-1,j}$ is the lagged error correction term obtained from cointegration equation *j*, ξ_{1t}, ξ_{2t} are serially uncorrelated errors and α_{1j} and α_{2j} depict the speeds of adjustment of the variables *y* and *x*, respectively, to the *j*-th long-run equilibrium.

The use of error-correction modeling provides an additional channel through which causality in the Granger sense may be assessed. The standard Granger test may provide invalid causal information due to the omission of error-correction terms from the tests. If the error-correction term is excluded from causality tests when the series are cointegrated, no causation may be detected when it exists, i.e., when the coefficient of the error-correction term is statistically significant.

According to equation (8), if we fail to reject the null hypotheses that α_1 and all γ_{12} are equal to zero we conclude that x_t does not Granger cause y_t.

Once cointegration is detected, it must follow that *x* causes *y*, *y* causes *x* or that there exists a feedback between the variables (Granger, 1986; 1988).

Toda and Phillips (1993) provide some guidelines for testing for causality. The first step would be to test for unit roots in all the variables involved. In the case of stationary variables, the model would be estimated in levels and a standard Granger causality can be applied. If all the variables are nonstationary, I(1), in levels and are stationary in first differences, I(0), then a cointegration test is carried out to determine if a long-term relationship exists. Once cointegration is detected, causality tests have to be performed using an error correction model. If no cointegration is detected, then the model has to be estimated in first differences and the SGC is applied.

3. Previous Empirical Evidence

The direction of causality between exports and growth in the MENA region has not been adequately investigated. Notable efforts include the works of Jung and Marshall (1985), Hutchinson and Singh (1992), Dodaro (1993), Kugler and Dridi (1993), Sharma and Dhakal (1994), Dutt and Ghosh (1996), Pomponio (1996), Riezman et al. (1996), and Xu (1996). Typically, the evidence for causality from these studies was mixed and varied depending on the sample, the specific measures of exports and of economic performance that were used, and the methodology adopted. In the following survey of past works dealing with causality tests between exports and economic growth we focus solely on time series analyses. Most of the studies on the MENA economies failed to pre-test for unit roots, to determine the optimal length of lags and/or to apply cointegration tests and error correction models when testing for causality. Unless otherwise stated, most of the studies surveyed below failed to apply cointegration tests to detect long-run relationship between exports and economic growth. In the presence of cointegrated series, inferences based on the SGC are inappropriate (Granger, 1988). The few studies that adopted cointegration tests chose to use the EG test rather than the Johansen test, which is known to be more reliable. Our aim is to employ the latest econometric techniques and the most up-to-date data to examine the causal relationship between exports and economic growth in selected MENA economies. In this way we hope to provide some guidelines to policymakers for fostering economic growth and lessen the volatility of the economic activity in the MENA region.

In an early paper, Jung and Marshall (1985) using a bivariate SGC test found support for ELG in the case of Egypt for the period 1965-1979. They also found bidirectional causality for Israel (1950-1978),[10] but no causality for Morocco, Tunisia or Turkey.[11] Chow (1987), using a bivariate Sims test on annual data of real manufactured exports and GDP, found evidence of a bidirectional causality in the case of Israel.

Hutchinson and Singh (1992), using annual data in the natural logarithms of real non-export GDP and exports for the period 1950-1985 and applying bivariate SGC, failed to find any causality in the cases of Egypt, Morocco, and Tunisia. Kugler and Dridi (1993) were among the few to use Johansen's methodology to test for cointegration in order to test for causality between exports and growth for some of MENA countries. They could not, however, find any cointegration among the variables in the case of Egypt, which provides no support to the ELG hypothesis. Dodaro (1993) who employed a bivariate SGC test on real GDP growth and real growth of real exports of goods and non-factor services over 1967-1987 did not find any evidence of causality between growth and exports in the cases of Algeria, Jordan, Morocco, Sudan or Tunisia. However, he did find evidence for unidirectional causality from economic growth to exports in the case of Egypt and bidirectional causality in the case of Israel. No cointegration tests were performed in this study.

Sharma and Dhakal (1994) used six variable SGC on natural logarithms of real GDP and exports, with testing for unit root and choosing lag lengths based on Akaike's Final Prediction Error (FPE) criterion. They found support for the GLE hypothesis in the cases of Egypt, Morocco, and Tunisia, but no support for causality in the case of Turkey. Reizman et al. (1996) found support for ELG when using bivariate SGC test in the cases of Algeria, Egypt, and Tunisia but no evidence of causality in the cases of Israel, Jordan, Morocco, Sudan, or Turkey. However, with the inclusion of imports as an additional variable in a trivariate system they obtained different results. ELG is supported only in the cases of Jordan and Sudan while no causality is detected for the rest of the MENA countries in the sample. Pomponio (1996) who used the more sophisticated cointegration and ECM approach in a bivariate setting, found support for the GLE in the cases of Algeria and Tunisia, but no causality was detected for Morocco, Sudan or Turkey. When he introduced investments as an additional variable in a trivariate model, he found evidence for ELG in Turkey and Tunisia where a bidirectional causality was detected. However, his findings with regard to Algeria, Morocco, and Sudan remained intact. Although he employed the most appropriate tools, because he used nominal data that incorporate the effects of changes in prices, causality between real exports and real economic growth cannot be inferred.

Xu (1996) used a cointegration and ECM approach but could not establish evidence for long-term relationship between exports and economic growth for Israel, Morocco, Tunisia, and Turkey. Nevertheless, he did confirm GLE in the cases of Israel and Tunisia, a feedback relation in the case of Turkey but no causality for Morocco.[12] Dutt and Ghosh (1996) using tests based on EG cointegration and causality based on ECM for the period 1953-1991 point to the existence of cointegration and causality from exports to growth in the cases of Israel and Turkey, evidence that supports the ELG hypothesis. They found a bidirectional causality between exports and growth in the case of Morocco.

4. Data and Empirical Findings

4.1. Data and variable definitions

Data used in this study are obtained from *World Data Indicators* (*WDI*) 1998 CD- ROM. Our sample includes the following countries for the specified periods: Algeria (1968-1996), Egypt, Morocco, Tunisia, and Turkey (1966-1996), Iran (1974-1995), Israel (1968-1994), and Jordan (1976-1996). All variables are taken in constant prices of 1987 expressed in local currencies. The variables used in this study and their definitions are the following: LGDP is the natural logarithm of real GDP; LX is the natural logarithm of real total exports; LMAN is the natural logarithm of real manufactured exports; and LM is the natural logarithm of real imports.

Since some researchers believe that the mixed and conflicting evidence regarding ELG might result from omitted variables, we go beyond the traditional bivariate approach by including imports as an additional variable in the system.[13] This is in accordance with some recent studies[14] which suggest that imports may contribute to the establishment of cointegration and thus have to be accounted for when testing for long-term equilibrium between economic growth and exports. The inclusion of imports in the system allows us to capture the role of promoting exports in the accumulation of foreign exchange which makes it easier for the economy to finance the importation of capital goods which in turn boosts economic growth. Hence, by incorporating imports as a third variable in the system we allow not only for a direct effect of exports on economic growth but also for an indirect effect that involves imports. Findings by Riezman et al. (1996) suggest that omitting imports from the system may "either mask or overstate the effect of exports on income."

In the next section we analyze the causal relationship between export growth and economic growth using two measures of exports. First, we use total exports as a measure of exports, and then we use manufactured exports. This distinction is very important because manufactured exports rather than primary exports have a greater impact on leading economic growth. As our analysis will show, causality results are crucially dependent on the export measure used, and this may explain in part the conflicting evidence in previous studies.

4.2. Case A: Causality Between Total Exports and Economic Growth

4.2.1. Test results for unit roots

As we underlined earlier, a necessary step when testing for causality is first to test for stationarity of the series involved. Table 1 provides the results of unit root tests using the augmented Dickey-Fuller test supplemented by the Ljung-Box Q-test of serial correlation up to a lag order of four. Our results show that in all the cases, a lag length of 4 is long enough to assure white noise residuals. The length of lags in equation 5 is determined using the General to Specific Method as suggested by Campbell and Perron (1991). Our results indicate that for four of the countries under investigation all of the three variables, LGDP, LX, and LM, have unit roots, i.e., are *I(1)*, in their levels. For Algeria and Egypt, all variables but LX are *I(1)* in levels. For Iran, all variables but LM are *I(1)* in levels, and for Jordan, all variables but LGDP are *I(0)* in levels. However, all variables for all the countries are stationary in their first differences.

Insert Table 1 here

4.2.2. Test results for cointegration and Granger-causality

The second step in the process of finding a causality direction is to test for cointegration among the variables of each country applying the Engle-Granger

(EG) and the Johansen maximum likelihood cointegration tests. Using Johansen's method, the cointegrating rank, r^*, of the time series was tested by the maximum eigenvalue statistic. Denoting the number of cointegrating vectors by r, the maximum eigenvalue ($\lambda_{\max}$) test is calculated under the null hypothesis that $r = r^*$ against the alternative of $r = r^* + 1$. The two tests, EG and $\lambda_{\max}$, are applied to all countries except Algeria, Egypt, Iran and Jordan where the variables are of different integration order, and therefore are not cointegrated.

Using the Engle-Granger test, we test for stationarity of the residuals that are obtained from OLS regression of LGDP on LX and LM. Table 2 shows that variables are cointegrated except in the case of Morocco where no cointegration was detected even at the 10% significance level. Applying the Johansen test, as presented in Table 3, did not affect our findings.

Insert Tables 2 and 3 here

Following the guidelines of Toda and Phillips (1993), once cointegration has been identified for a country we apply the ECM to detect a causal direction. However, in the absence of cointegration, the standard Granger causality test (SGC) is performed on the first differences of the variables.

Table 4 summarizes the results of causality tests according to the following procedures: SGC on first differences of the logarithms of the variables for Algeria, Egypt, Iran, Jordan and Morocco; and ECM for Israel, Tunisia, and Turkey. For three countries, Iran, Israel and Turkey, the GLE hypothesis seems to hold while a bidirectional causality is detected in the cases of Algeria and Tunisia only. Actually, in the case of Algeria, the causality from exports to economic growth is only marginally significant. No causality was found in the cases of Egypt, Jordan and Morocco and the only country for which a unidirectional causality from exports to growth was found is Sudan. This finding is undermined by the fact that exports affect economic growth negatively.[15] A possible explanation may be the impact of a corrupt government that controls most of the export sectors. Engaging in rent seeking activities may offset the beneficial effect of promoting exports on economic growth. To sum up, using total exports within the framework of a trivariate setting lends very limited support to the ELG hypothesis, as in seven out of the nine cases the ELG hypothesis was rejected.

Insert Table 4 here

4.3. Case B: Causality Between Manufactured Exports and Economic Growth

As we showed, for the majority of the MENA countries examined in this paper, our findings did not support the ELG hypothesis when using total exports. Now we examine the causal relationship between exports and economic growth, using manufactured exports as a measure of exports.

When justifying the ELG hypothesis, economists point to the positive impact of promoting the export sector, where promoting the manufacturing sector is more likely to generate a significant effect on economic growth**.** The gains in these sectors in terms of specialization and utilization of economies to scale, productivity, re-allocation of resources, easing foreign exchange constraints, and spillovers are expected to be significantly greater for manufacturing exports than for traditional sectors. The experience of East Asian countries that reported sustained economic growth based on labor-intensive manufactured exports adds to the plausibility of considering manufactured exports instead of total exports when testing for causality between exports and economic growth.

Table 5 and Figure 1 show the ratios of manufactured exports to total merchandise exports for some of the MENA countries for selected years. Despite the fact that the ratios tend to rise, manufactured exports are not a significant component, with the exceptions of Israel, Tunisia, and Turkey. This fact led us to investigate the causal relationships between manufactured exports and economic growth to check if our findings (when considering aggregate exports) hold true when only manufactured exports are considered. Real manufactured export figures were calculated from the WDI data.

We follow the same procedures that were used to test causality between total exports and growth to find a relationship between manufactured exports and economic growth. Iran and Sudan are not considered here because of the unavailability of data on manufactured exports.

Insert Table 5 and Figure 1 here

4.3.1. Test results for unit roots

As we can see from Table 1, ADF test results indicate that for five of the seven countries where data on manufactured exports are available, all of the three variables, LGDP, LMAN, and LM, have unit roots, i.e., are *I(1)*, in their levels.

For Algeria, all variables but LMAN are *I(1)*. For Jordan, all variables but LGDP are *I(0)* in levels. However, all variables for all the countries are stationary in their first differences.

4.3.2. Test results for cointegration and Granger-causality

The cointegration tests are applied only for the five countries where all the variables are non-stationary in their levels; therefore Algeria and Jordan are excluded. The results of the cointegration tests are provided in Table 2 (EG cointegration test) and Table 3 (Johansen's test). According to both cointegration tests, in all the countries except Egypt there exists a long-run equilibrium between economic growth and manufactured exports. Turning to our main objective of testing for the direction of causality, from Table 6 we observe the presence of bidirectional causality for Morocco, Tunisia, and Turkey and unidirectional causality from manufactured exports to growth only in the case of Israel. No causality is detected in the cases of Algeria, Egypt or Jordan.[16] The picture that emerges is important. Countries with a low share of manufacturing in total exports show no causality. Moreover, these countries show no long-run relationship between manufactured exports and economic growth. When we turn to countries with relatively high shares of manufactured exports, as exhibited in Table 5 and Figure 1, we observe a bidirectional causality between manufactured exports and economic growth. In the case of Israel, the country with the highest ratio of manufactured exports to total merchandise exports, causality runs unidirectionally from manufactured exports to economic growth. These results indicate that manufactured exports may have a positive impact on economic growth once a minimal threshold of manufactured exports has been reached. Our results are in line with the large body of research assessing the validity of ELG in developed countries by observing an advantageous effect of promoting exports on economic growth (Marin (1992) and Bodman (1996)). Since developed countries are characterized by a high share of manufacturing in total exports, our results seem to be in harmony with the above stated studies. Our results also invite similar tests of the ELG hypothesis that distinguish between total exports and manufactured exports in other developing countries.

Insert Table 6 here

The implications of our findings are significant. They indicate that policy makers should focus on promoting manufacturing exports to capitalize on the beneficial impact of such policies on economic growth. Macroeconomic stability (a small budget deficit, low inflation and appropriate exchange rates to maintain the profitability of export industries), removing import quotas and reducing tariffs on capital goods and raw materials, political stability and the elimination of corruption, developing education and training institutions to provide the labor force with the needed skills, and appropriate infrastructure (ports, roads, power plants and telecommunication facilities) are often cited as necessary policies and conditions to promote manufactured exports which in turn would stimulate the economy as a whole.[17] Governments have to find ways to support exporters in the relevant sectors. Obviously, comprehensive studies are needed to identify which sectors have the maximum impact on the economy. These sectors would be the ones in which the economy has a comparative advantage and with the most linkages to other sectors of the economy.

5. Concluding Remarks

Utilizing the latest econometric time series techniques, we attempted to detect a causal relationship between exports and economic growth for some MENA countries where data is available. Specifically, we assessed whether promoting exports or, in particular, exports of manufactured goods enhances economic growth. Promoting exports has been suggested by prominent economists and by international institutions as a key strategy to foster economic growth. However, our results show that not all exports contribute equally to economic growth. MENA countries whose main exports are primary goods are prone to long episodes of economic slowdown due to fluctuations in the prices of such goods. Sound policies which aim to diversify production and focus on manufacturing sectors in which the economies possess a comparative advantage may reduce the adverse effects of price fluctuations.

Our analysis revealed some important points. When considering total exports, our causality tests uncovered little support for the ELG hypothesis in that in only two countries out of the nine did we find a bidirectional causality between export growth and economic growth, in contradiction to what is widely accepted. In order to explain these findings, we tested for the impact of manufactured exports and found evidence for a positive causality from manufactured exports to economic growth for countries with a relatively high share of manufactured exports in total merchandise exports. These findings indicate the importance of promoting manufactured exports in the MENA countries to enhance economic growth. The sectors should be chosen based on the expected gains to the whole economy. A more detailed analysis at the sectoral level is necessary to further assess these aspects.

TABLE 1: Results of the ADF Unit Root Tests

Country	Variable	ADF in Levels	P*	Q(4)	ADF in first differences	P*	Q(4)
	LGDP	-0.41	1	0.18	-5.76***	0	6.95
	LX	-4.91***	0	2.55	-6.91***	1	4.43
ALGERIA	LM	-1.375	2	0.34	-1.863*	2	0.01
	LMAN	-3.54*	4	3.83	-4.47***	0	6.12
	LGDP	-1.26	1	0.88	-3.28**	0	0.56
	LX	-3.53*	1	1.63	-5.35***	1	0.67
EGYPT	LM	-1.78§	1	5.12	-4.06***§	0	5.69
	LMAN	-2.14	3	0.66	-5.69***	0	3.59
	LGDP	-0.61	4	6.80	-4.15***	3	3.86
IRAN	LX	-1.67	0	6.07	-3.24**	0	3.24
	LM	-4.92***	2	5.58	-5.16***	4	0.45
	LGDP	-2.77	1	1.00	-3.70**	0	1.01
	LX	-2.33	4	1.85	-3.79***	0	2.95
ISRAEL	LM	-2.68	0	0.24	-4.95***	0	0.59
	LMAN	-3.00	0	1.73	-5.76***	0	2.72
	LGDP	-2.77	2	5.66	-2.80*	2	1.77
	LX	-4.84***	4	3.27	-4.44***	4	2.58
JORDAN	LM	-5.58***	4	1.22	-4.07***	4	2.55
	LMAN	-3.73**	0	6.79	-5.36***	1	4.99
	LGDP	-1.40	1	3.79	-8.05***	0	2.34
	LX	-2.06	0	1.75	-6.29***	0	4.00
MOROCCO	LM	-2.42	2	2.87	-4.62***	0	2.56
	LMAN	-1.66	0	1.03	-5.39***	0	1.81
	LGDP	-2.60	1	0.67	-3.69**	0	5.62
	LX	-2.79	0	3.76	-6.19***	1	2.92
SUDAN	LM	-1.69	0	1.89	-4.37***	0	0.90
	LGDP	-1.36	0	1.95	-6.14***	0	3.50
	LX	-1.90	0	2.04	-5.32***	0	0.68
TUNISIA	LM	-1.04	0	2.38	-4.65***	0	1.93
	LMAN	-2.50	0	0.55	-6.50***	0	0.08
	LGDP	-2.68§	2	5.13	-5.36***§	1	5.03
	LX	-2.15	0	4.09	-3.22**	3	0.46
TURKEY	LM	-2.24	3	0.69	-3.25**	3	0.14
	LMAN	-2.53	3	0.99	-4.02***	0	4.62

LGDP, LM, LX, LMAN are the natural logarithms of real GDP, real imports, real total exports, and real manufactured exports, respectively.
*P** is the number of lags included in the ADF equation, and is determined by the General to Specific method.
Q(4) is the Ljung-Box Q-test for up to the fourth-order serial correlation in the residuals, which is asymptotically distributed $\chi^2_{(4)}$.
*, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.
§ Lags that were chosen by the General to Specific method did not guarantee white noise in the residuals. Lag orders here were chosen by both the AIC and SBC and the obtained residuals are white noise.

TABLE 2: Engle – Granger Cointegration Test Results[†]

Country	Cointegration Vectors	ADF t-statistic	p*	Q(4)	JB(2)
EGYPT:	LGDP, LMAN, LM	-1.72*	0	3.59	3.21
ISRAEL:	LGDP, LX, LM	-4.07***	3	1.17	2.12
:	LGDP, LMAN, LM	-3.53***	0	2.78	0.06
MOROCCO:	LGDP, LX, LM	-1.79	3	2.40	0.94
:	LGDP, LMAN, LM	-5.90***	0	2.92	0.23
SUDAN:	LGDP, LX, LM	-3.84***	0	2.24	1.08
TUNISIA:	LGDP, LX, LM	-2.59**	0	4.73	0.42
:	LGDP, LMAN, LM	-3.49***	4	2.20	2.20
TURKEY:	LGDP, LX, LM	-2.67***	1	0.97	0.91
:	LGDP, LMAN, LM	-3.36***	2	1.04	18.92

LGDP, LM, LX, LMAN are the natural logarithms of real GDP, real imports, real total exports, and real manufactured exports, respectively.

[†] Residuals were obtained by regressing levels of LGDP on LX and LM. Similar results were obtained when regressing LX on LGDP and LM.

*, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

*P** is the number of lags included in the ADF equation, and is determined by the General to Specific method with 4 lags being the maximum allowed.

Q(4) is the Ljung-Box Q-test for up to the fourth-order serial correlation in the residuals, which is asymptotically distributed $\chi^2_{(4)}$.

JB(2) : The Jarque-Berra test for normality in residuals which is asymptotically distributed $\chi^2_{(2)}$.

TABLE 3: Johansen Cointegration Tests

		LGDP, LM, and LX			LGDP, LM, and LMAN		
Country	**Hypotheses**	$\lambda_{\max}$	p^*	r^*	$\lambda_{\max}$	p^*	r^*
EGYPT	HA				20.22	4	0
	HB				16.95		
ISRAEL	HA	44.89***	4	1	26.00**	4	1
	HB	11.58			5.57		
MOROCCO	HA	12.00	2	0	27.06***	3	1
	HB	7.65			13.97		
SUDAN	HA	22.59**	4	1			
	HB	14.24					
TUNISIA	HA	35.60***	4	1	25.30**	4	1
	HB	5.46			14.36		
TURKEY	HA	26.40***	3	1	37.53***	3	1
	HB	6.59			8.81		

HA: $H_0: r = 0$ against $H_1: r = 1$

HB: $H_0: r = 1$ against $H_1: r = 2$

LGDP, LM, LX, LMAN are the natural logarithms of real GDP, real imports, real total exports, and real manufactured exports, respectively.
*,**, *** indicate significance at the 10%, 5%, and 1% levels, respectively.
$\lambda_{\max}$ is the maximum eigenvalue statistic.
*p** represents the optimal lag length based on AIC from the unrestricted VAR model.
*r** is the number of cointegration vectors based on Johansen's method.

TABLE 4: Causality Tests - GDP, Total Exports, and Imports

PANEL A:

COUNTRY	**Null Hypothesis**			α	***p***	**Q(4)**	**JB(2)**
	X does not Granger cause GDP						
	$F(p,m)$	t_m	$F(p+1,m)$				
ALGERIA	2.446*				4	7.931	2.023
EGYPT	0.025				1	2.153	0.489
IRAN	3.015				4	2.594	2.24
ISRAEL	0.041	-0.488	0.215	-0.172	4	1.549	1.380
JORDAN	0.584				3	2.787	0.426
MOROCCO	0.015				2	1.571	2.980
SUDAN	1.224	-3.263***	4.193**	-0.152	3	3.094	1.193
TUNISIA	2.809*	-3.998***	4.404**	-0.548	4	5.286	1.458
TURKEY	0.332	-1.038	0.800	-0.150	3	5.329	4.102

Panel B

COUNTRY	**Null Hypothesis**			α	***p***	**Q(4)**	**JB(2)**
	GDP does not Granger cause X						
	$F(p,m)$	t_m	$F(p+1,m)$				
ALGERIA	3.557**				4	1.077	0.396
EGYPT	2.239				2	1.322	0.533
IRAN	7.878***				3	3.542	0.839
ISRAEL	3.122*	2.530**	2.587*	1.22	4	5.043	0.273
JORDAN	4.194				4	7.397	0.263
MOROCCO	1.044				2	5.062	13.08
SUDAN	0.447	1.689	1.423	0.25	3	3.647	1.280
TUNISIA	0.323	-2.201**	1.977	-0.66	4	4.581	3.069
TURKEY	9.887***	4.179***	8.698***	1.84	3	6.309	0.013

Notes:
Lag lengths of the three variables were determined using Akaike's AIC method, with maximum lags of 4 allowed for each variable.

In the cases of Israel, Sudan, Tunisia, and Turkey, in Panel A, *F(p,m)* and *F(p,m+1)* are the *F* statistics for testing the null hypotheses: $\gamma_{12} = 0$ and $\gamma_{12} = \alpha_1 = 0$ from equation (8), respectively. In all other cases *F(p,m)* is the F statistic for testing the null hypothesis in equation (2). In Panel B, for the 4 countries mentioned above, *F(p,m)* and *F(p,m+1)* are the *F* statistics for testing the null hypotheses: $\gamma_{21} = 0$ and $\gamma_{21} = \alpha_2 = 0$ from equation (9), respectively. In all other cases *F(p,m)* is the F statistic for testing the null hypothesis in equation (4). t_m is the t-statistic for testing the null hypothesis that the coefficient of the error correction term in either equation (8) or (9) is zero.

n is the number of observations; *p* the number of lags*; m = n – 3p-1* in SGC and *m= n – 3p –2* in ECM.
*, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Q(4) is the Ljung-Box Q-test for up to the fourth-order serial correlation in the residuals, which is asymptotically distributed $\chi^2_{(4)}$.

JB(2) is the Jarque-Berra test for normality in residuals which is asymptotically distributed $\chi^2_{(2)}$.

Table 5: Ratios of Manufactured to Merchandise Exports

Country	1966	1976	1986	1996
Algeria	5.60	0.90	1.40	3.50
Egypt	21.60	24.90	20.04	31.64
Israel	67.76	76.77	84.79	91.13
Jordan	18.30	21.02	36.45	50.00
Morocco	6.56	16.02	43.52	50.30
Turkey	2.01	23.76	58.16	73.77
Tunisia	13.22	25.72	59.76	79.81

Figure 1: Ratios of Manufactured to Merchandise Exports

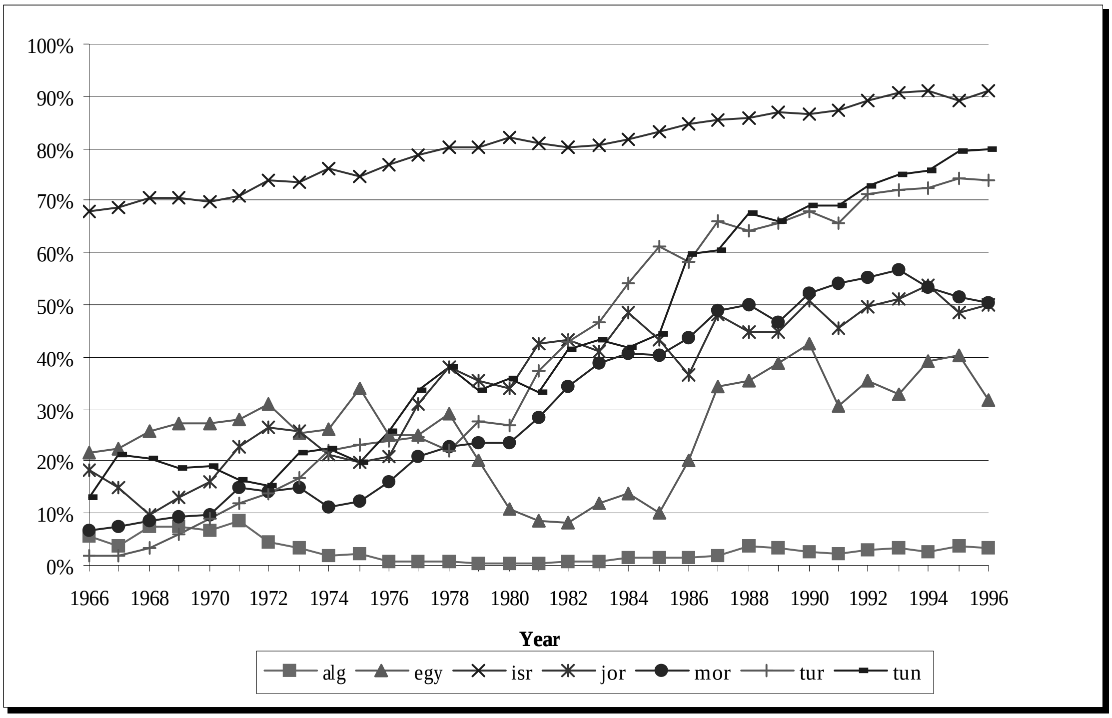

TABLE 6: Causality Tests - GDP, Manufactured Exports, and Imports

Panel A

COUNTRY	**Null Hypothesis**			α	**p**	**Q(4)**	**JB(2)**
	MAN does not Granger cause GDP						
	$F(p,m)$	t_m	$F(p+1,m)$				
ALGERIA	1.941				2	1.924	3.582
EGYPT	1.156				1	4.397	0.068
ISRAEL	1.218	-2.179**	2.000	-0.353	3	2.839	0.804
JORDAN	2.033				3	1.964	1.402
MOROCCO†	0.646	0.429	0.324	0.114	2	0.150	1.402
TUNISIA	1.566	-3.99***	4.174 **	-0.186	4	3.464	1.332
TURKEY	0.107	-2.262**	2.004	-0.340	3	3.463	3.368

Panel B

COUNTRY	**Null Hypothesis**			α	**p**	**Q(4)**	**JB(2)**
	GDP does not Granger cause MAN						
	$F(p,m)$	t_m	$F(p+1,m)$				
ALGERIA	0.022				2	2.033	1.324
EGYPT	0.632				1	3.793	1.636
ISRAEL	0.734	1.210	0.920	0.791	3	3.989	0.014
JORDAN	1.571				3	3.831	1.213
MOROCCO	27.153***	7.619***	29.135***	3.843	2	4.346	0.772
TUNISIA	6.205***	0.743	4.736**	0.124	4	7.979	1.204
TURKEY	8.503***	4.715***	12.732***	3.090	3	7.610	2.498

Notes:
Lag lengths of the three variables were determined using Akaike's AIC method, with maximum lags of 4 allowed for each variable.

In the cases of Israel, Morocco, Tunisia, and Turkey, in Panel A, *F(p,m)* and *F(p,m+1)* are the *F* statistics for testing the null hypotheses: $\gamma_{12} = 0$ and $\gamma_{12} = \alpha_1 = 0$ from equation (8), respectively. In all other cases *F(p,m)* is the F statistic for testing the null hypothesis in equation (2). In Panel B, for the 4 countries mentioned above, *F(p,m)* and *F(p,m+1)* are the *F* statistics for testing the null hypotheses: $\gamma_{21} = 0$ and $\gamma_{21} = \alpha_2 = 0$ from equation (9), respectively. In all other cases *F(p,m)* is the F statistic for testing the null hypothesis in equation (4). t_m is the t-statistic for testing the null hypothesis that the coefficient of the error correction term in either equation (8) or (9) is zero.

n is the number of observations; *p* the number of lags*; m = n – 3p-1* in SGC and *m= n – 3p –2* in ECM.
*, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.
Q(4) is the Ljung-Box test for serial correlation of up to order 4 in the residuals, which is asymptotically distributed $\chi^2_{(4)}$.
JB(2) is the Jarque-Berra test for normality in residuals which is asymptotically distributed $\chi^2_{(2)}$.
† See footnote (16).

Bibliography

[1] Bahmani-Oskooee, M., Mohtadi H. and Shabsigh, G. (1991) Exports, growth and causality in LDCs: A re-examination. *Journal of Development Economics* 36(2), 405-415.

[2] Balassa, B. (1978) Exports and economic growth: further evidence. *Journal of Development Economics* 5(2), 181-189.

[3] Balassa, B. (1982), *Development Strategies in Semi-industrialized Economies*. New York: Oxford University Press**.**

[4] Balassa, B. (1984) Adjustment to external shocks in developing economies. World Bank Staff Working Paper 472, Washington, DC, The World Bank.

[5] Barro, R. J. (1991) Economic growth in a cross section of countries. *Quarterly Journal of Economics* 106(2), 407-443.

[6] Biswal, B. and Dhawan, U. (1998) Export-led growth hypothesis: cointegration and causality analysis for Taiwan. *Applied Economics Letters* 5(11), 699-701.

[7] Bodman, M. P. (1996) On export-led growth in Australia and Canada: cointegration, causality and structural stability. *Australian Economic Papers* 35(67), 282-299.

[8] Campbell, J. Y. and Perron, P. (1991) Pitfalls and opportunities: what macroeconomists should know about unit roots. NBER Technical Working Paper #100, NBER, Cambridge, MA.

[9] Chow, P. C. Y. (1987) Causality between export growth and Industrial development: empirical evidence from the NICs. *Journal of Development Economics* 26(1), 55-63.

[10] Dickey, D.A. and Fuller, W.A. (1979) Distribution of the estimators for autoregressive time series with a unit root. *Journal of the American Statistical Association* 74, 427–431.

[11] Dodaro, S. (1993) Exports and growth: a reconsideration of causality. *Journal of Developing Areas* 27(2), 227-244.

[12] Dollar, D. (1992) Outward-oriented developing economies really do grow more rapidly: evidence from 95 LDCs, 1976-1985. *Economic Development and Cultural Change* 40(3), 523-544.

[13] Dutt, S. D. and Ghosh, D. (1996) The export growth-economic growth nexus: a causality analysis. *Journal of Developing Areas* 30(2), 167-182.

[14] Engle, R.F. and Granger, C.W.J. (1987) Cointegration and error correction: representation, estimation, and testing. *Econometrica* 55(2), 251-276.

[15] Feder, G. (1983) On exports and economic growth. *Journal of Development Economics* 12(1-2), 59-73.

[16] Giles, J. A. and Williams, C. L. (2000) Export-led growth: a survey of the empirical literature and some non-causality results. Part 1. *Journal of International Trade and Economic Development* 9(3), 261-337.

[17] Glasure, Y. U. and Lee, A. (1999) The export-led growth hypothesis: the role of the exchange rate, money, and government expenditure from Korea. *Atlantic Economic Journal* 27(3), 260-272.

[18] Granger, C. W. J. (1969) Investigating causal relations by econometric models: cross spectral methods. *Econometrica* 37(3), 424-438.

[19] Granger, C. W. J. (1986) Developments in the study of cointegrated economic variables. *Oxford Bulletin of Economics and Statistics* 48(3), 213-228.

[20] Granger, C. W. J. (1988) Some recent developments in a concept of causality. *Journal of Econometrics* 39(1/2), 199-211.

[21] Hutchinson, M. and Singh, N. (1992) Exports, non-exports and externalities: a Granger causality approach. *International Economic Journal* 6(2), 79-94.

[22] Johansen, S. (1988) Statistical analysis of cointegration vectors’. *Journal of Economic Dynamics and Control* 12(2-3), 231-254.

[23] Jung, S. W. and Marshall, P. J. (1985) Exports, growth and causality in developing countries. *Journal of Development Economics* 18(1), 1-12.

[24] Kormendi, R. C. and Meguire, P. G. (1985) Macroeconomic determinants of economic growth: cross-country evidence. *Journal of Monetary Economics* 16(2), 141-163.

[25] Kravis, I. B. (1970) Trade as a handmaiden of growth: similarities between the nineteenth and twentieth centuries. *Economic Journal* 80(323), 850-872.

[26] Kugler, P. and Dridi, J. (1993) Growth and exports in LDCs: a multivariate time series study. *International Review of Economics and Business* 40(9), 759-767.

[27] Marin, D. (1992) Is the export-led growth hypothesis valid for industrialized countries?. *The Review of Economics and Statistics* 74(4), 678-688.

[28] Pomponio, X. Z. (1996) A Causality analysis of growth and export performance. *Atlantic Economic Journal* 24(2), 168-176.

[29] Prebisch, R. (1950) *The Economic Development of Latin America and Its Principal Problems*. New York: The United Nations.

[30] Radelet, S. (1999) Manufactured exports, export platforms, and economic growth. CAER II Discussion Paper No. 43, HIID, Cambridge, MA.

[31] Riezman, R. G., Summers, P. M. and Whiteman, C. H. (1996) The engine of growth or its handmaiden? A time series assessment of export-led growth. *Empirical Economics*, 21(1), 77-113.

[32] Schwarz, A. (1978) Estimating the dimension of a model. *Annals of Statistics* 6(2), 461-464.

[33] Serletis, A. (1992) Export growth and Canadian economic development. *Journal of Development Economics* 38(1), 133-145.

[34] Sharma, S. C. and Dhakal, D. (1994) Causal analyses between exports and economic growth in developing countries. *Applied Economics* 26(12), 1145-1157.

[35] Sims, C. A. (1972) Money, Income and Causality. *American Economic Review* 62(4), 540-552.

[36] Toda, H. Y. and Phillips, P. C. P. (1993) Vector autoregression and causality. *Econometrica* 61(6), 1367-1393.

[37] Xu, Z. (1996), On the causality between export growth and GDP growth: An empirical reinvestigation. *Review of International Economics* 4(2), 172-184.

Notes

[1] ELG is considered one of the main pillars of the free trade school of thought that emerged in the 80s. The other major school of thought, which is known as the protectionism school and is based on Prebisch (1950), calls for the adoption of policies of import substitution rather than promoting exports to stimulate economic growth.

[2] See Giles and Williams (2000) for a comprehensive survey of the empirical literature.

[3] This region encompasses the 21 members of the Arab League, plus Iran, Israel, and Turkey.

[4] Chow (1987), Bahmani Oskooee et al. (1991), and Biswal and Dhawan (1998), and others use this definition of the ELG hypothesis.

[5] This is the general case. Special cases of no drift or time trend may be considered.

[6] The t-statistic under the null hypothesis of a unit root does not have the conventional t-distribution. Dickey and Fuller (1979) showed that the distribution under the null hypothesis is nonstandard, and simulated the critical values for selected sample sizes.

[7] Other alternatives to determine the optimal lag length include Akaike's (1973) Information Criterion (AIC) and Schwarz's (1978) Bayesian Criterion (SBC).

[8] The discussion here is based on the principles of the Engle-Granger method. It differs from the Johansen (1988) method in which the focus is on testing the restrictions imposed by cointegration on an unrestricted VAR model involving the series.

[9] The lag length should be pre-determined from the unrestricted VAR using one of the commonly used model selection criteria, such as AIC, to ensure that the errors are white noise disturbances.

[10] They concluded that the effect is negative in each direction.

[11] In these cases, the results were hindered by the presence of serial correlation.

[12] For countries with no cointegration detected, Xu performed SGC on first differences.

[13] Potential variables include the exchange rate, terms of trade, investment, and government spending. An example is found in Glasure and Lee (1999).

[14] See Serletis (1992) and Riezman et. al (1996).

[15] The result emerges from the cointegration equation that is not presented here.

[16] In the case of Morocco causality runs from manufacturing exports to growth through imports. Manufacturing exports causes imports and imports in turn causes economic growth.

[17] Radelet (1999).