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Does Saving Really Matter for Growth? Mexico (1970-2000)

by

M Teresa Alguacil, Ana Cuadros and Vicente Orts

Centre for Research in Economic Development and International Trade, University of Nottingham

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Acknowledgements
The authors would like to thank Oliver Morrissey for his valuable comments. They are also indebted to the projects: Fundación Caixa Castellóë BANCAIXA P1B99-15 and CICYT SEC 1999-0598 for financial support.

May 2002

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Outline
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2. Theoretical Considerations and Empirical Studies
3. Data and Methodological Approach
4. Empirical Results
5. Concluding Remarks and Policy Implications
6.

Does Saving Really Matter for Growth?

Mexico (1970-2000)

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1 Introduction

The central presumption of Solow's (1956) type growth models is that higher saving precedes and causes economic growth. The main policy implication of these models for development is that countries that manage to increase their saving rate, and therefore investment, will increase their rate of growth. Alternatively, if the reverse sequence occurs, the policy emphasis should be shifted away from saving and concentrated on removing impediments to growth.

The existence of a positive association between saving and growth is a robust empirical finding (see, for example, Modigliani, 1970, Bosworth, 1993, Carrol and Weil, 1994, and Edwards, 1995). However, correlation does not imply causality and the debate about the saving-growth nexus is far from being settled. The controversy concerning the temporal precedence between these two variables is one of the most questioned issues in current macroeconomics, as noted by Schmidt-Hebbel *et al.* (1996). Nevertheless, the determination of the direction of the causal link between saving and growth is a crucial economic problem as it has important policy implications for developing countries.

The view that growth appears to cause saving has found support in several recent papers. For instance, Gavin *et al.* (1997) argue that: "Higher growth rate precedes higher saving rather than the reverse... According to this view, Latin America's chronically low rate of saving is primarily the consequence, more than the cause, of the region's history of low and volatile economic growth" (p. 13). Sinha and Sinha (1998) vindicate these assertions and conclude that the conventionally accepted view that higher saving rate causes higher economic growth does not hold for Mexico. Their principal finding is that causality goes in the opposite direction.

In this paper, we present an alternative perspective on the saving-growth relationship in Mexico for the period 1970-2000. Our main objective is to highlight that in an open economy, domestic investment can be financed by domestic or foreign saving, through inflows of international capital. That is, net foreign resource inflows might supplement domestic saving and help countries reach higher rates of investment and growth. This hypothesis seems to be particularly relevant for certain types of capital inflows, principally for foreign direct investment (FDI).

The relatively successful implementation of macroeconomic stabilisation measures and liberalisation programs since the beginning of the eighties have increased the participation of FDI in total capital inflows in the Mexican economy. These programs have created a more favourable economic environment augmenting foreign investors confidence in this country. A large proportion of foreign flows has been directed to innovative "greenfield" investments in the manufacturing sector, particularly the *maquiladoras*, where international trade links are strong (Ramírez, 2000). The Mexican experience can thus provide an interesting case study to evaluate the influence of FDI on the saving-growth nexus.

Contrary to Sinha and Sinha (1998), our findings support the dominant view that higher saving precedes higher growth in Mexico. As we will demonstrate, the lack of support for the saving-growth nexus found by these authors could be related to the omission of foreign direct investment (FDI). By omitting this variable, they do not consider either the role played by foreign inflows in complementing domestic saving, or the beneficial effects of FDI on domestic income.

The rest of the paper is organised as follows. Section 2 discusses the the-

oretical reasons for considering FDI when analysing the saving-growth nexus. Section 3 contains a description of data and the estimation procedure. Section 4 presents the empirical results. Concluding remarks are given in Section 5.

2 Theoretical Considerations and Empirical Studies

Theoretically, the link between saving and growth operates through two relations. The first is given by the aggregate production function, and relates the increases in output with capital stock accumulation. The second relation is an equilibrium condition that states the equality between saving and investment. Accordingly, an increase in saving induces capital accumulation and eventually higher output level.[1]

Nevertheless, in an open economy saving and investment need not be equal. A country may invest more than it saves and borrow from the rest of the world, running current account deficits. Formally, this can be written as

$$I_t \equiv S_t - CA_t \tag{1}$$

where S_t and I_t are domestic saving and investment, respectively, and CA_t is the current account balance.

Consequently, domestic investment can be financed by domestic or foreign saving, through inflows of international capital.[2] However, Identity (1) does not

[1] Even if the increase in the saving rate leads to temporary higher investment and economic growth rates, higher saving rates can permanently affect the level of output and the standard of living.

[2] Capital inflows either finance a current account deficit or add to reserve accumulation,

capture any causal relationship among its components. An exogenous change in international capital inflows may modify either of the variables of this identity depending on the type and nature of these capital movements: foreign direct investment (FDI), portfolio investment or other financial flows (primarily bank loans).

There is increasing evidence, indicating that the effects of these three types of capital inflows are different. As Reinhart (1999) mentioned, when "there are important behavioural differences among the various types of capital flows, then their effects on economic activity, such as saving and investment, are also likely to differ". There exists a general belief that the most important of these flows is FDI, which has been considered as "good colesterol" for developing economies (Hausmann and Fernández Arias, 2000). Bosworth and Collins (1999) find that FDI appears to have highly beneficial effects on domestic investment. The results obtained by these authors suggest a near one-for-one relationship. In contrast, portfolio capital inflows appear to have no discernible impact on investment, and the effect of loans lies between the other two (p. 164).

Moreover, FDI seems to have a higher permanent component, as it is more persistent than other components of capital flows, in terms of its volatility and predictability (see, for example, Sarno and Taylor, 1997 and Lipsey, 1999). In each of the last three financial and exchange rate crises (Latin America in 1982, Mexico in 1994, and East Asia in 1997), direct investment inflows into the affected countries were more stable than inflows of portfolio or other forms of investment (Lipsey, 2001).[3]

according to the balance of payments restriction defined as: $-CA_t = NCI_t - RES_t + ERR_t$, where NCI are net capital inflows and RES and ERR represent reserves and error and omissions, respectively.

[3]This author points out that after the 1994 crisis, direct investment inflows declined in

Finally, foreign direct investment may also accelerate growth through the transfer of managerial and technological know-how.[4] In a survey on the impact of inward foreign direct investment on growth in developing countries, de Mello (1997) argues that FDI is believed to be a very important source of human capital augmentation and technological change, since it promotes the use of more advanced technologies by domestic firms and provides specific productivity-increasing labour training and skill acquisition.[5] In the Mexican case, quite a few studies have supported the claim that FDI has led to significant positive spillover effects on the labour productivity of domestic firms. This is for instance the case of Blomström (1986), Blomström and Wolf (1994), Kokko (1996), and Ramírez (2000).

The results of the above empirical studies lend support to the hypothesis that FDI is "different" when compared with other capital inflows, and the "preferred" type of flow for promoting growth. Thus, the shift of the composition of capital flows to developing countries toward foreign direct investment and away from loans after the 1982 crisis can be contemplated as "good news" for these countries. The 1980s and 1990s witnessed an unprecedented increased in FDI flows in the more dynamic economies. Capital flows to developing economies are concentrated among a few countries in Asia and Latin America. Five countries (in descending order, China, Mexico, Korea, Thailand and Brazil) accounted for nearly two-thirds of financial flows to developing countries in the 1990-95 period (Bosworth and Collins, 1999).

Mexico, but not as much as other investment inflows. Moreover, they never turned negative, as did the others, and they rebounded much more quickly.

[4] See Borensztein et al (1998) and Balasubramanyam et al (1996) for evidence pertaining to the favourable effects of FDI.

[5] Nevertheless, according to Blomström et al (2000), FDI contributes to economic growth only when a sufficient absorptive capability of the advanced technologies is available in the host economy.

To summarise, the key point that we try to stress is that estimates of domestic saving effects on growth, which ignore the role of FDI (in countries with an important openness process) may give a misleading picture of the true saving-growth nexus. This study attempts to close this gap and to identify the channels through which FDI may affect this connection in Mexico.

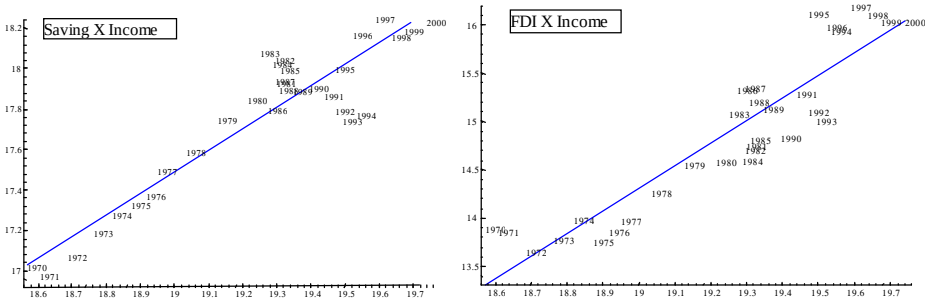
3 Data and Methodological Approach

In this section, we investigate Granger causality between domestic saving and income in Mexico. It is well documented that the exclusion of relevant variables induces spurious significance and inefficient estimates (see e.g. Gujarati, 1995, and Canova, 1995). As Fair (1988) demonstrated, when the omitted variables are correlated with the included ones, the non-causality test will be misspecified. Therefore, we evaluate the saving-growth nexus in a multivariate setting, in which foreign direct investment is also allowed to exert its influence over these two focus variables.

The data employed in this work are annual and are taken from the World Development Indicators (World Bank), except foreign direct investment flows, which are obtained from the International Financial Statistics (IMF). All series are in real dollars (1995 prices) and in all regressions they are expressed in natural logarithms. Gross domestic product is employed in place of domestic income and domestic saving and FDI are both deflated by using the GDP deflator. The sample period runs from 1970 to 2000.

Figure 1 presents the cross plots of domestic saving and foreign investment flows in relation to domestic income. As we can see, except for the period from

Figure 1: Domestic saving and FDI in relation to domestic income (in real log terms)



mid-eighties to early-nineties (coinciding with economic recession in Mexico), both saving and foreign direct investment appear positively related to domestic output. This effect is even more pronounced in the saving-income relation. However, this correlation does not imply causality but only a positive association, thus leaving unsettled the debate concerning the direction of the saving-growth nexus.

Theoretically, the relationship between saving and output, and between these two variables and foreign direct investment may run in either or both directions and potentially cause simultaneity bias. In fact, the reverse causation between saving and growth reported by Sinha and Sinha (1998) does not contradict the prediction of Solow's model. Just as domestic economic activity is likely to depend on saving, so too can the level of output influence saving, as economic growth is one of its main determinants. Additionally, greater domestic income as an indicator of higher expected profits might attract new foreign investment projects. In these circumstances, the estimation of a VAR model to test causality hypotheses is more reliable than that of a single equation model. VAR models treat all variables as potentially endogenous avoiding thus infecting the model

with false identifying restrictions (Sims, 1980).

Accordingly, to undertake our empirical analysis, we specify the following three-variable vector autoregressive model comprised of gross domestic savings (S), gross domestic product (Y) and foreign direct investment flows (FDI).

$$x_t = \mu + \beta t + \Phi_1 x_{t-1} + \cdots + \Phi_s x_{t-s} + u_{\ t} \ t = 1, \ldots, T \tag{2}$$

where $x_t = (S_t', Y_t', FDI_t')'$, $\Phi_i (i = 1, \cdots, s)$ are all matrices of coefficients and $u_t \sim IN(0, \Sigma_u)$.[6]

Following the Solow's model prediction, we would expect to obtain a causal relationship running from S to Y, which amounts a rejection of the null hypothesis that *all* of the coefficients on lagged savings are equal to zero in the output equation (that is, $H_0 : \phi^{(21)} = 0$, where $\phi^{(21)} = \phi_1^{(21)}, \phi_2^{(21)} \ldots, \phi_s^{(21)}$). The reverse causation between saving and output, as established by Sinha and Sinha (1998), will require the significance of the lagged output variable in the saving equation to be found (i.e., to reject $H_0 : \phi^{(12)} = 0$, where $\phi^{(12)} = \phi_1^{(12)}, \phi_2^{(12)} \ldots, \phi_s^{(12)}$).[7]

A general problem for Granger causality testing in time series analysis is the possible existence of stochastic trends in the variables. The traditional F-test and its Wald test counterpart to determine whether some parameters of a stable VAR model are jointly zero are not valid for non-stationary processes,

[6] It was found necessary to include three impulse dummy variables in 1984, 1988 and 1994. The first one tries to capture the transition from an inward to and outward-oriented model of economic development, beginning with the Miguel de la Madrid Administration (1982-1988). The other two account for the economic crises experienced by Mexico.

[7] As proposed by Granger (1969), in this study causality is synonymous with predictability. That is, x is said to Granger cause y if and only if y(t) is predicted better by using the past history of x, together with the past history of itself, rather than by using just the past history of y.

as the test statistics do not have a standard distribution (Sims *et al.*, 1990; Toda and Phillips, 1993). Although alternative procedures have been developed to improve the power and size of the Granger non-causality test (Engle and Granger, 1987, Johansen, 1988, Johansen and Juselius, 1990, and Mosconi and Giannini, 1992[8]), they are cumbersome and involve pre-testing for integration and cointegration. As Engle and Granger (1987) demonstrate, if the original series are non-stationary, valid results in Granger causality are obtained simply by first differentiating the VAR model. Nevertheless, this transformation may lead to loss of information about the long-run relationship between the trend components of the original series. In that case, Granger causality will further require the inclusion of an error correction term in the stationary model in order to capture the short-term deviations of series from their long-term equilibrium path.

However, as Giles and Mirza (1999) pointed, the above testing sequence may induce an over-rejection of the non-causal null (i.e., pre-testing for non-stationarity can often convey the wrong conclusion of causality), leaving us open to the possibility of distortions in the inference procedure. Additionally, Toda (1994) and Ho and Sorense (1996) demonstrate that the reduced rank methodology, devised by Johansen and Juselius (1990) has limitations in the detection of economic long-run relationships.

To deal with these problems, Toda and Yamamoto (1995) and Dolado and Lütkepohl (1996), hereafter TYDL, propose a technique that is applicable irrespective of the integration and cointegration properties of the system (and so to the possible pre-test biases). This method involves using a Modified Wald

[8] Mosconi and Giannini (1992) proposed a likelyhood ratio test for cointegrated systems

statistic (denoted MWald) for testing significance of the parameters of a VAR(s) model (where s is the lag length in the system).[9] In this case, the estimation of a VAR($s + d_{max}$) guarantees the asymptotic χ^2 distribution of the Wald statistic, where d_{max} is the maximal order of integration we believe may occur in the model.[10] As we are not interested in the cointegration relationships themselves but rather in testing restrictions on the coefficients of the model, this testing procedure will be preferable to the two-step methodology of the error correction models. Following Dolado and Lütkepohl (1996), we construct these tests based on multivariate least squares estimation.

4 Empirical Results

Prior to applying the TYDL technique for Granger non-causality testing, we proceed to establish the optimal lag length of the system and the maximum order of integration of variables. The order of integration of the series is tested here by means of the Augmented Dickey and Fuller (1979, 1981), and Phillips and Perron (1988) tests. According to the τ and Z(t) statistics, shown in Table 1, the null hypothesis of a unit root is not rejected for S, Y, and *FDI*. The null hypothesis of variables integrated of order one is however clearly rejected in the differentiated variables (denoted with Δ), indicating that they have a unit root in their levels.

To select the lag structure of the VAR model, we employ the Akaike's Infor-

[9] By means of a Monte Carlo experiment, Zapata and Rambaldi (1997) demonstrate that the MWald test has a comparable performance in size and power to the Wald and likelihood ratio tests.

[10] Toda and Yamamoto (1995) show that if variables are integrated of order d, the usual selection procedure is valid whenever $k \geq d$. Therefore, if $d = 1$, the lag selection procedure is always consistent.

Table 1: Test of the Unit Root Hypothesis

H_0 : One Unit Root H_1 : No Unit Root						
	ADF statistics			PP statistics		
Variable (lag)	τ_τ (i)	τ_μ (ii)	τ (iii)	$Z(t_{\widetilde{\alpha}})$ (i)	$Z(t_{\alpha *})$ (ii)	$Z(t_{\widehat{\alpha}})$ (iii)
Y (1)	-2.56	-1.62	2.66	-2.02	-1.74	4.82
S (1)	-2.27	-2.25	1.74	-1.60	-1.64	2.10
FDI (2)	-2.50	-0.67	2.26	-3.53	-0.58	1.82
ΔY (1)	-3.03	-3.05	-1.84	-3.79	-3.67	-2.10
ΔS (1)	-2.85	-2.77	-2.39	-4.17	-4.02	-3.44
ΔFDI (1)	-5.28	-5.42	-4.54	-6.24	-6.36	-5.92
Critical values for 100 observations Sig. levels:						
1%	-4.07	-3.51	-2.59	-4.07	-3.51	-2.59
5%	-3.46	-2.89	-1.94	-3.46	-2.89	-1.94

Notes: (i), (ii) and (iii) indicate the model statistics with drift and trend, with drift, and without either drift or trend, respectively. The optimal lag used for the Augmented Dickey-Fuller tests (ADF), and the truncation lag parameter in the Phillips and Perron tests (PP) was determined using Akaike Information Criteria.

mation Criterion, AIC, and Hannan-Quinn Criterion, HQC (where the criteria indicated different lag lengths, the AIC criterion was preferred), setting the maximum lag at five[11]. These criteria were minimised for s=4, hence the order of the VAR employed to apply the Wald test was five. Nevertheless, since the choice of the lag length may affect inferences, the tests of causality were also conducted using an additional lag length in order to ensure that the results obtained did not rely on this choice.

In Table 2, we report the χ^2-test statistics obtained for Granger non-causality testing together with the estimate p-values. The results for the multivariate and bivariate causality tests are both obtained from the estimation of a three-equation system, in which S, Y, and FDI have been jointly determined, as

[11] Higher orders of the VAR model produce singular variance-covariance matrices.

Table 2: Granger Causality Test

H_0 :	Lag length / VAR order	MWald (d.o.f)	P-value
$S \nrightarrow Y$	**4 / 5**	**34.73 (4)**	**0.000**
	5 / 6	28.29 (5)	0.000
$FDI \nrightarrow Y$	**4 / 5**	**32.77 (4)**	**0.000**
	5 / 6	31.50 (5)	0.000
$S, FDI \nrightarrow Y$	**4 / 5**	**62.05 (8)**	**0.000**
	5 / 6	59.53 (10)	0.000
$Y \nrightarrow S$	**4 / 5**	**9.44 (4)**	**0.051**
	5 / 6	7.91 (5)	0.161
$S \nrightarrow FDI$	**4 / 5**	**21.32 (4)**	**0.000**
	5 / 6	70.22 (5)	0.000
$FDI \nrightarrow S$	**4 / 5**	**7.77 (4)**	**0.100**
	5 / 6	5.69 (5)	0.338
$Y, FDI \nrightarrow S$	**4 / 5**	**22.04 (8)**	**0.005**
	5 / 6	13.58 (10)	0.193

Note: $\nrightarrow$ denotes "do(es) not cause". To determine the appropriate lag length, p, we employ Akaike's Information Criterion and Hannan-Quinn Criterion. Figures in parentheses are degree of freedom (d.o.f).

shown in Equation (2). The outcomes for the optimal model are reported in bold letters.

As can be appreciated, irrespective of the choice of the lag length, there is strong evidence of a causal relationship running from domestic saving to output. This result supports the Solow's model prediction that saving precedes and causes economic growth. We find also that foreign direct investment Granger-causes domestic output in all cases considered, which confirms the expected beneficial effects of FDI on domestic investment and income in Mexico. Moreover, the multivariate causality test indicates that both saving and FDI jointly cause economic growth. Furthermore, the χ^2 statistics obtained provide support for the findings of Sinha and Sinha (1995), which is consistent with a positive impact of an increase in output over domestic saving. In our specifications,

however, this causation relies on the lag structure of the model. Only for the optimal lag length do we obtain evidence of bi-directional causality between saving and output.

The findings of this paper also suggest a uni-directional causal relationship going from saving to foreign investment but not in the opposite direction. The null hypothesis of Granger non-causality from S to FDI is strongly rejected at 1% level, regardless of the lag length of the system. Conversely, the hypothesis of Granger non-causality from FDI to saving cannot be rejected at standard significance levels in either model. The significant impact of saving on FDI probably reflects the increasing confidence of foreign investors when domestic saving rises.

In summary, the overall effect of FDI on the Mexican economy seems to be not negligible. Its impact over domestic investment and output is probably reinforcing the relation between national saving and output, which confirms our perception about the importance of including foreign investment flows when analysing this connection in an open economy.

5 Concluding Remarks and Policy Implications

As we have tried to stress, both the direction of causality between saving and growth, and the interpretation of their causal relationship are still open issues. The view that growth appears to precede saving and not vice versa has found support in several recent papers. Thus, the causation between these two variables is far from being settled and this can be a crucial element in policy design.

Our analysis starts off from the premise that saving and investment need

not be equal in an open economy. Indeed, domestic investment can be financed by domestic or foreign saving, through inflows of international capital. This is particularly evident for foreign direct investment, which shows important behavioural differences with other types of capital flows.

Thus, we investigate the saving-growth nexus in Mexico by taking into account both the role played by foreign inflows in complementing domestic saving and the beneficial effects of FDI on domestic investment and income. The results obtained, using the Granger non-causality test procedure developed by Toda and Yamamoto (1995) and Dolado and Lütkepohl (1996), add empirical support to the central presumption of Solow's model that higher saving precedes economic growth. This outcome is to some degree contrary to that of Sinha and Sinha (1998), which indicates that higher growth rate is a precursor of saving rather than the reverse. We proved that this one-way causality might be related to the omission of foreign direct investment. In fact, by also considering the influence of foreign capital inflows, we show that the causation between saving and output is bi-directional instead of uni-directional. Moreover, the causal relationship running from FDI to output, that has been identified in this work, confirms the importance of these investment projects in stimulating economic growth in Mexico. Additional evidence has been found on a saving-FDI linkage, providing further support to the crucial role of domestic saving for economic growth.

The main policy implication of our analysis is the need to achieve a proper combination of an outward oriented strategy with policies that promote saving and guarantee macroeconomic stability. As demonstrated, without saving, neither investment nor growth occurs.

Acknowledgements

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