CREDIT Research Paper

No. 01/04

Openness and Growth: Re-Examining Foreign Direct Investment, Trade and Output Linkages in Latin America

by

A. Cuadros, V. Orts and M.T. Alguacil

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

The Centre for Research in Economic Development and International Trade is based in the School of Economics at the University of Nottingham. It aims to promote research in all aspects of economic development and international trade on both a long term and a short term basis. To this end, CREDIT organises seminar series on Development Economics, acts as a point for collaborative research with other UK and overseas institutions and publishes research papers on topics central to its interests. A list of CREDIT Research Papers is given on the final page of this publication.

Authors who wish to submit a paper for publication should send their manuscript to the Editor of the CREDIT Research Papers, Professor M F Bleaney, at:

Centre for Research in Economic Development and International Trade,
School of Economics,
University of Nottingham,
University Park,
Nottingham, NG7 2RD,
UNITED KINGDOM

Telephone (0115) 951 5620
Fax: (0115) 951 4159

CREDIT Research Papers are distributed free of charge to members of the Centre. Enquiries concerning copies of individual Research Papers or CREDIT membership should be addressed to the CREDIT Secretary at the above address.

CREDIT Research Paper

No. 01/04

Openness and Growth: Re-Examining Foreign Direct Investment, Trade and Output Linkages in Latin America

by

A. Cuadros, V. Orts and M.T. Alguacil

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

The Authors
Ana Cuadros and Maria Teresa Alguacil are respectively Lecturer at the Economics Department of the University Jaume I of Castellon in Spain. Vicente Orts is Professor at the same Department. They all belong to the Institute of International Economics.

Acknowledgements
Useful comments were received from participants at a CREDIT seminar in the University of Nottingham, specially Norman Gemmel, Tim Lloyd and Oliver Morrissey.

March 2001

Openness and Growth: Re-Examining Foreign Direct Investment, Trade and Output Linkages in Latin America

by
A. Cuadros, V. Orts and M.T. Alguacil

Abstract
The relationship between openness and economic growth in developing countries has been fully analysed by a large number of empirical papers. Primary attention has been given to the advantages of an outward-oriented strategy and to the role of exports in economic performance. Nevertheless, the evidence about the export-led growth (ELG) hypothesis is rather mixed. In particular, recent time series studies fail to provide uniform support for this hypothesis. Taking into account that openness is increasing not only trade but also foreign direct investment flows, in this paper we have employed a vector autoregressive (VAR) model to test the existence and nature of the causal relationship between output level, inward FDI and trade in Argentina, Brazil and Mexico from the middle seventies to 1997. Our principal aim is to analyse the extent and sources of international linkages between openness and economic performance in these developing countries. Although we have not found evidence about the ELG hypothesis, our results suggest a significant impact of FDI on economic growth and trade in the analysed countries.

Outline

I INTRODUCTION

The impact of policy reform on economic performance has been one of the topical issues of development economics in recent years. Since the middle seventies, there has been considerable progress in trade reform in most developing countries, turning from an import substitution strategy to an outward (or export) oriented approach.

The role of trade policy, and in particular, outward versus inward-oriented trade strategies, has been the focus of considerable academic effort. Openness has been considered one of the main determinants of economic growth in developing countries. Most of the empirical research in this area has treated exports as the principal channel through which the liberalisation process can affect the output level and eventually the rate of economic growth, that is, the export-led growth hypothesis (ELG). Nevertheless, the empirical support for this hypothesis is mixed. While most cross-section studies have found a positive association between exports and growth, a considerable number of studies, applying a range of time series methodologies, found mixed results either supporting or rejecting the export-led growth hypothesis.

The source of the fragility of the trade and growth results may stem from the omission of relevant mechanisms through which openness can promote growth. In particular, the liberalisation process is expected to increase not only trade but also foreign direct investment (FDI). Furthermore, in the last few decades, FDI flows have been growing at a pace far exceeding the volume of international trade. Between 1975 and 1995, the aggregate stock of FDI rose from 4.5% to 9.7% of world GDP, with sales of foreign affiliates of multinational enterprises substantially exceeding the value of wold exports (Barrell and Pain, 1997). In this context, if international capital flows are significant, focusing only on trade as a proxy for openness may be misleading (Golberg and Klein, 1999).

In fact, recent literature has highlighted the role played by FDI on economic growth. As we will discuss in Section II, it is argued that FDI has been a major channel for the access to advanced technologies by recipient countries and hence plays a central role in the technological progress of those countries (Borensztein *et al*, 1998). Besides, FDI seems to promote growth through the generation of productivity spillovers. Furthermore,

if there exists a complementary relationship between FDI and trade, foreign investment may increase the volume of international trade. So, a full understanding of the relationship among trade in goods, FDI and output level is important for obtaining a complete picture of the role played by openness in economic development.

One area of the world where the shift of opinion in favour of openness has been more marked, both in the number of countries involved and in the intensity of the reforms, has been Latin America. This region is increasingly arousing the interest of transnational corporations and experiencing a dramatic growth in foreign capital inflows, particularly in the form of foreign direct investment. Latin America and the Caribbean is the second developing region in terms of the volume of FDI inflows, only surpassed by Southeast Asia. According to ECLAC (1999), in 1998 Latin America and the Caribbean countries received aproximately 41% of total FDI flows destined to developing countries. Although most of the countries in this region benefited from increased foreign capital inflows, these flows have been concentrated in a few countries. Brazil, Mexico and Argentina are the main recipients, receiving almost two thirds of FDI flows to the region.

Most of the empirical work about the impact of foreign direct investment in host countries has focused on the Southeast Asian region. Issues related to the contribution of FDI flows in Latin America are less well-known, in spite of the increasing importance of foreign investment in this region. This motivates the principal aim of this paper - to examine the existence and nature of any causal relationship between output levels, inward FDI and trade in Brazil, Mexico and Argentina.

The paper is organised as follows. Section II reviews the literature on the ELG hypothesis, discussing some theoretical reasons for the inclusion of FDI in the analysis. The empirical analysis and the causality results are shown in Section III. Conclusions are summarised in Section IV.

II. THE RELEVANCE OF A THIRD FACTOR INFLUENCE ON THE EXPORT-GROWTH RELATIONSHIP

The export-led growth hypothesis postulates that exports are a main determinant of overall economic growth. There are quite a few arguments that can be used to provide

the theoretical rationale for this hypothesis. The first of these is that the export sector may generate positive externalities on non-export sectors through more efficient management styles and improved production techniques (Feder, 1982). The second argument is related to the fact that export expansion will increase productivity by offering potential for scale economies (Helpman and Krugman, 1985). Thirdly, exports are likely to alleviate foreign exchange constraints and can thereby provide greater access to international markets (Esfahani, 1991). These arguments have recently been supplemented by the literature on "endogenous" growth theory which emphasises that exports are likely to increase long-run growth by allowing a higher rate of technological innovation and dynamic learning from abroad (Lucas, 1988; Romer, 1986, 1989; Grossman and Helpman, 1991; and Edwards, 1992).

Despite the popularity of the ELG hypothesis, the empirical evidence is not so clear. While a substantial literature, applying a range of cross-section type methodologies, supports an association between exports and growth, time-series evidence fails to provide uniform support for the ELG hypothesis[1]. Morever, the results obtained by cross-country studies have been brought into question due to some important limitations. First, these studies implicitly assume a common economic structure and similar production technology across different countries, which is unlikely to be true. Furthermore, cross-country differences in technology presumably affect both the international pattern of specialisation and trade, and the rate of technological progress and growth[2]. Second, the economic growth of a country is influenced by a host of domestic policies such as monetary, fiscal and external policies, which are not taken into account. Third, cross-country regressions take positive associations as evidence of causation and provide little insight into the way exports affect growth (Giles and Williams, 2000).

The recognition of the potential difficulties with cross-sectional research in attempting to examine for ELG has been addressed in a number of time-series studies. The results obtained by studies which have applied causality tests to examine the nature of a causal relationship between exports and growth are also mixed. While some studies have found a positive association, others have not found support for any relation between these variables.

1 For a review of exports and growth literature, see, for example, Edwards (1993) and Giles and Williams (2000).

The reasons for the lack of uniform support for the ELG hypothesis are quite varied, but the empirical literature provides at least three explanations. The first one is related to the potential non-linearity of the openness-growth relationship. Baldwin and Sbergami (2000) argue that the source of the fragility of the trade and growth results may stem from the imposition by empirical researchers of a linear relationship between openness proxies and growth.

In a recent survey of the empirical literature on the ELG hypothesis, Giles and Williams (2000) mention a second explanation based on possible biases of the pretesting for non-stationary and cointegration properties before the Granger causality test. According to Giles and Mirza (1999), this testing sequence is not satisfactory as it can lead to severe over-rejection of a non-causal null, leaving open the possibility of distortions in the inference procedure. To avoid these preliminary tests, Toda and Yamamoto (1995) and Dolado and Lütkepohl (1996) propose a technique that it is applicable irrespective of the integration or cointegration present in the system.

Thirdly, the relation may not be from exports to output. It is not clear in the literature to what degree is the positive association between trade and growth is due to the fact that trade acts as a stimulant of growth, and to what degree it reflects the fact that growth leads to trade. Furthermore, some authors do not find support for the view that exporting is a particularly beneficial conduit of faster productivity growth. The positive association between exports and productivity appears due to the impact of productivity growth on exports rather than the reverse[3].

Assuming that trade does induce economic growth, what are the channels by which this effect operates? The relation between GDP growth and openness is extremely complex and there could be other factors influencing this relationship. As we mentioned before, the liberalization process in developing countries has increased not only trade but also FDI flows. So, for a complete knowledge of the relation between openness and growth,

2 See Grossman and Helpman (1995).

3 This is the main conclusion obtained, among others, by Kunst and Marin (1989), Clerides *et al* (1996) and Bernard and Jensen (1999a, 1999b). The results of these studies indicate no causal link from exports to productivity while the null of non-causality from productivity to exports has to be rejected at conventional levels.

one should include not only the role of FDI but also the existence of linkages between trade and FDI.

There is increasing agreement on the types of benefits which are likely to accrue to the host economy from FDI. This is particularly the case for technology and management expertise, as multinational enterprises seem to be one of the principal vehicles for the international transfer of technology. The link between technology and economic growth has been hightlighted by an OECD study of both OECD and developing countries, which found a significant effect on economic growth from the innovation and diffusion of technology (OECD, 1991).

Furthermore, foreign investors can contribute to economic growth because they tend to be more productive than local firms. An analysis of 282 pairs of foreign and domestic firms of similar size drawn from 80 manufacturing industries in Brazil concluded that foreign firms have a significantly higher ratio of value-added to output than domestic firms (Wilmore, 1986). Similar results are obtained by De Gregorio (1992) in twelve Latin American countries and by Borensztein *et al* (1995) for a sample of 69 developing countries.

Another mechanism through which FDI can affect growth is by the generation of productivity spillovers. Blömstrom and Persson (1983) and Blömstrom (1986) find evidence that FDI has led to significant positive spillover effects on the labour productivity of domestic firms and on the rate of growth of domestic productivity in Mexico (Blomström and Wolf, 1994). Kokko (1994, 1996) argues that this effect may arise from a process of competitive interaction between foreign and domestic firms, finding empirical evidence that spillovers are more likely in Mexican manufacturing where foreign and domestic firms are in direct competition and where the technological gap between them is not too great[4]. More direct evidence bearing upon this hypothesis is provided by Kokko, Tansini and Zejan (1996) who find, for Mexico and Uruguay, that

4 This effect could be related with a dynamic component of FDI, which arises from the international rivalry of firms. The entry of a foreign investor into a market can pose a competitive challenge to local firms or to existing investors (OECD, 1998).

spillovers are difficult to identify in industries where foreign affiliates have much higher productivity levels than local firms[5].

Nevertheless, the effect of FDI on economic growth is an empirical question, as it seems to be dependent upon a set of conditions in the host country economy. Firstly, the benefits from FDI rely on the technical capability of host country firms. According to Blomström, Globerman and Kokko (2000) there are a greater number of studies estimating direct productivity spillovers for developing countries than for developed countries. The former tends to produce more mixed results than the latter. These authors argue that the reason for these mixed results is that FDI contributes to economic growth only when a sufficient absorptive capability of the advanced technologies is available in the host economy[6]. Secondly, the beneficial impact of FDI is enhanced in an environment characterised by an open trade and investment regime and macroeconomic stability. In this environment, FDI can play a key role in improving the capacity of the host country to respond to the opportunities offered by global economic integration (OECD, 1998). In the absence of such an environment, FDI may thwart rather than promote growth. It may serve to enhance the private rate of return to investment by foreign firms while exerting little impact on social rates of return in the recipient economy (Balasubramanyam, Salisu and Sapsford, 1996).

As we have tried to highlight in this section, openness has played a crucial role in the growth of both trade and FDI. An outstanding question is the relationship between these two variables. Trade flows and foreign direct investment can be linked in a variety of ways. Direct investment may encourage export promotion, import substitution, or greater trade in intermediate inputs, especially between parent and affiliate producers (Goldberg and Klein, 1998). However, the empirical evidence about the relationship between trade and FDI is ambiguous.

Most of multinational firms' investment is export-oriented, so foreign investment can increase the speed with which a host economy can become integrated within a global

---

5 All these studies sustained that FDI could promote further GDP growth. However, the causality could also run the opposite way: the size and average real income level of the host country is expected to attract inward FDI (Dowling and Hiemenz, 1982; Lee and Rana, 1986). Rapid economic growth in the host country is expected to increase the confidence of overseas investors because a greater demand should make the host market a more profitable place to do business.

6 Borensztein et al (1998) and Balasubramanyam, Salisu and Sapsford (1999) obtain similar conclusions.

production network in sectors in which it may formerly have had no industrial experience (OECD, 1998). This is the main conclusion obtained by Rodriguez Clare (1996) and also by Calderón, Mortimore and Peres (1996) who argue that multinational enterprises have been leaders in some of the most important industries on which Mexico has based the expansion of its industrial exports. Thus, it seems that FDI could be associated with export trade in goods, and the hosting country can benefit from an FDI-led export growth.

However, other empirical works do not find significant links between FDI and trade flows. Goldberg and Klein (1998) have found that the trade-promoting effects of FDI appear to be weak or insignificant with regard to Latin American trade with the United States and Japan. At a sectoral level, Goldberg and Klein (1999) study how the net exports of specific manufacturing sectors of eight Latin American countries respond to direct investment from the United States into these specific sectors as well as into other manufacturing and non-manufacturing sectors. Their results do not suggest systematic linkages between sectoral trade and FDI in Latin America.

This brief review of the literature reveals that a full understanding of the relationship among trade in goods, FDI and output is required in order to analyse the extent and sources of international linkages between openness and economic performance in developing countries. In the next section, we examine the ELG hypothesis and the FDI-growth nexus in Argentina, Brazil and Mexico. These countries are not taken to be representative of all Latin American host countries, but, as we mentioned in Section I, they are among the most important recipients of inward investment within this area and offer advantages in terms of national or regional market size which many other Latin American countries can not.

III. EMPIRICAL ANALYSIS

We employ Granger´s (1969) concept of causality to test the relationship between trade (exports), inward FDI and output using quaterly data (seasonally adjusted) for Argentina, Brazil and Mexico[7]. The analysis concentrates on the period between the middle

7 Following Granger (1969), *x* is said to Granger cause *y* if and only if *y* is predicted better by using the past history of *x*, together with the past history of *y* itself, rather than by using just the past history of *y*.

seventies and 1997, although we have covered a slightly different period for each country depending on the availability of quaterly data on foreign direct investment[8].

We formulate a vector autoregressive (VAR) system[9], comprised of exports (*exp*), inward foreign direct investment (*fdi*), foreign income (y^*)[10], and domestic income (y), all of them are in real terms and expressed in natural logarithms[11]. In selecting the number of lags to be included in our model, we follow the procedure suggested by Hendry and Mizon (1993) and Hendry and Doornik (1994), and sequentally look at the statistical significance of the different lags by a joint *F* test statistic.

According to Johansen´s (1988) technique[12], to avoid spurious results in the causality testing we need to proceed as follows: firstly, to determine the order of integration of the series. Secondly, to identify the possible long-term relationships among the integrated variables included in the system. In absence of a cointegration vector, with I(1) series, valid results in Granger causality testing are obtained by simply first differentiating the VAR model. With cointegrated variables, Granger causality will further require inclusion of an error correction term (ECT) in the stationary model in order to capture the short-term deviations of series from their long-term equilibrium path.

As mentioned in Section II, Giles and Mirza (1999) have pointed out that the pretesting for non-stationarity and cointegration before the Granger causality test can lead to over-rejection of a non-causal null; i.e. pretesting for non-stationarity can often lead to the wrong conclusion of causality. To deal with the possibility of distortions in the inference procedure, Toda and Yamamoto (1995) and Dolado and Lütkepohl (1996) (here-after TYDL) argue that we might test Granger´s concept of causality on an augmented VAR in levels even if the analysed series are integrated or cointegrated of an arbitrary order. This

8 See Appendix C.

9 We follow Sims (1980) and formulate a VAR where no a priori restrictions on the endogenous or exogenous character of variables are established at a first stage. Sims proposed specifying an unrestricted autoregressive model to avoid infecting the model with false identifying restrictions.

10 We have included foreign income to account for potential external shocks. We expect that an increase in foreign income leads to a greater level of domestic goods sales abroad (Goldstein and Khan, 1985). We have used USA GDP as an indicator of foreign income because USA is the largest source of FDI for these countries.

11 The inclusion of a variable that captures the effect of relative prices modifications such as the terms of trade has been rejected due to the non availability of quaterly data about this variable. Morever, when we have considered some proxies for the terms of trade, our main results do not change significantly. This conclusion is similar to the one obtained by De Gregorio (1992) in a sample of twelve Latin American countries.

is the reason why in this paper we have also employed the augmented lag approach proposed by TYDL. However, this procedure does not replace the conventional hypothesis testing of unit roots and cointegration ranks. It should be considered as complementing the pretesting method that may suffer inference biases[13].

The results of model selection procedure are shown in Table 1. Given the *F* test statistics, in the Mexican case we opted for a system with a lag length of four, i. e. a VAR (4) model[14], since lags 6 and 5 of all variables are insignificantly different from zero in the four equations. The forth-period lag however appears to be significant at 5 per cent, at least in one equation (*fdi* equation). In the Brazilian case, we opted for a system with a lag length of five, i. e. a VAR (5) model, as long as the fifth-period lag appears to be significant at 5 per cent, at least in one equation (*exp* equation). In Argentina, we opted for a system with a lag length of four, i. e. a VAR (4) model. In this case, lags 6 and 5 are insignificantly different from zero and only the fourth-period lag appears to be significant at 10 per cent, at least in one equation (*fdi* equation).

Once the optimum lag length was found, we tested for both, the order of integration of the series by means of the Dickey-Fuller test (Dickey and Fuller 1979, 1981) and for multivariate cointegration. On the basis of the results shown in Table A. 1 of Appendix A, the null hypothesis of nonstationarity can not be rejected in all cases considered. The exception is the variable *fdi* for Brazil[15].

12 Detailed discussion of the Johansen (1988) technique is found in Harris (1995), Chapter 5.

13 Toda and Yamamoto (1995).

14 We start with a length of six quarters in the three analysed cases, considering that this period covers time enough to capture the short-run behaviour of series.

15 In this case, we have used the cumulative FDI due to the erratic behaviour of the FDI flows. Even in this case, the resulting variable is I(0) in levels so we have not included the *fdi* variable in the cointegration analysis for Brazil.

Table 1: Model selection

MEXICO			Equation		
Statistics		*exp*	*y*	*fdi*	y^*
Lag-length = 6					
$F_s = 6$		0.45	1.32	1.32	0.67
Lag-length = 5					
$F_s = 5$		0.89	1.06	0.49	0.49
Lag-length = 4					
$F_s = 4$		0.24	0.55	3.06[a]	0.74
BRAZIL			Equation		
Statistics	d.o.f.	*exp*	*y*	*fdi*	y^*
Lag-length = 6					
$F_s = 6$		0.30	1.25	0.69	0.43
Lag-length = 5					
$F_s = 5$		2.60[a]	0.78	1.75	1.25
ARGENTINA			Equation		
Statistics	d.o.f.	*exp*	*y*	*fdi*	y^*
Lag-length = 6					
$F_s = 6$		1.04	1.47	1.49	1.14
Lag-length = 5					
$F_s = 5$		0.10	1.63	0.49	0.64
Lag-length = 4					
$F_s = 4$		0.75	0.77	2.50[b]	0.04

Note: The uppercases "*a* " and " *b* " reject the null hypothesis of zero restriction at 5 per cent and 10 per cent significance level, respectively. *s* denotes both the order of the VAR and the lag analised.

For the identification of possible long-term relations, the multivariate analysis has been performed using the Johansen (1988) and Johansen and Juselius (1990) maximum likelihood procedure. In Table 2, we report the results of Johansen´s maximum eigenvalue test (λ_{max}) for the presence of long-term relationships.

Table 2: Johansen´s test for multiple cointegration

Statistic $H_0 : r$	$n - r$	Model 1	$\lambda(0.95)$	Model 2	$\lambda(0.95)$	Model 3	$\lambda(0.95)$
MEXICO							
λ_{max}							
0	4	59.59	53.12	45.87	47.21	57.50	56.64
1	3	33.62*	34.91	21.19	29.68	30.35	34.55
2	2	16.41	19.96	8.56	15.41	10.96	18.17
3	1	4.81	9.24	1.11	3.76	2.18	3.74
Statistic $H_0 : r$	$n - r$	Model 1	$\lambda(0.95)$	Model 2	$\lambda(0.95)$	Model 3	$\lambda(0.95)$
BRAZIL							
λ_{max}							
0	3	21.92*	24.31	23.02	29.68	35.37	34.55
1	2	9.75	12.53	7.53	15.41	18.08	18.17
2	1	2.86	3.84	0.07	3.76	7.09	3.74
Statistic $H_0 : r$	$n - r$	Model 1	$\lambda(0.95)$	Model 2	$\lambda(0.95)$	Model 3	$\lambda(0.95)$
ARGENTINA							
λ_{max}							
0	4	58.79	53.12	61.99	62.99	61.23	54.64
1	3	32.43*	34.91	35.56	42.44	34.96	34.55
2	2	15.97	19.96	18.32	25.32	18.22	18.17
3	1	6.77	9.24	8.38	12.25	8.30	3.74

Notes: r indicates the number of cointegrating vectors under the null hypothesis. $n - r$ indicates the number of eigenvalues obtained from the Johansen's approach that are no different from zero under the null hypothesis. See Johansen (1988) and Osterwald-Lenum (1992) for critical values [λ (0.95)]. Model 1 represents the model with no linear trends in the levels of the data. Model 2 and Model 3 denote the model with linear and quadratic trends in the levels of the data, respectively.

(*) denotes the first time the null is not rejected.

The results in Table 2 suggest that it is possible to accept the hypothesis that a single cointegration vector is present in our model for Mexico and Argentina, since the null that r = 0 (or alternatively n – r = 4) is rejected but the null that r = 1 (or alternarively n – r = 3) is not rejected. In the Brazilian case, it is not possible to accept the hypothesis about the existence of a long-run relationship among the variables considered in this analysis.

Given these results, and following the Granger Representation Theorem, we add an ECT in each equation of the first differentiated VAR model in the Argentinian and Mexican cases[16]. So that, it would be possible, in what follows both, to separate the long-term relationship between the economic variables from their short-term responses, and to determine the direction of the Granger long-term causality.

Following Johansen and Juselius (1990), and according to the results previously obtained, the corresponding Error Correction Model (ECM) can be written as follows[17]:

$$\Delta exp_t = \alpha_{10} + \sum_{s=1}^{n} \alpha_{11}(s)\Delta exp_{t-s} \sum_{s=1}^{n} \alpha_{12}(s)\Delta y_{t-s} + \sum_{s=1}^{n} \alpha_{13}(s)\Delta fdi_{t-s} + \sum_{s=0}^{n} \alpha_{14}(s)\Delta y^{*}_{t-s} + \gamma_1 ECT_{t-1} + \varepsilon_{1t} \quad (2.1)$$

$$\Delta y_t = \alpha_{20} + \sum_{s=1}^{n} \alpha_{21}(s)\Delta y_{t-s} + \sum_{s=1}^{n} \alpha_{22}(s)\Delta exp_{t-s} + \sum_{s=1}^{n} \alpha_{23}(s)\Delta fdi_{t-s} + \sum_{s=0}^{n} \alpha_{24}(s)\Delta y_{t-s}^{*} + \gamma_2 ECT_{t-1} + \varepsilon_{2t} \quad (2.2)$$

$$\Delta fdi_t = \alpha_{30} + \sum_{s=1}^{n} \alpha_{31}(s)\Delta fdi_{t-s} + \sum_{s=1}^{n} \alpha_{32}(s)\Delta y_{t-s} + \sum_{s=1}^{n} \alpha_{33}(s)\Delta exp_{t-s} + \sum_{s=0}^{n} \alpha_{34}(s)\Delta y_{t-s}^{*} + \gamma_3 ECT_{t-1} + \varepsilon_{3t} \quad (2.3)$$

where α_{ij} , γ_i (i = 1, 2, 3 and j = 1, 2, 3, 4) are all parameters, n is the lag length in the autoregressive model and ε_i (i = 1, 2, 3) are white noise disturbances[18].

16 According to the Granger Representation Theorem, with cointegrated I(1) series, an ECT has to be included in the differenced model in order to capture the equilibrium relationship among the cointegrated variables in their dynamic behaviour.

17 It was also found necessary to include some dummies to account for outliers that took a value of one in 1995:1 (D95) (in the Mexican case), in 1986:4 (D86) in the Brazilian case and in 1979:2 (D79) and 1987:2 (D87) in Argentina.

18 Note that we did not include an equation for y^* as we have considered the foreign income as an exogenous variable.

Accepting that the model is correctly specified[19], we next focus on temporal Granger non causality testing. With an ECT in the model, Granger non causality will imply both neither short- nor long-term causality between variables (Engle and Granger, 1987). Taking this view, causality can be derived through: a) the χ^2 test of the joint significance of lags of other variables (Wald test), and b) the significance of the lagged ECT (*t*-test). Table 3 presents the results of temporal Granger causality testing. Aditionally, in Table B. 1 of Appendix B, we report the results obtained from the modified Wald test based on an augmented VAR model, as proposed by TYDL.

In common with much time-series work, our results do not seem to support the ELG hypothesis for the three countries. As we can see in Table 3, no positive causal relationship has been found from exports to national income. Even in the Mexican case, where it is possible to find evidence about a causal relation between these variables, the sign of this conexion in the long run is contrary to the expected one. This result seems to be robust to the integration and cointegration properties of the process as well as to the presence of deterministic trends such as can be seen in Table B. 1 of Appendix B. Besides, as the ECT is statistically significant in the export equation in the Argentinian and Mexican cases, the relationship goes from national income to exports, which is not consistent with the export led growth hypothesis.

19 Autocorrelation diagnostic test of this ECM has been performed, indicating that there is no evidence of serial

Table 3: Temporal Granger-causality tests on ECM

MEXICO	Source of causation Short run				*ECT*	
	Δexp	Δy	Δfdi	Δy^*	e_{t-1}	
	$\chi^2(3)$	$\chi^2(3)$	$\chi^2(3)$	$\chi^2(4)$	*t*	Coeff.
Δexp	-	0.35	16.50[a]	14.02[a]	-2.76[a]	-0.13
Δy	11.60[a]	-	16.24[a]	5.73	-3.82[a]	-0.03
Δfdi	5.31	2.43	-	4.16	1.29	0.30
COINTEGRATION VECTOR:						
(y + 0.24 *exp* – 0.32 *fdi* – 0.41 y^* - 2.72)						
BRAZIL	Source of causation Short run				*ECT*	
	Δexp	Δy	Δfdi	Δy^*	e_{t-1}	
	$\chi^2(4)$	$\chi^2(4)$	$\chi^2(4)$	$\chi^2(5)$	*t*	Coeff.
Δexp	-	6.36	8.30[c]	6.23	-	-
Δy	1.46	-	2.08	3.94	-	-
Δfdi	1.03	5.67	-	3.98	-	-
ARGENTINA	Source of causation Short run				*ECT*	
	Δexp	Δy	Δfdi	Δy^*	e_{t-1}	
	$\chi^2(3)$	$\chi^2(3)$	$\chi^2(3)$	$\chi^2(4)$	*t*	Coeff.
Δexp	-	1.13	1.59	2.14	-2.12[b]	-0.14
Δy	2.10	-	1.53	0.92	-0.10	-0.00
Δfdi	11.65[a]	6.09	-	1.15	3.96[a]	0.83
COINTEGRATION VECTOR:						
(y + 3.33 *exp* 2.97 *fdi* + 8.83 y^* - 123)						

Notes: The uppercases "*a*", "*b*" and "*c*" denote significance at the 1%, 5% and 10% level, respectively. Figures in parenthesis are degrees of freedom.

correlation in the residuals.

Nevertheless, we have found some evidence about a positive impact of FDI on national income. Specifically, in the Mexican case we can accept the existence of positive causal relationship going from FDI flows to output not only in the short but also in the long run. This result is also confirmed by the application of the modified Walt test as proposed by TYDL (Table B.1). This finding would be consistent with an FDI-growth nexus and with the studies mentioned in section II which identify positive spillovers effects from FDI in Mexico. Since the middle eighties, this country has attempted to improve its economic development by stabilising and opening up its economy to the world. Although, Brazil and Argentina have also liberalised their economies, the openness process in Mexico was earlier[20].

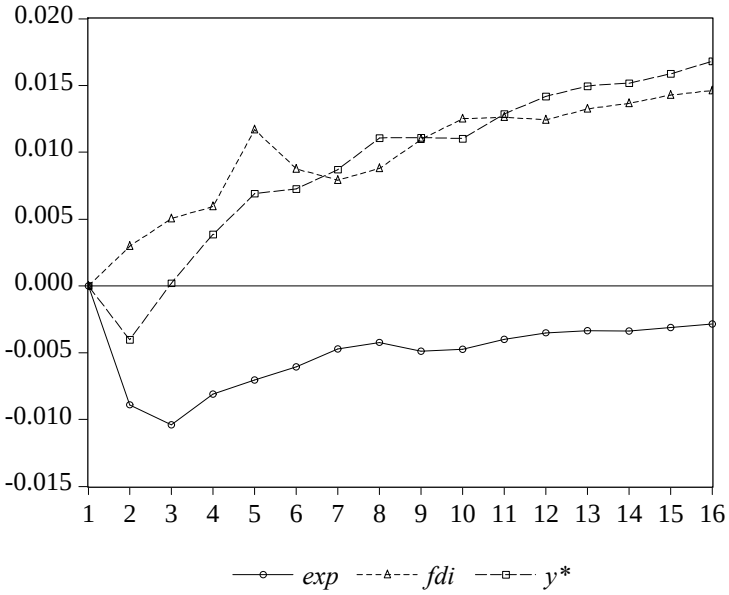
The impulse response functions[21] provide further insight into the dynamic of these effects. Figures 1, 2 and 3 represent the responses of national income to shocks in FDI, exports and foreign income in Mexico, Argentina and Brazil, respectively. These plots indicate a positive effect of an exogenous increase in FDI over national income in the Mexican and Argentinian cases. Morever, looking at these graphs, it seems that the negative relationship between exports and national income in these countries is confirmed. As expected, in the Brazilian case the response of national income to shocks in the rest of variables will tend eventually to zero.

An aditional relevant outcome refers to the FDI effects on trade. Contrary to the results previously obtained by Goldberg and Klein (1998, 1999), our results seem to confirm a complementarity relation between these two variables. As reported in Table 3, there exists a positive long-run causal relationship going from FDI to exports in Mexico and Argentina, which is also supported by the augmented lag approach. We have also found evidence about short-term Granger causality between these two variables in Mexico and Brazil. Nevertheless, the results obtained for the Brazilian case by the Granger causality test based on the augmented VAR model support the existence of a negative relationship going from FDI to exports.

---

[20] With respect to the timing of reforms, Edwards (1995) classifies countries as early reformers (Chile, Mexico), second-wave reformers (Costa Rica, Uruguay), third-wave reformers (Argentina, Brazil, Colombia, Peru, Venezuela) or non-reformers (Ecuador).

Figure 1: Mexico, Impulse Response of National Income to One Standard Deviation Shock in:



Finally, foreign income seems to have played an important role in the Mexican case as there exists evidence about a long-run positive causal relationship going from y^* to exports and to the domestic output level. Besides, foreign income seems to have influenced FDI flows in Argentina, as there is a positive causal long-run relation going from y^* to FDI. However, these results are only partially supported by the modified Wald test.

21 The impulse response functions represent the response paths (beyond the sample period) of each variable to shocks in the others, also taking into account the short-term adjustment to long-term disequilibrium in the dependent variable.

Figure 2: Argentina, Impulse Response of National Income to One Standard Deviation Shock in:

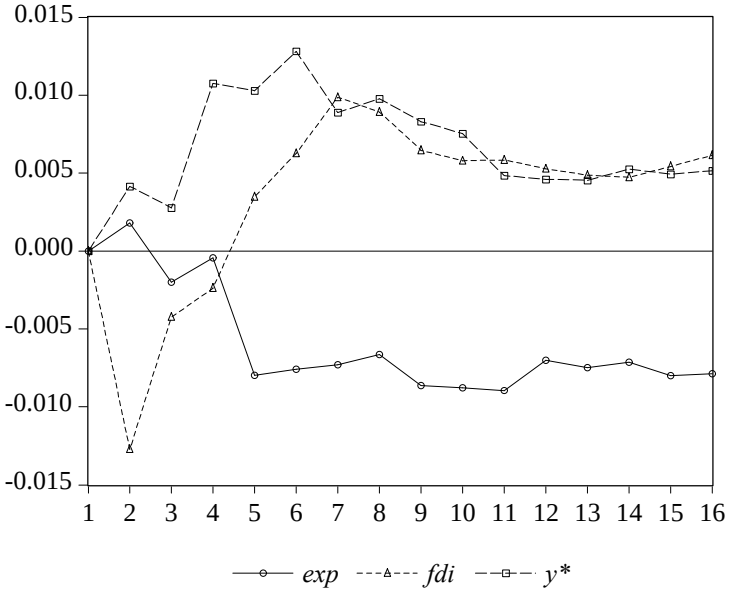
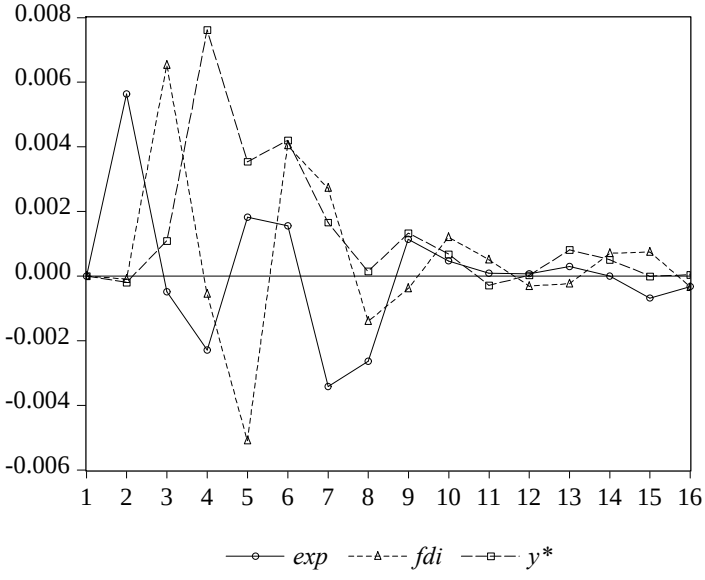


Figure 3: Brazil, Impulse Response of National Income to One Standard Deviation Shock in:



IV. SUMMARY REMARKS

One of the more intensively studied topics in recent years has been the role of exports in economic performance of developing countries. The impetus for much of this research is the hypothesis of export-led growth which suggests that the growth of exports has a favourable impact on economic growth. However, the empirical evidence on the causal relationship between exports and growth is mixed. In particular, recent time series studies fail to provide uniform support for the ELG hypothesis.

The libelization process in developing countries has increased not only trade but also FDI flows. This is particularly true in the Latin American region, a major recipient of FDI. Due to the increasing importance of foreign direct investment, focusing only on trade as a proxy for openness may be misleading. This is the reason why the principal aim of this paper is to analyse both the ELG hypothesis and the FDI growth nexus in Mexico, Brazil and Argentina, which are the main recipient countries of FDI in Latin America.

Our findings do not support the export-led growth hypothesis for these three countries. On the contrary, in some of the studied cases, we have found evidence for a negative causal relationship between domestic income and exports. Our results provide evidence about a positive impact of FDI on national income. Specifically, in the Mexican case FDI appears to be an important factor in promoting growth. This outcome agrees with the conclusions of quite a few desagregated studies on the Mexican economy, which have found significant positive spillovers from FDI. The existence of an environment characterised by an open trade regime and macroeconomic stability could help to explain the benefits associated to inward investment in this country.

Finally, as we have tried to highlight in this paper, a central question concerning FDI is whether it increases the volume of trade. Our results suggest that FDI has played a significant influence on export expansion in two of the three analysed countries. This would confirm the idea that most of multinational firms investment in these countries is an export-oriented investment, as they seem to have benefited from an FDI-led export growth. In so doing, FDI has served to integrate national markets into the world economy far more effectively than could have been achieved by traditional trade flows alone.

REFERENCES

Balasubramanyam, V.N. , Salisu, M. and Sapsford, D. (1996): "Foreign Direct Investment and Growth in EP and IS Countries", *The Economic Journal* 106, 92-105.

Balasubramanyam, V.N. , Salisu, M. and Sapsford, D. (1999): "Foreign Direct Investment as an Engine of Growth", *The Journal of International Trade and Economic Development* 8, 27-40.

Baldwin, R.E. and Sbergami F. (2000): "Non-Linearity in Openness and Growth Links: Theory and Evidence", paper presented at the European Trade Study Group, Second Annual Conference, Glasgow, October.

Barrell, R. and Pain, N. (1997): "Foreign Direct Investment, Technological Change, and Economic Growth within Europe", *The Economic Journal* 107, 1770-1786.

Bernard, A.B. and Jensen, J.B. (1999a): "Exceptional Exporter Performance: Cause, Effect or Both?, *Journal of International Economics* 47 (1), 1-26.

Bernard, A.B. and Jensen, J.B. (1999b): "Exporting and Productivity". Mimeo, Yale University.

Blomström, M. and Persson, H. (1983): "Foreign Investment and Spillover Efficiency in an Underdeveloped Economy: Evidence from the Mexican Manufacturing Industry", *World Development*, 11, 493-501.

Blomström, M. (1986): "Foreign Investment and Productive Efficiency: the Case of Mexico", *Journal of Industrial Economics*, 15, 97-110.

Blomström, M. and Wolf, E. (1994): "Multinational Corporations and Productivity Convergence in Mexico". In W. Baumol, R. Nelson and E. Wolf (Eds.) *Convergence of Productivity: Cross-National Studies and Historical Evidence*. Oxford: Oxford University Press.

Blomström, M., Globerman, S. and Kokko, A. (2000): "The Determinants of Host Country Spillovers from Foreign Direct Investment", CEPR Discussion Paper No. 2350.

Borensztein, E.J, De Gregorio, J. and Lee, J.W. (1995): "How Does Foreign Direct Investment Affect Economic Growth?", NBER Working Paper No. 5057.

Borensztein, E.J, De Gregorio, J. and Lee, J.W. (1998): "How does Foreign Direct Investment Affect Economic Growth", *Journal of International Economics* 45, 115-135.

Calderón, A. , Mortimore, M. and Peres (1996): "Foreign Investment as a Source of International Competitiveness". In Dunning J.H. and Narula (eds.) *Catalyst for Economic Restructuring*. Routledge, 241-279.

Clerides, S., Lach, S. et al (1996) Is Learning by Exporting Important? Micro-Dynamic Evidence from Colombia, Mexico and Morocco. Cambridge MA, NBER.

De Gregorio, J. (1992): "Economic Growth in Latin America", Journal of Development Economics 39, 59-84.

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.

Dickey, D.A. and Fuller, W.A. (1981): "Likelihood Ratio Statistics for Autoregressive Time Series with a Unit Root", *Econometrica* 49, 1057-1072.

Dolado, J.J. and Lütkepohl, H. (1996): "Making Wald Tests Work for Cointegrated VAR Systems", *Econometric Reviews* 15, 369-86.

Dowling, J.M. and Hiemenz, U. (1982): "Aid, Savings and Growth in the Asian Region", *The Developing Economies* 21, 3-13.

Economic Commission for Latin America and the Caribbean (ECLAC) (1999): *La Inversión Extranjera en América Latina y el Caribe*. United Nations.

Edwards, S. (1992): "Trade Orientation, Distortions and Growth in Developing Countries", *Journal of Development Economics* 39, 31-57.

Edwards, S. (1993): "Openness, Trade Liberalisation, and Growth in Developing Countries", *Journal of Economic Literature* 31, 1358-1393.

Edwards, S. (1995): *Crisis and Reform in Latin America: From Despair to Hope*. Oxford: Oxford University Press.

Engle, R.F. and Granger, C.W.J. (1987): "Cointegration and Error Correction: Representation, Estimation and Testing", *Econometrica* 55, 251-276.

Esfahani, H.S. (1991): "Exports, Imports, and Economic Growth in Semi-Industrialized Countries", *Journal of Development Economics* 35, 93-116.

Feder, G. (1982): "On Exports and Economic Growth", *Journal of Development Economics* 12, 59-73.

Fuller, W.A. (1976) *Introduction to Statistical Time Series*. New York: John Wiley & Sons.

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, 261-337.

Giles, J.A. and Mirza, S. (1999): "Some Pretesting Issues on Testing for Granger non-Causality". Mimeo, Department of Economics, University of Victoria.

Goldberg, S. and Klein, W. (1998): "Foreign Direct Investment, Trade, and Real Exchange Rate Linkages in Developing Countries". In Reuven Glick (ed.) *Managing Capital Flows and Exchange Rates: Lessons from the Pacific Basin*. Cambridge University Press.

Goldberg, S. and Klein, W. (1999) : “International Trade and Factor Mobility: an Empirical Investigation”, NBER Working Paper No. 7196.

Goldstein, M. and M. Khan (1985): “Income and Price Effects in Foreign Trade”. In R.W. Jones and P.B. Kenen (eds.) *Handbook of International Economics*, vol. II. Amsterdam: North-Holland, 1041-1105.

Granger, C.W.J. (1969): “Investigating Causal Relations by Econometric Models and Cross Spectral Methods”, *Econometrica* 37, 424-38.

Grossman, G. and Helpman, E. (1991) *Innovation and Growth in the World Economy*. Cambridge: MIT Press.

Grossman, G. and Helpman, E. (1995): “Technology and Trade”. In Grossman, G. and Rogoff, K. (Eds.) *Handbook of International Economics*, vol. III, Elsevier Science, B.V., 1279-1337.

Harris, R.I.D. (1995) *Using Cointegration Analysis in Econometric Modelling*. Hertfordshire, Prentice Hall/Harverster Wheatsheaf.

Helpman, E. and Krugman, P.R. (1985) *Market Structure and Foreign Trade.* Cambridge: MIT Press.

Hendry, D.F. and Doornik (1994): “Modelling Linear Dynamic Econometric System”, *Scottish Journal of Political Economy* 41, 1-33.

Hendry, D.F. and Mizon, G.E. (1993): “Evaluating Dynamic Econometric Models by Encompassing the VAR”. In Phillips, P.C.B. (ed.) *Models, Methods and Applications of Econometrics*. Oxford: Basil Blackwell, 272-300.

International Monetary Fund (IMF) (1998): *International Financial Statistics 1998*. Washington, D. C.

Johansen, S. (1988): “Statistical Analysis of Cointegration Vectors”, *Journal of Economic Dynamics and Control* 12, 231-54.

Johansen, S. and Juselius, K. (1990): “Maximum Likelihood Estimation and Inference on Cointegration with Application to the Demand for Money”, *Oxford Bulletin of Economics and Statistics* 52, 169-210.

Kokko, A. (1994): “Technology, Market Characteristics, and Spillovers”, *Journal of Development Economics*, 43, 279-293.

Kokko, A. (1996): “Productivity spillovers from competition between local firms and foreign affiliates, *Journal of International Development* 8, 517-530.

Kokko, A., Tansini, R. and Zejan, M. (1996): “Local Technological Capability and Spillovers from FDI in the Uruguayan Manufacturing Sector”, *Journal of Development Studies* 34, 602-611.

Kunst R. M. and Marin, D. (1989): “On Exports and Productivity: a Causal Analysis”, *Review of Economics and Statistics* 71, 699-703.

Lee, J. and Rana, P. (1986): “The Effect of Foreign Capital Inflows on Developing Countries of Asia”, Asian Development Bank Economic Staff Paper No. 4.

Lucas, R. E. (1988): "On the Mechanics of Economic Development", *Journal of Monetary Economics* 22, 3-42.

OECD (1991) *Technology and Productivity: The Challenge for Economic Policy*. Paris.

OECD (1998) *Foreign Direct Investment and Economic Development: Lessons from Six Emerging Economies*. Paris.

Osterwald-Lenum, M. (1992): “A Note with Quantiles of the Asymptotic Distribution of the Maximum Likelihood Cointegration Rank Test Statistics”, *Oxford Bulletin of Economics and Statistics* 54, 461-71.

Rodriguez-Clare, A. (1996): “Multinationals, Linkages, and Economic Development”, *The American Economic Review* 86, 852-873.

Romer, P.M. (1986): "Increasing Returns and Long-Run Growth", *Journal of Political Economy* 94, 1002-37.

Romer, P.M. (1989): "What Determines the Rate of Growth and Technological Change?", World Banking Working Paper No. 279.

Schwert, G.W. (1989): “Tests for Unit Roots: a Monte Carlo Investigation”, *Journal of Business and Economic Statistics* 7, 147-59.

Sims, C.A. (1980): “Macroeconomics and Reality”, *Econometrica* 48, 1-48.

Toda, H.Y. and Yamamoto, T. (1995): “Statistical Inference in Vector Autoregressions with Possibly Integrated Processes”, *Journal of Econometrics* 66, 225-50.

Wilmore, L. (1986): “The Comparative Performance of Foreign and Domestic Firms in Brazil”, *World Development* 14.

World Bank (1999): *World Development Indicators 1999*. Washington D. C.

APPENDIX A

Table A. 1: Tests of the unit root hypothesis

	Augmented Dickey-Fuller statistic		
	τ_τ (1)	τ_μ (2)	τ (3)
MEXICO			
Levels			
exp	-2.68	-1.92	1.49
y	-2.56	-0.36	1.54
fdi	-2.60	-1.26	0.97
y^*	-2.77	0.16	2.72
First differences			
Δ *exp*	-4.43	-4.50	-4.23
Δ *y*	-3.92	-3.90	-3.57
Δ*fdi*	-8.00	-8.00	-7.89
Δy^*	-3.55	-3.52	-2.09
BRAZIL			
Levels			
exp	-3.94	-1.04	1.10
y	-2.48	-1.87	1.81
fdi	-5.24	-4.41	3.14
y^*	-2.88	-0.57	3.17
First differences			
Δ *exp*	-6.62	-6.66	-6.47
Δ *y*	-5.14	-5.20	-4.97
Δ*fdi*	-4.05	-4.43	-3.78
Δy^*	-3.94	-4.01	-2.51
ARGENTINA			
Levels			
exp	-3.65	-1.86	0.35
y	-3.05	-2.84	0.06
fdi	-3.90	-1.84	-0.90
y^*	-2.65	-0.14	2.98
First differences			
Δ *exp*	-5.68	-5.62	-5.62
Δ *y*	-4.15	-4.20	-4.23
Δ*fdi*	-6.43	-6.47	-6.44
Δy^*	-3.50	-3.52	-2.09
Sig Level			
1%	-4.07	-3.51	-2.59
5%	-3.46	-2.89	-1.94

Notes: (1), (2) and (3) 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 test was selected using the formula $m = ent\ [4(T/100)^{1/4}]$ suggested by Schwert (1989). Critical values can be found in Fuller (1976) and Dickey and Fuller (1981).

APPENDIX B

Table B. 1: Granger causality tests based on an augmented VAR model (TYDL augmented lags method)

MEXICO

Equation	Source of causation							
	exp		*y*		*fdi*		y^*	
	χ^2 (4)	$\Sigma_{coeff.}$	χ^2 (4)	$\Sigma_{coeff.}$	χ^2 (4)	$\Sigma_{coeff.}$	χ^2 (4)	$\Sigma_{coeff.}$
exp	-	-	2.58	-0.68	13.4[a]	0.17	11.4[b]	2.56
y	20.3[a]	-0.04	-	-	13.3[a]	0.05	7.68	-0.69
fdi	3.97	-0.06	4.99	3.98	-	-	3.16	-10.9

BRAZIL

Equation	Source of causation							
	exp		*y*		*fdi*		y^*	
	χ^2 (5)	$\Sigma_{coeff.}$	χ^2 (5)	$\Sigma_{coeff.}$	χ^2 (5)	$\Sigma_{coeff.}$	χ^2 (5)	$\Sigma_{coeff.}$
exp	-	-	14.5[a]	0.26	14.4[a]	-0.04	8.03	0.45
y	1.15	-0.05	-	-	2.20	0.10	5.13	0.45
fdi	1.53	-0.03	2.85	0.01	-	-	1.64	-0.02

ARGENTINA

Equation	Source of causation							
	exp		*y*		*fdi*		y^*	
	χ^2 (4)	$\Sigma_{coeff.}$	χ^2 (4)	$\Sigma_{coeff.}$	χ^2 (4)	$\Sigma_{coeff.}$	χ^2 (4)	$\Sigma_{coeff.}$
exp	-	-	1.36	0.30	12.0[b]	0.17	1.43	-1.09
y	3.10	-0.03	-	-	3.92	-0.01	0.94	-0.66
fdi	5.65	-0.39	3.75	0.42	-	-	5.10	0.37

Notes: The uppercases "*a*", "*b*" and "*c*" denote significance at the 1%, 5% and 10% level, respectively. Figures in parenthesis are degrees of freedom.

APPENDIX C

Statistical Sources

MEXICO, PERIOD: 1979:1-1997: 4

Variable	Data	Source
exp	Quaterly data on exports of goods and services in million of US real dollars (deflator: consumer price index expressed in real dollars)	-International Financial Statistics (IFS 1998), IMF
fdi	Quaterly data of foreign direct investment flows into Mexico in million of US real dollars. A GDP deflator in US dollars has been used.	-IFS (1998), IMF -World Developmet Indicators (1999)
y	Quaterly data on real domestic income proxied by the industrial production index	-IFS (1998), IMF
y^*	Quaterly data on USA GDP (million US$) in real terms	-IFS (1998), IMF

BRAZIL, PERIOD: 1975:1-1997: 4

exp	Quaterly data on exports of goods and services in million of US real dollars (deflator: wholesale price index expressed in real dollars)	-IFS (1998), IMF
fdi	Quaterly data of foreign direct investment flows into Brazil in million of US real dollars. A GDP deflator in US dollars has been used.	-IFS (1998), IMF -World Developmet Indicators (1999)
y	Quaterly data on real domestic income proxied by the industrial production index	-IFS (1998), IMF
y^*	Quaterly data on USA GDP (million US$) in real terms	-IFS (1998), IMF

ARGENTINA, PERIOD: 1977:1-1997: 4

exp	Quaterly data on exports of goods and services in million of US real dollars (deflator: wholesale price index expressed in real dollars)	-IFS (1998), IMF
fdi	Quaterly data of foreign direct investment flows into Brazil in million of US real dollars. A GDP deflator in US dollars has been used.	-IFS (1998), IMF -World Developmet Indicators (1999)
y	Quaterly data on real domestic income proxied by the manufacturing production index	-IFS (1998) -World Development Indicators (1999)
y^*	Quaterly data on USA GDP (million US$) in real terms	-IFS (1998), IMF

CREDIT PAPERS

98/1 **Norman Gemmell and Mark McGillivray,** "Aid and Tax Instability and the Government Budget Constraint in Developing Countries"

98/2 **Susana Franco-Rodriguez, Mark McGillivray and Oliver Morrissey,** "Aid and the Public Sector in Pakistan: Evidence with Endogenous Aid"

98/3 **Norman Gemmell, Tim Lloyd and Marina Mathew,** "Dynamic Sectoral Linkages and Structural Change in a Developing Economy"

98/4 **Andrew McKay, Oliver Morrissey and Charlotte Vaillant,** "Aggregate Export and Food Crop Supply Response in Tanzania"

98/5 **Louise Grenier, Andrew McKay and Oliver Morrissey,** "Determinants of Exports and Investment of Manufacturing Firms in Tanzania"

98/6 **P.J. Lloyd,** "A Generalisation of the Stolper-Samuelson Theorem with Diversified Households: A Tale of Two Matrices"

98/7 **P.J. Lloyd,** "Globalisation, International Factor Movements and Market Adjustments"

98/8 **Ramesh Durbarry, Norman Gemmell and David Greenaway,** "New Evidence on the Impact of Foreign Aid on Economic Growth"

98/9 **Michael Bleaney and David Greenaway,** "External Disturbances and Macroeconomic Performance in Sub-Saharan Africa"

98/10 **Tim Lloyd, Mark McGillivray, Oliver Morrissey and Robert Osei,** "Investigating the Relationship Between Aid and Trade Flows"

98/11 **A.K.M. Azhar, R.J.R. Eliott and C.R. Milner,** "Analysing Changes in Trade Patterns: A New Geometric Approach"

98/12 **Oliver Morrissey and Nicodemus Rudaheranwa,** "Ugandan Trade Policy and Export Performance in the 1990s"

98/13 **Chris Milner, Oliver Morrissey and Nicodemus Rudaheranwa,** "Protection, Trade Policy and Transport Costs: Effective Taxation of Ugandan Exporters"

99/1 **Ewen Cummins,** "Hey and Orme go to Gara Godo: Household Risk Preferences"

99/2 **Louise Grenier, Andrew McKay and Oliver Morrissey,** "Competition and Business Confidence in Manufacturing Enterprises in Tanzania"

99/3 **Robert Lensink and Oliver Morrissey,** "Uncertainty of Aid Inflows and the Aid-Growth Relationship"

99/4 **Michael Bleaney and David Fielding,** "Exchange Rate Regimes, Inflation and Output Volatility in Developing Countries"

99/5 **Indraneel Dasgupta,** "Women's Employment, Intra-Household Bargaining and Distribution: A Two-Sector Analysis"

99/6 **Robert Lensink and Howard White,** "Is there an Aid Laffer Curve?"

99/7 **David Fielding,** "Income Inequality and Economic Development: A Structural Model"

99/8 **Christophe Muller,** "The Spatial Association of Price Indices and Living Standards"

99/9 **Christophe Muller,** "The Measurement of Poverty with Geographical and Intertemporal Price Dispersion"

99/10 **Henrik Hansen and Finn Tarp,** "Aid Effectiveness Disputed"
99/11 **Christophe Muller,** "Censored Quantile Regressions of Poverty in Rwanda"
99/12 **Michael Bleaney, Paul Mizen and Lesedi Senatla,** "Portfolio Capital Flows to Emerging Markets"
99/13 **Christophe Muller,** "The Relative Prevalence of Diseases in a Population of Ill Persons"
00/1 **Robert Lensink,** "Does Financial Development Mitigate Negative Effects of Policy Uncertainty on Economic Growth?"
00/2 **Oliver Morrissey,** "Investment and Competition Policy in Developing Countries: Implications of and for the WTO"
00/3 **Jo-Ann Crawford and Sam Laird,** "Regional Trade Agreements and the WTO"
00/4 **Sam Laird,** "Multilateral Market Access Negotiations in Goods and Services"
00/5 **Sam Laird,** "The WTO Agenda and the Developing Countries"
00/6 **Josaphat P. Kweka and Oliver Morrissey,** "Government Spending and Economic Growth in Tanzania, 1965-1996"
00/7 **Henrik Hansen and Fin Tarp,** "Aid and Growth Regressions"
00/8 **Andrew McKay, Chris Milner and Oliver Morrissey,** "The Trade and Welfare Effects of a Regional Economic Partnership Agreement"
00/9 **Mark McGillivray and Oliver Morrissey,** "Aid Illusion and Public Sector Fiscal Behaviour"
00/10 **C.W. Morgan,** "Commodity Futures Markets in LDCs: A Review and Prospects"
00/11 **Michael Bleaney and Akira Nishiyama,** "Explaining Growth: A Contest between Models"
00/12 **Christophe Muller,** "Do Agricultural Outputs of Autarkic Peasants Affect Their Health and Nutrition? Evidence from Rwanda"
00/13 **Paula K. Lorgelly,** "Are There Gender-Separate Human Capital Effects on Growth? A Review of the Recent Empirical Literature"
00/14 **Stephen Knowles and Arlene Garces,** "Measuring Government Intervention and Estimating its Effect on Output: With Reference to the High Performing Asian Economies"
00/15 **I. Dasgupta, R. Palmer-Jones and A. Parikh,** "Between Cultures and Markets: An Eclectic Analysis of Juvenile Gender Ratios in India"
00/16 **Sam Laird,** "Dolphins, Turtles, Mad Cows and Butterflies – A Look at the Multilateral Trading System in the 21st Century"
00/17 **Carl-Johan Dalgaard and Henrik Hansen,** "On Aid, Growth, and Good Policies"
01/01 **Tim Lloyd, Oliver Morrissey and Robert Osei,** "Aid, Exports and Growth in Ghana"
01/02 **Christophe Muller,** "Relative Poverty from the Perspective of Social Class: Evidence from The Netherlands"
01/03 **Stephen Knowles,** "Inequality and Economic Growth: The Empirical Relationship Reconsidered in the Light of Comparable Data"
01/04 **A. Cuadros, V. Orts and M.T. Alguacil,** "Openness and Growth: Re-Examining Foreign Direct Investment and Output Linkages in Latin America"

DEPARTMENT OF ECONOMICS DISCUSSION PAPERS

In addition to the CREDIT series of research papers the School of Economics produces a discussion paper series dealing with more general aspects of economics. Below is a list of recent titles published in this series.

99/1 **Indraneel Dasgupta,** "Stochastic Production and the Law of Supply"

99/2 **Walter Bossert,** "Intersection Quasi-Orderings: An Alternative Proof"

99/3 **Charles Blackorby, Walter Bossert and David Donaldson,** "Rationalizable Variable-Population Choice Functions"

99/4 **Charles Blackorby, Walter Bossert and David Donaldson,** "Functional Equations and Population Ethics"

99/5 **Christophe Muller,** "A Global Concavity Condition for Decisions with Several Constraints"

99/6 **Christophe Muller,** "A Separability Condition for the Decentralisation of Complex Behavioural Models"

99/7 **Zhihao Yu**, "Environmental Protection and Free Trade: Indirect Competition for Political Influence"

99/8 **Zhihao Yu,** "A Model of Substitution of Non-Tariff Barriers for Tariffs"

99/9 **Steven J. Humphrey,** "Testing a Prescription for the Reduction of Non-Transitive Choices"

99/10 **Richard Disney, Andrew Henley and Gary Stears,** "Housing Costs, House Price Shocks and Savings Behaviour Among Older Households in Britain"

99/11 **Yongsheng Xu,** "Non-Discrimination and the Pareto Principle"

99/12 **Yongsheng Xu,** "On Ranking Linear Budget Sets in Terms of Freedom of Choice"

99/13 **Michael Bleaney, Stephen J. Leybourne and Paul Mizen,** "Mean Reversion of Real Exchange Rates in High-Inflation Countries"

99/14 **Chris Milner, Paul Mizen and Eric Pentecost,** "A Cross-Country Panel Analysis of Currency Substitution and Trade"

99/15 **Steven J. Humphrey,** "Are Event-splitting Effects Actually Boundary Effects?"

99/16 **Taradas Bandyopadhyay, Indraneel Dasgupta and Prasanta K. Pattanaik,** "On the Equivalence of Some Properties of Stochastic Demand Functions"

99/17 **Indraneel Dasgupta, Subodh Kumar and Prasanta K. Pattanaik,** "Consistent Choice and Falsifiability of the Maximization Hypothesis"

99/18 **David Fielding and Paul Mizen,** "Relative Price Variability and Inflation in Europe"

99/19 **Emmanuel Petrakis and Joanna Poyago-Theotoky,** "Technology Policy in an Oligopoly with Spillovers and Pollution"

99/20 **Indraneel Dasgupta,** "Wage Subsidy, Cash Transfer and Individual Welfare in a Cournot Model of the Household"

99/21 **Walter Bossert and Hans Peters,** "Efficient Solutions to Bargaining Problems with Uncertain Disagreement Points"

99/22 **Yongsheng Xu,** "Measuring the Standard of Living – An Axiomatic Approach"

99/23 **Yongsheng Xu,** "No-Envy and Equality of Economic Opportunity"

99/24 **M. Conyon, S. Girma, S. Thompson and P. Wright,** "The Impact of Mergers and Acquisitions on Profits and Employee Remuneration in the United Kingdom"

99/25 **Robert Breunig and Indraneel Dasgupta,** "Towards an Explanation of the Cash-Out Puzzle in the US Food Stamps Program"

99/26 **John Creedy and Norman Gemmell,** "The Built-In Flexibility of Consumption Taxes"

99/27 **Richard Disney,** "Declining Public Pensions in an Era of Demographic Ageing: Will Private Provision Fill the Gap?"

99/28 **Indraneel Dasgupta,** "Welfare Analysis in a Cournot Game with a Public Good"

99/29 **Taradas Bandyopadhyay, Indraneel Dasgupta and Prasanta K. Pattanaik,** "A Stochastic Generalization of the Revealed Preference Approach to the Theory of Consumers' Behavior"

99/30 **Charles Blackorby, WalterBossert and David Donaldson,** "Utilitarianism and the Theory of Justice"

99/31 **Mariam Camarero and Javier Ordóñez,** "Who is Ruling Europe? Empirical Evidence on the German Dominance Hypothesis"

99/32 **Christophe Muller,** "The Watts' Poverty Index with Explicit Price Variability"

99/33 **Paul Newbold, Tony Rayner, Christine Ennew and Emanuela Marrocu,** "Testing Seasonality and Efficiency in Commodity Futures Markets"

99/34 **Paul Newbold, Tony Rayner, Christine Ennew and Emanuela Marrocu,** "Futures Markets Efficiency: Evidence from Unevenly Spaced Contracts"

99/35 **Ciaran O Neill and Zoe Phillips,** "An Application of the Hedonic Pricing Technique to Cigarettes in the United Kingdom"

99/36 **Christophe Muller,** "The Properties of the Watts' Poverty Index Under Lognormality"

99/37 **Tae-Hwan Kim, Stephen J. Leybourne and Paul Newbold,** "Spurious Rejections by Perron Tests in the Presence of a Misplaced or Second Break Under the Null"

00/1 **Tae-Hwan Kim and Christophe Muller,** "Two-Stage Quantile Regression"

00/2 **Spiros Bougheas, Panicos O. Demetrides and Edgar L.W. Morgenroth,** "International Aspects of Public Infrastructure Investment"

00/3 **Michael Bleaney,** "Inflation as Taxation: Theory and Evidence"

00/4 **Michael Bleaney,** "Financial Fragility and Currency Crises"

00/5 **Sourafel Girma,** "A Quasi-Differencing Approach to Dynamic Modelling from a Time Series of Independent Cross Sections"

00/6 **Spiros Bougheas and Paul Downward,** "The Economics of Professional Sports Leagues: A Bargaining Approach"

00/7 **Marta Aloi, Hans Jørgen Jacobsen and Teresa Lloyd-Braga,** "Endogenous Business Cycles and Stabilization Policies"

00/8 **A. Ghoshray, T.A. Lloyd and A.J. Rayner,** "EU Wheat Prices and its Relation with Other Major Wheat Export Prices"

00/9 **Christophe Muller,** "Transient-Seasonal and Chronic Poverty of Peasants: Evidence from Rwanda"

00/10 **Gwendolyn C. Morrison,** "Embedding and Substitution in Willingness to Pay"

00/11 **Claudio Zoli,** "Inverse Sequential Stochastic Dominance: Rank-Dependent Welfare, Deprivation and Poverty Measurement"

00/12 **Tae-Hwan Kim, Stephen Leybourne and Paul Newbold,** "Unit Root Tests With a Break in Variance"

00/13 **Tae-Hwan Kim, Stephen Leybourne and Paul Newbold,** "Asymptotic Mean Squared Forecast Error When an Autoregression With Linear Trend is Fitted to Data Generated by an I(0) or I(1) Process"

00/14 **Michelle Haynes and Steve Thompson,** "The Productivity Impact of IT Deployment: An Empirical Evaluation of ATM Introduction"

00/15 **Michelle Haynes, Steve Thompson and Mike Wright,** "The Determinants of Corporate Divestment in the UK"

00/16 **John Beath, Robert Owen, Joanna Poyago-Theotoky and David Ulph,** Optimal Incentives for Incoming Generations within Universities"

00/17 **S. McCorriston, C. W. Morgan and A. J. Rayner,** "Price Transmission: The Interaction Between Firm Behaviour and Returns to Scale"

00/18 **Tae-Hwan Kim, Douglas Stone and Halbert White,** "Asymptotic and Bayesian Confidence Intervals for Sharpe Style Weights"

00/19 **Tae-Hwan Kim and Halbert White,** "James-Stein Type Estimators in Large Samples with Application to the Least Absolute Deviation Estimator"

00/20 **Gwendolyn C. Morrison,** "Expected Utility and the Endowment Effect: Some Experimental Results"

00/21 **Christophe Muller,** "Price Index Distribution and Utilitarian Social Evaluation Functions"

00/22 **Michael Bleaney,** "Investor Sentiment, Discounts and Returns on Closed-End Funds"

00/23 **Richard Cornes and Roger Hartley,** "Joint Production Games and Share Functions"

00/24 **Joanna Poyago-Theotoky,** "Voluntary Approaches, Emission Taxation and the Organization of Environmental R&D"

00/25 **Michael Bleaney, Norman Gemmell and Richard Kneller,** "Testing the Endogenous Growth Model: Public Expenditure, Taxation and Growth Over the Long-Run"

00/26 **Michael Bleaney and Marco Gundermann,** "Credibility Gains and Output Losses: A Model of Exchange Rate Anchors"

00/27 **Indraneel Dasgupta,** "Gender Biased Redistribution and Intra-Household Distribution"

00/28 **Richard Cornes and Roger Hartley,** "Rentseeking by Players with Constant Absolute Risk Aversion"

00/29 **S.J. Leybourne, P. Newbold, D. Vougas and T. Kim,** "A Direct Test for Cointegration Between a Pair of Time Series"

00/30 **Claudio Zoli,** "Inverse Stochastic Dominance, Inequality Measurement and Gini Indices"

00/01 **Spiros Bougheas,** "Optimism, Education, and Industrial Development"

00/02 **Tae-Hwan Kim and Paul Newbold,** "Unit Root Tests Based on Inequality-Restricted Estimators"

Members of the Centre

Director

Oliver Morrissey - aid policy, trade and agriculture

Research Fellows (Internal)

Simon Appleton – poverty, education, households
Adam Blake CGE models of low-income countries
Mike Bleaney - growth, international macroeconomics
Indraneel Dasgupta – development theory
Norman Gemmell – growth and public sector issues
Ken Ingersent - agricultural trade
Tim Lloyd agricultural commodity markets
Paula Lorgelly – health, gender and growth
Andrew McKay - poverty, peasant households, agriculture
Chris Milner - trade and development
Wyn Morgan - futures markets, commodity markets
Christophe Muller – poverty, household panel econometrics
Tony Rayner - agricultural policy and trade

Research Fellows (External)

V.N. Balasubramanyam (*University of Lancaster*) – foreign direct investment and multinationals
David Fielding *(Leicester University)* - investment, monetary and fiscal policy
Göte Hansson (*Lund University*) – trade, Ethiopian development
Robert Lensink *(University of Groningen)* – aid, investment, macroeconomics
Scott McDonald *(Sheffield University)* – CGE modelling, agriculture
Mark McGillivray *(RMIT University)* - aid allocation, human development
Jay Menon *(ADB, Manila)* - trade and exchange rates
Doug Nelson *(Tulane University)* - political economy of trade
David Sapsford (*University of Lancaster*) - commodity prices
Finn Tarp *(University of Copenhagen)* – aid, CGE modelling
Howard White *(IDS)* - aid, poverty