Contribution of Exports to Growth, Mexico 1970-1990: Capital Accumulation or Labour Productivity Growth?

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Abstract: Recent contributions to growth theory suggest two main venues through which foreign trade contributes to economic growth; enhanced capital accumulation, and increased productivity growth. These mechanisms have different implications for development policy and trade liberalization in Mexico. This paper tests these competing hypotheses using sectoral data from the Mexican manufacturing industry between 1970 and 1990. Despite large variations in export shares across sectors and over the period, overall the study finds little supportive evidence that *(i)* exports lead to higher sectoral investment rates, and *(ii)* exports lead to faster labour productivity growth. Estimates suggest that, to the extent that monetary policy can inhibit the overvaluation of the real exchange rate, it may be also conducive to both faster capital accumulation and export growth.

Resumen: Contribuciones recientes en la teoría del crecimiento sugieren dos canales para los efectos del comercio exterior en el crecimiento económico: la acumulación de capital y el crecimiento de la productividad, con distintas implicaciones de política para México. Este trabajo analiza dos hipótesis alternativas utilizando datos del sector manufacturero entre 1970 y 1990. Hay pocas evidencias de que las exportaciones conduzcan a mayores tasas de inversión sectorial y a un mayor crecimiento de la productividad. En la medida en que la política monetaria inhiba la sobrevaluación del tipo de cambio real, podrá obtener una mayor acumulación de capital y el crecimiento de las exportaciones.

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1. Introduction

This paper investigates the causal link between exports and investment, and exports and labour productivity growth using sectoral data from the Mexican manufacturing industry between 1970 and 1990. In the case of Mexico, the analysis of the mechanisms through which trade contributes to economic growth is not merely an academic exercise, but also concerns the evaluation of some of the important policy choices undertaken by Mexico since 1986. These policies have two important aspects. First, in 1986, as part of an economic reform package, the Mexican government initiated an extensive trade liberalization programme which transformed the economy from a "mildly inward oriented" (World Bank, 1987) to a more outward oriented market economy.[1] These policies have, at least partly, been based on the expectation that they would lead to a fast economic recovery after the severe recession of the early 1980s, and a higher long-term economic growth. However, as noted by Dornbusch and Werner (1994), so far these expectations have been largely unfulfilled.

Second, although, by and large, economic growth was slow, these policies were remarkably successful in expanding the Mexican exports. Economic reform policies not only created incentives for exports through liberalization of trade but were also initially accompanied by a monetary policy which emphasized the need for maintaining an undervalued exchange rate as exemplified by the large devaluations that took place between 1985 and 1987. Overall, these policies culminated in a highly favorable environment for the export sector which responded vigorously to these new policies. For instance, in the manufacturing industry the share of exports in total output increased from 3.7 percent in 1970 to 13 percent in 1990. The strong performance of the export sector was especially pronounced after the implementation of the trade liberalization programme.

In assessing the contribution of exports to economic growth in Mexico, there are several reasons to focus on capital accumulation and labour productivity growth. Proponents of export-led growth strategies, for instance, have long suggested that trade contributes to economic growth by increasing economic efficiency, and by inducing positive export externalities; see, *e.g.*, Corbo *et al.* (1985), and Ito and Krueger

[1] For a detailed discussion of the trade liberalization policies undertaken during this period, see Aspe (1993, ch. 3).

(1995). These authors seem to contend that growth of exports is a prerequisite for sustainable economic growth. However, theoretical explanations advanced for this presumed causal link between exports and economic growth have not always been satisfactory. In particular, some of these arguments fail to differentiate between the *level* and the *growth* effects of trade. For example, the influential idea that exports and externalities originating from export industries lead to more efficient allocation of resources in the domestic economy refers essentially to a level effect. Nevertheless, it has been advanced by Feder (1983) and others as an argument to make a case for export-oriented growth strategies.

Recently, a number of authors have revisited the proposition that trade may induce growth effects using a range of theoretical models. Endogenous growth theorists have taken a special interest in this issue, and have suggested that trade may contribute to economic growth by increasing the diffusion of knowledge, the availability of resources devoted to the production of knowledge, the variety and quality of intermediate inputs, and the size of the markets. See, *e.g.*, Romer (1990a, 1994), Grossman and Helpman (1991), and Young (1991). For instance, Young (1991) argues that, after trade liberalization, developing countries may achieve faster productivity and output growth rates to the extent that they can specialize in goods which have not exhausted their learning by doing potentials. These theories have led some economists, such as Dornbusch (1992), to consider trade as a source of productivity and economic growth in developing economies.

A number of economists, on the other hand, have argued that the main contribution of trade to economic growth is not achieved through greater productivity growth, but through physical and human capital accumulation. For instance, Barro *et al.* (1995) discuss the implications of opening-up in a neoclassical growth model, and conclude that liberalization in less developed countries will immediately lead to greater rates of capital accumulation and economic growth. In addition, Baldwin (1992) emphasizes the dynamic aspects of the efficiency gains from trade which will lead to increased accumulation of physical capital after liberalization.

These theoretical models therefore help distinguish between two mechanisms through which trade may contribute to economic growth: *i)* increased productivity growth; and *ii)* increased accumulation of physical capital. Recent literature on economic growth have also emphasized that in an empirical analysis care should be exercised to

uncover the causal relationship implied by these theories. For instance, a simple correlation between a measure of foreign trade (such as exports) and growth does not necessarily imply a causal relationship; that is trade need not precede accumulation and growth.

One should also point out that, although in all these models free trade always improves economic welfare (level effects), especially in the endogenous growth models, liberalized trade does not necessarily lead to faster economic growth. The conditions for positive growth effects typically depend on the particulars of the model and the characteristics of the developing economy; see, *e.g.*, Young (1991). Therefore, at least theoretically, it is not possible to make blanket generalizations concerning the trade-growth relationship. This ambiguity also leads to differences between neoclassical and endogenous growth models in terms of their welfare and policy implications. From a policy standpoint, some of the endogenous growth-trade theories suggest that active industrial policy may be conducive to higher long-term growth.[2] In contrast, in the neoclassical formulations, free-trade always delivers the first-best outcome.

Given the theoretical ambiguity regarding the growth effects of trade, *and* the variety of mechanisms proposed, the trade-growth relationship is ultimately an empirical issue. However, in light of the existing cross-country evidence, so far, it has been difficult to make a judgement whether it is through externality based productivity effects, or capital accumulation that trade contributes to economic growth — be it in a causal or non-causal sense. For instance, Feder (1983) interprets the positive cross-country correlation between exports and output growth rates as supportive evidence for externality effects.[3] On the other hand, Levine and Renelt (1992), and Romer (1990b), report that even though there is a strong correlation between investment and exports, and investment and growth across countries, there is a weak relationship between exports and growth. Levine and Renelt thus interpret these correlations as evidence supportive of the view that the contribution of exports to economic growth is primarily in the form of

[2] These strategic policy issues are similar to those that arise in the international trade literature. Krugman (1984), for instance, has shown that considerations such as monopolistic competition and economies of scale may lead to situations in which import substitution acts as export promotion.

[3] It is important to recognize that no single variable is likely to capture the degree of openness-to-trade across countries. But, this measure is crucial in any empirical study. See Edwards (1993) for a discussion of this issue. This paper focuses on the share of exports as a measure of foreign trade orientation since much of the academic debate has centered around exports.

enhanced physical capital accumulation. Given the differences in interpretation of the econometric findings, and the sensitivity of cross-country growth regression results to model specification (Levine and Renelt, 1992), it thus seems unlikely that this debate can be resolved merely by cross-country studies.

In addition, cross-country studies tend to mask the prevailing heterogeneity of growth policies across even the most export-oriented economies. A recent study by Young (1995), for instance, carefully documents remarkable differences in openness-to-trade, investment, and productivity growth rates that have existed among the East Asian economies. It is therefore difficult to make any causal statements with respect to economic growth and trade (or export-orientation) using cross-country studies.[4] Detailed analysis of individual countries may, in fact, prove to be a better way to improve our current understanding of the interaction between trade and economic growth.

Recently, some authors have also been critical about the studies that attempt to explain cross-country differences in growth rates by differences in export performances. Yotopoulos (1996), for instance, argues that it is the real exchange rate, and not the export shares, which is a significant predictor of long-term growth. Despite the fact that the real exchange rate has been widely perceived as a measure of international competitiveness, and that it has been frequently used as a monetary policy target in many developing countries, including Mexico, it appears that this issue has been highly neglected in the trade-growth literature. This paper, therefore, uses a vector autoregressive model for panel data to explore the possibility that the real exchange rate may explain covariations between exports and rates of investment, and exports and labour productivity growth. The advantage of this framework is that it relates exports to investment and labour productivity growth while controlling for exchange rate movements, and thereby partially accounting for macroeconomic policies that may simultaneously affect all three variables.

The rest of the paper is organized as follows. Section 2 discusses the methodology and the variables used in the study. In Section 3 using successive three-year period averages of exports, investment rates and labour productivity growth rates, a battery of Granger-causality tests

[4] In his review of the existing empirical literature on the relationship between openness-to-trade and exports, Edwards (1993, p. 1389) also concludes that the cross-country studies have "resulted, in many cases, in unconvincing results whose fragility has been exposed by subsequent work".

are conducted. In Section 4 using annual data the analysis is extended to a VAR framework in which the relationship between real exchange rate, exports and rates of investment, and the real exchange rate, exports and labour productivity growth are modelled and estimated. Section 5 concludes the paper.

2. Methodology

2.1. Regressions

To test the hypotheses that trade leads to capital accumulation, and that trade leads to productivity growth, I conduct causality tests which are in the spirit of Granger (1969) and Sims (1972). Similar tests have also been conducted in the cross-country growth studies; see, *e.g.*, Blomström *et al.* (1996). In this context, claiming that Y Granger-causes X is equivalent to saying that the forecasting ability of an autoregression equation of X will improve significantly when past values of Y are included in the forecasting equation as an explanatory variable. Formally, consider the following regression models:

$$X_t = f(\mathbf{X}_{t-k}) \tag{1}$$

$$X_t = g(\mathbf{X}_{t-k}, \mathbf{Y}_{t-l}) \tag{2}$$

where $t = 0,...,T$; f, and g are regression functions; $\mathbf{X}_{t-k}$, and $\mathbf{Y}_{t-l}$ are vectors of lagged values of X_t and Y_t, respectively; and $T > k$, $l \geq 1$ are lag lengths. If the coefficients on the lagged Y in equation (2) are significantly different from zero, then it can be concluded that Y Granger-causes X.

To verify the robustness of the results with respect to alternative specifications, modified versions of the above regression equations may also be considered. Since exports and investment, and exports and labour productivity growth can have dynamic relationships, the empirical analysis also considers causality tests which incorporate both the lead and lagged values of the exogenous variables. In particular, consider the following regression equation:

$$X_t = h(\mathbf{X}_{t-k}, \mathbf{Y}_{t-l}, \mathbf{Y}_{t+r}), \tag{3}$$

where $0 < t + r \leq T$; h is a regression function; and $r \geq 1$ is the lead length. Similarly, in these modified versions, if the coefficients on the lagged Y_t are significantly different from zero, it can be concluded that Y Granger-causes X.

2.2. Variables

In the analysis, the share of manufacturing exports in sectoral output (EXP_{it}) is used to measure trade orientation of sector i at time t. In the cross-country growth literature, share of exports has been widely used to measure a country's openness to foreign trade and competition (Harrison, 1996). Following this literature, this study considers the share of sectoral exports as a proxy for sectoral openness-to-trade. To measure physical capital accumulation, the study uses the rate of gross investment (*INVEST*, investment-capital ratio) in each sector. To measure productivity growth, the first differenced natural logarithm of the real sectoral output-employment ratio (ΔAPL, *i.e.*, average labour productivity growth) is considered. Although labour productivity only captures a limited aspect of factor productivity, it is relatively straightforward to calculate and interpret. A careful analysis of total factor productivity would require detailed information on the human capital composition of each sector. Given that such information is not readily available, the analysis focuses on the conventional average labour productivity. There are 34 manufacturing sectors included in the analysis. The description of the data sources are provided in Appendix A.

Note that the data are both cross-section and time series. The causality tests are performed using *i)* successive three-year averages, and *ii)* annual measures of export shares, investment and productivity growth. Successive three-year averages are used to capture the growth effects of exports on accumulation and productivity growth as it helps to mitigate the impact on the results of short-term fluctuations in the world demand for Mexican exports and in labour productivity due to economic cycles. This methodology has the advantage of focusing on the medium-term variations in exports, investment and labour productivity growth rates, and therefore provides a suitable framework for the analysis of growth. It is especially useful in reducing the short-term effects on exports and investment of business cycle fluctuations and world oil price movements which are pervasive in the data. To check the robustness of results to model specification, the analysis is also extended to annual data (see Section 4).

3. Regression Models and Results

3.1. Exports and Investment

A common prediction of the new growth-trade literature, *e.g.*, Baldwin (1992), is that trade (and trade liberalization) induce growth effects by increasing the country's capital stock. In this context, claiming that exports cause capital accumulation amounts to saying that the forecasting ability of an autoregressive investment equation will improve significantly when past exports are included in the investment equation as an explanatory variable. In particular, consider the linearized versions of the regression models of (1) and (2), respectively, adopted for investment and exports:

$$INV = f_1 + f_2\, INV_{i(t-1)} - \varepsilon_{it}, \tag{4}$$

$$INV = g_1 + g_2\, INV_{i(t-1)} + g_3\, EXPORT_{i(t-1)} + \varepsilon_{it}', \tag{5}$$

where $\beta \equiv [f_1, f_2, g_1, \ldots g_3]'$ is a vector of coefficient parameters, and ε_{it}' and ε_t' are forecasting error terms. It should be emphasized that the regression models (4) and (5) are essentially forecasting equations from which one can assess the contribution of lagged exports to current investment once the recent history of investment is taken into account.[5] Any improvement in the explanatory power of equation (5) over (4) suggests that exports Granger-cause investment.

Table 1, columns [1] and [2], reports the estimated coefficients of equations (4) and (5). The results indicate that the coefficient estimate of export share in the preceding period is not statistically significant in the investment forecasting equation, once past values of investment

[5] In order to select the appropriate lag length, the regression equation (4) was first estimated with three lags, and the estimates were compared with those from two lags, and so on, based on two criteria: *i)* the Akaike information criterion (AIC), and *ii)* a lag selection test for panel data proposed by Holtz-Eakin *et al.* (1988, pp. 1380-1381). The test results suggest that we cannot not reject the investment forecasting model with one lag of investment. In choosing the lag length for the regression equation (5) two alternative specifications were also considered; two lags of both investment and exports, and two lags of investment and one lag of exports. None of these tests provided statistical evidence that the investment equation contains more than a single lag of investment and exports. Similar results emerged for the export forecasting equation discussed below. Appendix B, Table 5 presents the test results. In addition, none of the specification tests proposed by Arellano and Bond (1991) provided any evidence against the specified models.

Table 1. Estimates of the Investment and Exports Equation

No. of sectors: 34

	Dependent Var.: INV_{it}			*Dependent Var.: $EXPORT_{it}$*		
Variable	*[1]*	*[2]*	*[3]*	*[4]*	*[5]*	*[6]*
$INV_{i(t-1)}$	*0.7306	*0.7154	*0.8038	–	0.0001	–0.0004
	(0.0706)	(0.0634)	(0.1228)		(0.0003)	(0.0006)
$EXPORT_{i(t-1)}$	–	0.5610	–34.4276	*1.0121	*1.0072	*1.0769
		(10.0912)	(26.6744)	(0.0413)	(0.0427)	(0.1519)
INV_{it}	–	–	–	–	–	0.0003
	–	–	–	–	–	(0.0003)
$INV_{i(t+1)}$	–	–	–	–	–	0.0004
						(0.0003)
$EXPORT_{it}$	–	–	32.1940	–	–	–
			(27.3546)			
$EXPORT_{i(t+1)}$	–	–	6.4418	–	–	–
			(19.7448)			
Constant	*8.2764	*7.9616	*6.5199	*0.0139	*0.0121	0.0001
	(1.2063)	(1.3946)	(1.4398)	(0.0042)	(0.0059)	(0.0057)
R^2	0.412	0.419	0.673	0.749	0.748	0.705
No. of obs.	204	204	136	204	204	136

Notes: *The coefficient estimate is significant at the 5 percent level.
(a) Investment rate and export share are unweighted averages of annual data; 1970-1972, 1973-1975, 1976-1978, 1979-1981, 1982-1984, 1985-1987, and 1988-1990.
(b) Ordinary least squares estimates of coefficient parameters. Asymptotic standard errors robust to heteroskedasticity, as described in Arellano and Bond (1991), are reported in parentheses.
(c) R^2 is the coefficient of determination of the regression.

are taken into consideration. Note that the preceding period investment is significant and is a relatively good predictor of current investment.[6] Therefore, there is no supportive evidence for the hypothesis of this model that exports Granger-cause investment in the Mexican manufacturing industry during the sample period.

Modified versions of the regression equations (4) and (5) are also useful in analysing the causal relationship running from investment to exports; that is, versions of (4) and (5) can be employed to test the hypothesis that investment in one sector leads to higher future exports in the same sector. Note that this hypothesis is consistent with the arguments advanced by infant-industry protection advocates, who suggest that past investment and learning by doing effects improve the competitiveness of a sector, and thereby lead to increased exports. If the direction of causality indeed runs from investment to exports as the hypothesis suggests, then inclusion of the preceding period investment should improve the explanatory power of the export forecasting equation. In particular, consider the following forecasting models of exports:

$$EXPORT_{it} = f_1' + f_2' \, EXPORT_{i(t-1)} + \varepsilon_{it}, \qquad (6)$$

$$EXPORT_{it} = g_1' + g_2' \, EXPORT_{i(t-1)} + g_3' \, INV_{i(t-1)} + E_{it}' \qquad (7)$$

Estimates of the regression equations (6) and (7) are reported in Table (1), columns [4] and [5]. The results indicate that in this sample there is no evidence supportive of the hypothesis that investment Granger-causes exports. The preceding period investment is not significant at the 10 percent level, and the coefficient estimate of export share variable is significant at the 1 percent level.[7]

The robustness of these results with respect to alternative model specifications can be verified using the dynamic versions of the above regression equations; see equation (3). The estimated coefficients of this model are shown in Table (1), column [3]. The results emerging from

[6] To check the sensitivity of the conclusions to model specification, equation (5) was also estimated with alternative specifications including two lags of exports, three lags of investment with one and two lags of exports. None of the conclusions were affected by these sensitivity analyses. All the results mentioned but not reported in this paper are available from the author upon request.

[7] The forecasting equations (4)-(7) were also estimated in first differences, and none of the results were altered by this. Also, equations (6) and (7) were estimated with two lags of investment and exports, and the results were not sensitive to this.

this investment model also do not provide support for the hypothesis that exports Granger-cause investment in the sample period in the manufacturing industry. The coefficient estimates of the preceding, current and following period export shares are not significant at the 5 percent level, and the preceding period investment is significant at the 1 percent level. In addition, coefficient estimates of the preceding and current period exports are jointly insignificant at the 10 percent level.[8]

The same causality analysis with lagged, current and lead variables of investment together with lagged exports regressed on current exports has also been performed to investigate the directional causality from investment to exports. The results shown in Table (1), column [6], do not provide evidence for the hypothesis that lagged investment Granger-causes exports at conventional levels of statistical significance, and this is consistent with the previous results.[9]

3.2. Exports and Labour Productivity

In contrast to the neoclassical growth-trade theories, the endogenous growth-trade literature, *e.g.*, Young (1991), emphasizes that it is the productivity growth effects of trade (and trade liberalization) that generate long-term output growth effects. In the framework of Young, specialization in goods that entail learning by doing result in productivity spillover effects appropriated by their technological "neighbours". These learning by doing and spillover effects, in turn, manifest themselves in expanding exports and higher average productivity growth rates. In this context, claiming that exports cause productivity growth amounts to saying that the forecasting ability of an autoregressive productivity growth equation will improve significantly when past exports are included as an explanatory variable.

It should also be noted that since the main focus of this study is the impact of foreign trade on productivity growth, the appropriate measure to use in the analysis is the level of exports, and not the change in exports. This specification is therefore consistent with the predictions of the advocates of the export-led growth strategies and the

[8] The test statistic is 1.669, and it is distributed chis-quared with 2 degrees of freedom. Similar conclusions emerge when the investment equation is estimated in first differences.

[9] Other results (not reported) show, however, that when the regression equation with the current and lead values of investment is estimated in first differences the coefficient estimate of the preceding period investment becomes significant at the 1 percent level.

endogenous trade theorists that export oriented sectors have higher productivity growth rates; *i.e.*, that higher export levels lead to higher growth.[10]

In particular, the study considers the linearized versions of the regression models of (1) and (2) adopted for exports and labour productivity. It is important to emphasize that labour productivity growth equations should only be interpreted as forecasting equations using all the information contained in past productivity growth rates and exports. The point of all this is to specify an estimating equation to test if past exports help explain labour productivity growth, rather than to model the determinants of productivity growth in the manufacturing industry.

Table 2 reports the regression results of the causality analysis. Columns [1]-[3] show the estimation results of the regressions in which, under the maintained hypothesis, causality is running from exports to labour productivity growth.[11] Three results emerge from the regression estimates of the labour productivity growth forecasting equations. First, the coefficient estimate of the past export share variable is not significant in the productivity growth equation, which includes only past information. Second, the coefficients on the lagged and lead values of export share are *negative* when current exports are included in the regression. Third, the coefficient estimate of the current exports is positive and significant at the one percent level, which suggests that there is a significant contemporaneous correlation between exports and labour productivity growth. However, overall there is no systematic evidence that past exports lead to higher labour productivity growth rates.[12] Also, it is important to note that the constant term which

[10] Alternatively, the cross-sectoral relationship between the change in exports and the productivity growth could also be analyzed. But, this would have only uncovered whether export-oriented sectors have higher productivity levels. There is substantial empirical evidence which suggests that, in Mexico, export-oriented sectors have higher productivity levels; see, *e.g.*, Casar *et al.* (1990).

[11] The AIC and the *L*-test statistics (see footnote 5) provided mixed results regarding the appropriate lag length in the labour productivity growth forecasting equation. Specifically, the latter test suggests that there is no statistical evidence that labour productivity equation contains more than a single lag. However, when the model is estimated with a single lag, there is strong evidence for second-order serial correlation in error terms. The test statistic is –2.17 and has a standard normal distribution under the null of no second-order serial correlation (see Arellano and Bond, 1991). Therefore, the model with two lags was chosen as a parsimonious representation of average labour productivity growth.

[12] It should, however, be noted that when labour productivity forecasting equation is estimated with three lags of labour productivity growth and a single lag of exports, the coefficient estimate of lagged exports becomes statistically significant. Although, its coefficient is significant, lagged exports does not nevertheless improve the explanatory power of the model significantly.

captures the "trend" labour productivity growth rate is about 0.7 percent per year, and is highly significant.

For comparison, the same analysis is repeated to investigate the causality running from labour productivity growth to exports. Two important conclusions emerge from the results shown in Table 2, columns [4]-[6]. First, there is a positive correlation between current values of labour productivity growth and export shares. Note that this contemporaneous correlation between productivity growth and exports is robust to model specification. Second, past labour productivity growth seems to be negatively correlated with current export shares.[13] From an economic standpoint, the negative correlation between the past period averages of labour productivity growth and the current period averages of export shares (and vice versa) is somewhat counter-intuitive. However, it may be conjectured that the observed correlations might be due to omitted variables that are negatively correlated with the labour productivity growth, and positively correlated with the prediction errors of the export share forecasting equation.[14]

In summary, the regression results show that the contemporaneous correlations between three-year period averages of export shares and rates of investment, and between export shares and labour productivity growth rates are both positive. However, although the results are not supportive of any Granger-causal relationship among these three variables, they do not rule out the possibility of an association between exports and investment. In fact, given the estimated contemporaneous correlations, the results appear to be consistent with cross-country studies that reported significant correlations between exports and investment, and between exports and growth. It is therefore possible to explain these correlations by variations in common determinants that simultaneously affect investment, labour productivity, and exports. Although a range of variables can theoretically account for the observed correlations, the next section focuses on the real exchange rate using annual data. This will not only allow to check the sensitivity of the results based on the three-year averages of annual data employed in this section, but also help explore the significance of exchange rate

[13] The results are analogous when the export forecasting equation is estimated with a single lag of exports, rather than two.

[14] It should be emphasized that the results reported in this Section do not rule out the possibility that investment, labour productivity and exports may be determined jointly. The above analysis is thus consistent with the view that investment in physical capital, which increases labour productivity, may be undertaken to meet export demand.

Table 2: Estimates of the Productivity Growth and Exports Equation

No. of sectors: 34

	Dependent Var.: ΔAPL_{it}			*Dependent Var.:* $EXPORT_{it}$		
Variable	*[1]*	*[2]*	*[3]*	*[4]*	*[5]*	*[6]*
$\Delta APL_{i(t-1)}$	–0.0566	–0.0633	0.0354	–	*–0.2848	*–0.2952
	(0.0648)	(0.0647)	(0.0758)		(0.0767)	(0.0762)
$\Delta APL_{i(t-1)}$	*–0.2098	*–0.2023	*–0.0398	–	–	–
	(0.0862)	(0.0849)	(0.0653)			
$EXPORT_{i(t-1)}$	–	0.0413	*–0.1642	*1.0965	*1.1333	*1.1930
		(0.0319)	(0.8257)	(0.1135)	(0.1140)	(0.2245)
$EXPORT_{i(t-2)}$	–	–	–	–0.1516	–0.1797	–0.1683
				(0.1399)	(0.1376)	(0.1523)
ΔAPL_{it}	–	–	–	–	–	*0.1438
						(0.0663)
$\Delta APL_{i(t+1)}$	–	–	–	–	–	0.1246
						(0.0839)
$EXPORT_{it}$	–	–	*0.5496	–	–	–
			(0.1265)			
$EXPORT_{i(t+1)}$	–	–	*–0.3586	–	–	–
			(0.0849)			
Constant	*0.0241	*0.0214	*0.0169	*0.0173	*0.0222	*0.0167
	(0.0051)	(0.0039)	(0.0045)	(0.0039)	(0.0052)	(0.0036)
R^2	0.048	0.052	0.127	0.733	0.758	0.723
No. of obs.	170	170	136	170	170	136

Notes: * The coefficient estimate is significant at the 5 percent level.

(a) ΔAPL is the average labour productivity growth rate.

(b) Average labour productivity growth and export share are unweighted averages of annual data; 1970-1972, 1973-1975, 1976-1978, 1979-1981, 1982-1984, 1985-1987, and 1988-1990.

(c) Ordinary least squares estimates of coefficient parameters. Asymptotic standard errors robust to heteroskedasticity, as described in Arellano and Bond (1991), are reported in parentheses.

(d) R^2 is the coefficient of determination of the regression.

policies in growth and development. As the December 1994 currency crisis has illustrated, these policies are an important consideration in the Mexican case.

4. Exports and Real Exchange Rate

In the absence of any systematic causal links, a "natural" route to explain the contemporaneous correlations among exports, investment and labour productivity is to consider the possibility that all these variables may be determined by some common macroeconomic variables. Although this issue may have important policy implications, it has been highly neglected in the exports-growth literature.[15] Here we focus on the real exchange rate. Since Mexico is a small open economy, and was becoming more open during the sample period, the real exchange rate can be viewed as a measure of its international competitiveness and can be readily linked to the variables in question. In the international trade and development literature real exchange rate has also been used to measure the anti-export bias of a country (see Edwards (1993) for discussion). Improved competitiveness of the Mexican goods in the world markets due to a depreciation of its exchange rate may simultaneously induce faster capital accumulation to meet future world demand, and higher exports. To the extent that a currency depreciation reduces Mexican imports of consumption goods, the real exchange rate may also be linked to the alleviation of balance of payments constraints on the imports of capital goods. Therefore, a depreciation of the real exchange rate may simultaneously increase exports and accelerate capital accumulation.

Similarly, to the extent that real exchange rate movements have an impact on the utilization of the existing capital stock through aggregate demand effects, we may estimate a statistically significant correlation between the real exchange rate and the sectoral labour productivity growth rates. But this correlation may be positive or negative. For instance, a devaluation may reduce domestic income, and thereby reduce domestic absorption. If the increase in foreign demand for Mexican exports does not fully compensate the decline in domestic consumption, and if rapid adjustment is costly, some excess capacity in

[15] An important exception is the recent cross-country study by Yotopoulos (1996), which investigates the link between output growth rates and exchange rate policies.

the industry may occur. This may, in turn, lead to a decline in average labour productivity levels until firms adjust their employment. It is therefore possible that government policy changes may lead to predictable changes in all the variables under consideration without necessarily implying any causality in the observed covariations among exports, investment and productivity.

It is therefore useful to extend the previous analysis to a multivariate framework, and consider the real exchange rate as a determinant of sectoral exports, investment rates, and productivity growth rates. The regression analysis in Section (3) was based on the understanding that the (causal) relationships among these variables may be more easily identified using their medium-term averages. This framework is modified to accommodate the short-term movements in the real exchange rate that may have both short and medium-term effects. Therefore, in what follows the regression models are estimated using annual data. This also allows to check the sensitivity of the previous results to model specification.

4.1. Investment, Exports and Real Exchange Rate

To explore the possible relationships among exports, investment and the real exchange rate, I specify a reduced form vector autoregression (VAR) model. The advantage of the VAR framework is that it allows to conduct causality tests that are similar to those in Section 3. For a detailed discussion of VAR models and causality tests in panel data settings see Holtz-Eakin *et al.* (1988).[16] The model treats the real exchange rate as exogenous, and, as in the previous forecasting equations, specifies exports and investment as autoregressive processes. More specifically, consider the following VAR model:

$$EXPORT_{it} = \delta_0^* + \alpha^*(L)INV_{it} + \beta^*(L)EXPORT_{it} + \gamma^*(L)EXCH_{it} + u_{it}^* \quad (8)$$

$$INV_{it} = \delta_0 + \alpha(L)INV_{it} + \beta(L)EXPORT_{it} + \gamma(L)EXCH_{it} + u_{it} \quad (9)$$

[16] Readers who prefer the term "precedence" rather than causality in this framework, may interpret the findings of this section accordingly. Here, the terminology used by the panel data literature is adopted.

where $EXCH_{it}$ is the real exchange rate index, [$\alpha(L)$, $\alpha^*(L)$, $\beta(L)$, $\beta^*(L)$, $\gamma(L)$, $\gamma^*(L)$] are polynomial lag operators, and u_{it}, and u^*_{it} are random disturbances. In the empirical analysis, after preliminary diagnostic tests, three year lags of export and investment variables, and current and lagged values of real exchange rate index are found to be appropriate to capture the short-term dynamics.[17] Note that an increase in the exchange rate index indicates a depreciation of the Mexican peso with respect to the U.S. dollar.[18]

Table 3 reports the coefficient estimates of the VAR model (8)-(9) and a battery of specification tests. The estimation results show that in the Mexican manufacturing industry the real exchange rate is a determinant of both exports and investment decisions. In both regression equations, the estimated coefficient of the current real exchange rate is positive and significant. In addition, the lagged real exchange rate is significant in the investment equation. These results provide evidence in support of the main thesis of this paper, namely, that variables, such as the real exchange rate, which affect both investment and exports, may be behind the observed cross-country correlations and the contemporaneous correlations reported in Section 3. In general, estimation results of this multivariate analysis are a consistent with the previous Granger-causality tests. For instance, in the investment equation, coefficient estimates of lagged and two year lagged export shares are not significant. Only the coefficient estimate of the three year lagged export share is significant at the 5 percent level. Therefore, annual sectoral data do not exhibit systematic causal relationship between exports and investment in the Mexican manufacturing industry from 1970 to 1990.

4.2. Labour Productivity, Exports and Real Exchange Rate

To explore the link between exports and average labour productivity growth during this period, using the VAR framework a similar causality analysis is also conducted. Again, the main objective of these regression models is to uncover the relationship between exports and labour productivity growth, and not to provide an empirical model for the variables in question. Specifically, consider the following regression models:

$$EXPORT_{it} = \delta_0' + \beta'(L)EXPORT_{it} + \gamma'(L)EXCH_{it} + \alpha'(L)\Delta APL_{it} + \upsilon_{it}' \quad (10)$$

$$\Delta APL_{it} = \delta_0'' + \beta''(L)EXPORT_{it} + \gamma''(L)EXCH_{it} + \alpha''(L)\Delta APL_{it} + \upsilon_{it}'' \quad (11)$$

where ΔAPL is the growth of average labour productivity, and $EXCH$ is the real exchange rate. AIC and appropriate lag selection tests (see Appendix B, Table 5) do not provide strong evidence against the hypotheses that export and labour productivity growth equations contain more than three lags of exports and labour productivity. In addition, in both equations with three lags, we cannot reject the hypothesis of joint significance of the longest lags of exports and labour productivity at any level of significance less than 5 percent and 25 percent, for the export and labour productivity equations, respectively. Therefore, the regression models with three lags of exports and labour productivity growth are specified.[19]

Three important results emerge from the estimates of the regression models (10) and (11), shown in Table 4. First, after controlling for the real exchange rate effects, there is no significant relationship between current exports and the lagged labour productivity growth rates. Second, labour productivity growth and real exchange rate are negatively correlated. That is, a depreciation of the real exchange rate appears to have an adverse effect on the labour productivity growth rate. Although the coefficient estimate of the lagged real exchange rate variable in the labour productivity equation is positive, its absolute size is smaller than the contemporaneous correlation. These findings suggest that, say, during an undervalued exchange rate regime, excess capacity may occur in the manufacturing industry, due to perhaps contractions in aggregate demand, and this may lead to declining average labour productivity levels.[20]

[17] AIC and appropriate lag length selection tests provided no strong evidence against the hypothesis that the export and the investment equations contain more than three lags of exports and investment (see Appendix B, Table 5). As well, when the models are specified with three lags of investment and export, the longest lags are jointly significant at the ten percent level. The Wald statistic, which is distributed chi-squared under the null hypothesis of joint insignificance, is 5.34 and 11.44 for the export and investment equations, respectively.

[18] See Appendix A for the construction of the real exchange rate index.

[19] The labour productivity growth regressions were also estimated with two lags of exports and labour productivity only. None of the conclusions were affected by these specifications.

[20] See, *e.g.*, Krugman and Taylor (1978), on an analysis of the contractionary consequences of devaluations.

Table 3. Estimates of the VAR Model of Exports and Investment

Annual data: 1973-90 (34 sectors)

Independent Variables	*Exports Equation*	*Investment Equation*
$EXPORT_{i(t-1)}$	*77.2355 (11.8333)	1.7321 (14.0003)
$EXPORT_{i(t-2)}$	0.7064 (12.5967)	–22.7627 (22.4011)
$EXPORT_{i(t-3)}$	*20.0016 (9.1936)	*27.8996 (13.8274)
$EXCH_t$	*0.0753 (0.0172)	*0.1181 (0.0241)
$EXCH_{t-1}$	0.0222 (0.0158)	*0.0717 (0.0310)
$INV_{i(t-1)}$	*–0.0251 (0.0135)	*0.5112 (0.0537)
$INV_{i(t-2)}$	0.0115 (0.0261)	–0.0430 (0.0481)
$INV_{i(t-3)}$	–0.0095 (0.0249)	*0.1399 (0.0699)
Constant	*–5.5119 (1.2618)	*–14.9856 (3.2279)
R^2	0.174	0.543
$m_1, N(0, 1)(df = 34)$	–1.725	–0.944
$m_2, N(0, 1)(df = 34)$	0.923	0.332
$z_1, X^2\ (df = 8)$	4991.973	631.662
$z_2, X^2\ (df = 3)$	35.281	4.560
$z_3, X^2\ (df = 3)$	5.765	5.629

Notes: Estimated export and investment equations are (8) and (9), respectively. To reduce the number of leading zeros, coefficient estimates and standard errors of the exports equation have been multiplied by 100.

* The coefficient estimate is significant at the 5 percent level.

(a) Ordinary least squares estimates of coefficient parameters. Asymptotic standard errors robust to heteroskedasticity, as explained in Arellano and Bond (1991), are reported in parentheses.

(b) R^2 is the coefficient of determination of the regression. m_1 and m_2 have a $N(0, 1)$ distribution under the null of no first and second order serial correlation, respectively. z_1 is a Wald statistic which is a test of the joint significance of the independent variables asymptotically distributed as X^2_k under the hypothesis of no relationship, where k is the number of coefficients estimated. z_2 is a Wald statistic with X^2 distribution under the null hypothesis of the stationarity of the parameter coefficients of the export share variables across periods 1973-1981 and 1982-1990. z_3 is a Wald statistic which is a test of the joint significance of the past investment (export) variables in the export (investment) equation with X^2 distribution under the null hypothesis of no relationship. Degrees of freedom are reported in parentheses.

(c) Number of observations is 612 in all equations.

(d) All equations include a constant which is not reported.

Table 4. Estimates of the VAR Model of Exports and Labour Productivity Growth

Annual data: 1973-90 (34 sectors)

Independent Variables	*Exports Equation*	*Labour Productivity Equation*
$EXPORT_{i(t-1)}$	*76.7344 (12.6509)	*0.3045 (0.1391)
$EXPORT_{i(t-2)}$	1.0686 (12.8130)	–0.1922 (0.1647)
$EXPORT_{i(t-3)}$	*19.9037 (9.4257)	–0.0410 (0.1284)
$EXCH_t$	*0.0747 (0.0173)	*–0.0015 (0.0002)
$EXCH_{t-1}$	0.0285 (0.0162)	*0.0011 (0.0002)
$\Delta APL_{i(t-1)}$	–1.2515 (1.7550)	*–0.3547 (0.0813)
$\Delta APL_{i(t-2)}$	–0.5860 (1.9562)	–0.1169 (0.0756)
$\Delta APL_{i(t-3)}$	–0.8579 (1.7429)	–0.0402 (0.0306)
Constant	*–5.0533 (1.2131)	*0.0725 (0.0234)
R^2	0.822	0.165
$m_1, N(0, 1)(df = 34)$	–1.895	0.931
$m_2, N(0, 1)(df = 34)$	1.367	–1.502
$z_1, X^2\ (df = 8)$	5369.916	145.971
$z_2, X^2\ (df = 3)$	42.126	22.506
$z_3, X^2\ (df = 3)$	0.661	7.657

Notes: Estimated exports and labour productivity equations are (10) and (11), respectively.
To reduce the number of leading zeros, coefficient estimates and standard errors of the exports equation have been multiplied by 100.
* The coefficient estimate is significant at the 5 percent level.
(a) Ordinary least squares estimates of coefficient parameters. Asymptotic standard errors robust to heteroskedasticity, as explained in Arellano and Bond (1991), are reported in parentheses.
(b) Number of observations is 578 in all equations.
See also notes to Table 3.

Third, after accounting for the real exchange rate effects, there is a positive correlation only between current labour productivity growth rate and once lagged exports. However the coefficients on the remaining export share variables are not significant. The results indicate that impact of exports on productivity may be limited to one time level effects, and not to long-term productivity growth effects as suggested by the export-led growth advocates. Also these results may suggest that the negative correlation between past period labour productivity and export shares found in the previous section may be largely due to omitted variables.[21]

5. Concluding Remarks

In the economic growth literature there are two viewpoints that attempt to explain the contribution of international trade to economic growth. Whereas the first viewpoint states that the contribution of trade is mainly through its impact on capital accumulation, the alternative view contends that trade leads to growth through faster productivity growth. From a public policy standpoint, these hypotheses have different implications for development policy and trade liberalization. This paper therefore tested these two alternative hypotheses using sectoral data from the Mexican manufacturing industry between 1970 and 1990. Despite the large variations in export shares across sectors and over the sample period, overall the study found little evidence that *i)* exports lead to capital accumulation (or vice versa) and *ii)* exports lead to faster labour productivity growth (or vice versa).

In addition, although contemporaneous correlations among these variables are estimated to be positive and significant, the paper has argued that these associations may not be due to causal relationships. In particular, the study investigated the possibility of explaining these cross-sectional and time-series correlations by common macroeconomic variables, such as the real exchange rate. The results suggest strong links among exports, investment and labour productivity growth,

[21] To account for the possibility that the forecasting equations might have gone through a structural transformation after the 1982 debt crisis, I also performed structural change tests. The results shown in Tables 3 and 4 indicate that coefficients on past export variables may have exhibited parameter instability over the period under consideration; see the Wald statistics z_2 reported in these Tables. However, regression estimates (not reported) that take this issue into consideration did not alter any of the conclusions.

which can be partially attributed to the real exchange rate effects. These findings highlight the importance of macroeconomic (and exchange rate) policies in fostering economic growth in Mexico through accumulation, while improving the international competitiveness of the manufacturing industry. They also suggest that capital accumulation or exports may not necessarily foster each other when they are individually targeted.

The contribution of exports to growth has long attracted the attention of international trade-growth economists. The evidence presented in this paper seems to support the findings of the recent growth literature; *i.e.*, the relationship between export orientation and growth is weak. For instance, advocates of endogenous growth theories, such as Young (1995), have argued that, even in the most eminent export-oriented East Asian economies, extensive human and physical capital accumulation has been the most important determinant of economic growth. In a recent cross-country study, Sala-i Martin (1997, p.182) also found no evidence supporting the claim that outward orientation is a determinant of long-run growth.[22]

There is no doubt that international trade help to achieve efficient allocation of resources, and these *level* effects have long been emphasized by economists. However, it appears that linking exports to long-term *growth* based on externality effects or increasing returns to capital accumulation may not be empirically well supported. It may therefore be warranted to refocus the public policy discussions in Mexico on the microeconomic aspects of economic growth, such as education and human capital accumulation to faster long-term growth. Although neoclassical and endogenous growth theories have identified these factors as pertinent for growth and development, they have paid little attention to economic environments in which there is considerable exchange rate uncertainty. This uncertainty, however, seems to have more significance for economic policy than the externality based distinctions that the growth theories have made. Thus, to the extent that macroeconomic policies can prevent the overvaluation of the real exchange rate, and reduce policy-induced uncertainty and risk premiums, they may be conducive to both exports and capital accumulation.

[22] This is not to deny that there may be a positive relationship between alternative measures of openness-to-trade and growth; see, e.g., Sachs and Warner (1995), and Sala-i Martin (1997). It is possible that either export orientation is a poor measure of openness-to-trade, or that there may be reverse causality running from growth to trade (Slaughter, 1997).

References

Arellano, Manuel, and Stephen Bond (1991), "Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations", *Review of Economic Studies*, No. 58, pp. 277-297.

Aspe, Pedro A. (1993), *Economic Transformation the Mexican Way*, Cambridge, London, MIT Press.

Baldwin, Richard E. (1992), "Measurable Dynamic Gains from Trade", *Journal of Political Economy*, No. 100, pp. 162-174.

Barro, Robert J., N. Gregory Mankiw, and Xavier Sala-I Martin (1995), "Capital Mobility in Neoclassical Models of Growth", *American Economic Review*, No. 85, pp. 103-115.

Blomström, Magnus, Robert E. Lipsey, and Mario Zejan (1996), "Is Fixed Investment the Key to Economic Growth?", *Quarterly Journal of Economics*, No. 111, pp. 269-276.

Casar, José I., Carlos M. Padilla, Susana Marván, Gonzalo Rodríguez G., Jaime Ros (1990), *La organización industrial en México*, Mexico City, Siglo Veintiuno.

Corbo, Vitto, Anne O. Krueger, and Fernando Ossa (eds.) (1985), *Export Oriented Development Strategies*, Boulder, Westview Press.

Dornbusch, Rudiger (1992), "The Case for Trade Liberalization in Developing Countries", *Journal of Economic Perspectives*, Vol. 6, No. 1, pp. 69-85.

Dornbusch, Rudiger, and Alejandro Werner (1994), "Mexico: Stabilization, Reform, and No Growth", *Brookings Papers on Economic Activity*, 1, pp. 253-315.

Edwards, Sebastian (1993), "Openness, Trade Liberalization, and Growth in Developing Countries", *Journal of Economic Literature*, No. 31, pp. 1358-1393.

Feder, Gershon (1983), "On Exports and Economic Growth", *Journal of Development Economics*, No. 12, pp. 59-73.

Granger, C.W.J. (1969), "Investigating Causal Relations by Econometric Models and Cross-Spectral Methods", *Econometrica*, No. 37, pp. 424-438.

Grossman, Gene M., and Elhanan Helpman (1991), *Innovation and Growth in the Global Economy*, Cambridge, Mass.. MIT Press.

Harrison, Ann (1996), "Openness and Growth: A Time Series, Cross-Country Analysis for Developing Countries," *Journal of Development Economics*, No. 48, pp. 419-447.

Holtz-Eakin, Douglas, Whitney Newey, and Harvey Rosen (1988), "Estimating Vector Autoregressions with Panel Data", *Econometrica*, No. 56, pp. 1371-1395.

Ito, Takatoshi, and Anne O. Krueger (eds.) (1995), *Growth Theories in Light of the East Asian Experience*, Chicago/London, University of Chicago Press.

Krugman, Paul R., and Lance Taylor (1978), "Contractionary Effects of Devaluations", *Journal of International Economics*, No. 8, pp. 445-456.

Krugman, Paul R. (1984), "Import Protection as Export Promotion", in Henryk Kierzkowski (ed.), *Monopolistic Competition and International Trade*, Oxford, Blackwell.

Levine, Ross, and David Renelt (1992), "A Sensitivity Analysis of Cross-Country Growth Regressions", *American Economic Review*, No. 82, pp. 942-968.

Romer, Paul M. (1990a), "Endogenous Technological Change", *Journal of Political Economy*, No. 98, October, S71-S102.

——— (1990b), "Capital, Labor, and Productivity", *Brookings Papers on Economic Activity, Microeconomics*, pp. 337-367.

——— (1994), "New Goods, Old Theory, and the Welfare Costs of Trade Restrictions", *Journal of Development Economics*, No. 43, pp. 5-38.

Sachs, Jeffrey, and Andrew Warner (1995), "Economic, Reform and the Process of Global Integration.", *Brookings Papers on Economic Activity*, No. 1, pp. 1-18.

Sala-i Martin, Xavier X. (1997) "I Just Ran Two Million Regressions", *American Economic Review Papers and Proceedings*, Vol. 87, No. 2, pp. 178-183.

Slaughter, Matthew J. (1997), "Per Capita Income Convergence and the Role of International Trade", *American Economic Review Papers and Proceedings*, Vol. 87, No. 2, pp. 194-199.

Sims, Christopher A. (1972), "Money, Income and Causality", *American Economic Review*, No. 62, pp. 540-552.

World Bank (1987), *World Development Report 1987*, Oxford, Oxford University Press.

Yotopoulos, Pan A. (1996), *Exchange Rate Parity for Trade and Development: Theory, Tests, and Case Studies*, Cambridge, Cambridge University Press.

Young, Alwyn (1991), "Learning by Doing and the Dynamic Effects of International Trade", *Quarterly Journal of Economics*, No. 106, pp., 369-405.

——— (1995), "The Tyranny of Numbers: confronting the Statistical Realities of the East Asian Growth Experience", *Quarterly Journal of Economics*, No. 10, pp. 641-680.

Appendix A. Data

The export, and output data used in this study come from the national income accounts and were made available by the Instituto Nacional de Estadística, Geografía e Informática (INEGI). The sectoral capital stock and investment estimates are compiled by the Banco de México. The data cover both public and private sector, and include observations on forty nine manufacturing sectors *(ramas)*. Those sectors with heavy state ownership and price controls during the period under consideration were omitted. "Other manufacturing industries" was also omitted, leaving 34 sectors, which are: meat preparation and packing, preparation of fruits and vegetables, wheat flour, sugar, edible vegetable oil and fats, animal feed, other food products, alcoholic beverages, beer and malt, soft drinks, plywood and fiberboard, other wood products, paper and carton, basic chemicals, fertilizers, synthetic resins and artificial fibers, pharmaceutics, soaps, detergents and cosmetics, other chemical products, rubber products, glass and glass products, cement, non-metal products, iron and steel, basic metal industries, metal furniture, other metal products excluding machinery, non-electrical machinery and equipment industries, electrical machinery and appliances, durable electrical appliances, electronic machinery and equipment, electrical equipment and apparatus, automobile vehicles and engines, automobile parts and bodies for automobiles, transportation equipment.

Capital stock and investment variables are measured in constant 1970 prices. *Investment rate* is the ratio of gross investment to gross capital stock. Exports and output are measured in constant prices. *Export share* is defined as the ratio of total exports to gross output. *Real exchange rate index* is the period average nominal Mexican peso price of one U.S. dollar deflated by the ratio of the Mexican and U.S. consumer price indices (CPIs) with base year 1985. The base year for the real exchange rate index is then shifted to 1980. Data on the exchange rate, and the CPIs are obtained from IMF, *International Financial Statistics*. Since roughly 85 percent of the Mexican foreign trade is with the U.S. a weighted real exchange rate index has not been constructed.

Appendix B

Table 5. Tests for Lag Length

		a) Successive three-year averages				
Model		*l*	*AIC*	*L-statistic*	*df*	*p-value*
Investment equation		3	6.99	0.25	1	0.617
		2	5.84	0.14	1	0.708
		1	4.65	–	–	–
Export share equation		3	1.08	0.11	1	0.741
		2	1.07	0.01	1	0.920
		1	0.83	–	–	–
Labor productivity growth equation		3	1.13	0.22	1	0.639
		2	1.37	0.09	1	0.764
		1	1.20	–	–	–
		b) Annual Data				
Dep. Var.	*Indep. Var.*	*l*	*AIC*	*L-statistic*	*df*	*p-value*
Exports	Investment	4	1.08	0.01	2	0.995
Exports	Investment	3	1.09	–	–	–
Investment	Exports	4	2.82	1.69	2	0.429
Investment	Exports	3	1.13	–	–	–
Labor prod.	Exports	4	7.59	0.17	2	0.918
Labor prod.	Exports	3	7.76	–	–	–
Exports	Labor prod.	4	1.01	0.08	2	0.961
Exports	Labor prod.	3	1.08	–	–	–

Notes: AIC is the Akaike information criterion. *L*-statistic is defined as restricted sum of squared residuals minus the unrestricted sum of squared residuals, and it has a X^2 distribution under the null hypothesis of linear restrictions on lag lengths. The table shows the results for the sequence lag length **l** = 3 (versus 2), and *l* = 2 (versus 1). *df* is the degrees of freedom.

Sectoral Public Power and Endogenous Growth

David Mayer Foulkes*

Abstract: We study growth in an economy composed of sectors producing specific goods with advantage under fragmented competition. The government allocates public inputs. Sectorial political power defines government objectives and restrictions, and consists of passive resistance (bounding taxation), organized resistance (an effective minimum welfare demand), and socially organized power (pushing Sectorial objectives). Income distribution and growth, mechanisms and incentives for public investment allocation, and political organization incentives, are strikingly different functions of input dependence and political power in open and closed economies. Long-term political economy equilibria and tendencies in political transition due to technical or trade policy changes can be modeled.

Resumen: Estudiamos el crecimiento en una economía compuesta de sectores que producen bienes específicos con ventajas, bajo competencia fragmentada. El gobierno asigna insumos públicos según objetivos y restricciones, funciones del poder sectorial, originado en resistencia pasiva (que acota impuestos), resistencia organizada (demanda efectiva de bienestar mínimo) y poder socialmente organizado (que propugna objetivos sectoriales). Las dependencias económicas intersectoriales y el poder político implican distribución del ingreso, crecimiento, mecanismos e incentivos de inversión pública, e incentivos de organización política muy diferentes en economías abiertas y cerradas. Pueden modelarse equilibrios político-económicos de largo plazo y transiciones políticas debidas al cambio técnico o de política comercial.

1. Introduction

This article studies growth and distribution when the differentiated access of productive sectors to the economic benefits of power is of strategic importance. Our interest is centered in market economies in which the political system is characterized by a stable balance of

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