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Trade liberalisation and growth in developing countries

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Abstract

Trade liberalisation in developing countries over the last 20 years has often been implemented with the expectation of growth being stimulated; yet the evidence on its growth enhancing effects is mixed. This paper argues that problems with mis-specification and the diversity of liberalisation indices used are in part responsible for the inconclusiveness. Using a dynamic panel framework and three different indicators of liberalisation, the paper finds that liberalisation does appear to impact upon growth, albeit with a lag. The evidence points to a *J* curve type response and this finding is robust to changes in specification, sample size and data period.

JEL classification: F14; 040
Keywords: Trade liberalisation; Growth

1. Introduction

The role of trade policy in economic development has been a key debate in the development literature for most of the second half of the twentieth century. Whereas the prevailing wisdom in the 1950s and 1960s favoured import substitution, that in the 1970s and 1980s favoured export promotion/outward orientation. The evolution of thinking on trade orientation and growth has been charted by

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Krueger (1997). She emphasises the accumulation of evidence of a positive correlation between growth of exports and the growth of GDP, countries with a more open trade orientation appearing to grow faster through time. Edwards (1998) has argued that the positive association between trade and openness is robust to the measure of openness used, though Rodriquez and Rodrik (1999) challenge this conclusion, arguing that although there is little systematic evidence linking inward oriented trade policies and growth, the evidence linking outward orientation and growth overstates the relationship between the two.

A possible link between openness and growth has been an important factor in stimulating an unprecedented wave of unilateral trade reforms, with over 100 countries committing to some kind of trade liberalisation over the last 20 years. Many of these programmes have been voluntary; most however have been tied to the policy conditionality which is central to World Bank Structural Adjustment Loans (SALs).[1] Indeed, trade reforms account for a higher proportion of loan conditions than any other area of policy. The fundamental rationale for this degree of commitment to programmes of trade reform is the obvious belief that liberalisation is a pre-requisite to a transition from a relatively closed to a relatively open economy. If openness is indeed positively related to growth, then it follows that liberalisation is a requirement for growth. In this paper, we investigate whether or not liberalisation appears to have "worked" in the sense of stimulating growth in the short run.

Although not as extensive as that on trade orientation and growth, there is a literature on trade reform/trade liberalisation and (short run) growth. It is fair to say that this literature is fairly inconclusive. Some studies have identified a positive association, others find no association, or even a negative association. Some of the reasons why the literature is inconclusive relate to the fact that different analysts use different proxies for liberalisation and rely on different methodologies. In addition, of course, a given sample will include liberalisations of differing intensities and durations. We add to this literature in three ways. First, we investigate the relationship between liberalisation and growth in a panel framework allowing us to capture both inter-country and inter-temporal variation. Second, we exploit our panel to model the relationship as a dynamic rather than a purely static one. Third, in contrast to previous work which typically relies on a single indicator of liberalisation, we experiment with three different proxies with complementary features. Our results suggest that first, much is to be gained by working in a panel context; second, previous cross-country work which failed to model the dynamics of the liberalisation–growth relationship may be missing an important element; third, the results help explain why the current empirical literature is inconclusive.

[1] A detailed account of the SAL process and its ingredients can be found in Greenaway and Milner (1993).

The remainder of the paper is structured as follows: Section 2 briefly reviews the empirical literature to date. Section 3 sets out our model specification and the empirical methodology. Sections 4 and 5 report the details and discuss the implications of our results and Section 6 concludes.

2. Liberalisation and growth: a brief review of the literature

A substantial literature on the effects of trade liberalisation on a range of macroeconomic aggregates and microeconomic adjustment processes has developed, in parallel with the proliferation of trade reform programmes. Several major reviews have been published, including Edwards (1993), Krueger (1997), Rodrik (1997) and Rodriguez and Rodrik (1999). To provide context to our analysis, we focus only on a few key contributions. Prior to doing so, however, we first of all comment on the identification of liberalisation episodes, since this in itself is not straightforward and one of the contributions of this paper is the use of a range of alternative liberalisation measures.

2.1. Indicators of liberalisation

Even at the conceptual level, liberalisation is not unambiguous. In the simple $2 \times 2 \times 2$ trade model, one naturally thinks of it as tariff liberalisation. In a more sophisticated setting with instruments affecting the domestic prices of both importables and exportables, one can conceive of it as a move towards relative price neutrality. Finally, one can think of second best liberalisation, i.e. the substitution of more efficient for less efficient instruments—typically tariffs for quotas.

This ambiguity is reflected in the range of measures used empirically. A widely used indicator is changes in nominal tariffs. For example, Table 1 reports changes in tariffs for 26 countries which liberalised in the 1980s, 22 of which recorded a decrease in average tariffs. This has the virtue of simplicity: it is relatively straightforward to compute and interpret. It also has some important limitations, however. First, there may be instrument substitution taking place: nominal tariffs may well be lowered but at the same time safeguard or anti-dumping measures introduced. Second, depending on the pattern of tariff reductions, average effective protection can increase at the same time as nominal tariffs decline. An alternative strategy therefore is to estimate convergence to relative price neutrality, or changes in the degree of anti-export bias. Krueger's (1978) bias measure and Balassa's (1982) relative exchange rate measure are good examples. The data requirements are extremely demanding, however, which limits their use. A third approach is to combine information on changes in a range of trade policy measures to compute some kind of index of liberalisation. This strategy acknowledges that, in practice, trade reforms are multi-faceted, and it has been adopted by, for example, Papageorgiou et al. (1991) (PMC) and IMF (1998). Because they have a high

Table 1
Elements of recent trade liberalisations

Country	Average nominal tariff[a]			Tax[b]	ER
	Pre-Reform	Current	Ratio	Dependence	
South Asia					
Bangladesh (1989, 1992)	94	50	0.53	0.42	−5.3
India (1990, 1993)	128	71	0.55	0.30	−7.7
Pakistan (1987, 1990)	69	65	0.94	0.38	−11.7
Sri Lanka (1985, 1992)	31	25	0.81	0.22	−0.5
Average	80	53	0.71	0.40[c]	
East Asia					
China (1986, 1992)	38	43	1.13		−43.9
Philippines (1985, 1992)	28	24	0.88	0.29	1.8
Indonesia (1985, 1990)	27	22	0.81	0.03	−23.2
Korea (1984, 1992)	24	10	0.42	0.17	13.1
Thailand (1986, 1990)[d]	13	11	0.88	0.22	−0.5
Average	29	25	0.82	−0.65[c]	
SSA					
Cote d'Ivoire (1985, 1989)	26	33	1.27	0.31	CFA
Ghana (1983, 1991)	30	17	0.57	0.18	−11.1
Kenya (1987, 1992)	40	34	0.85	0.23	−5.4
Madagascar (1988, 1990)	46	36	0.78	0.32	−11.2
Nigeria (1984, 1990)	35	33	0.93	0.23	−71.2
Senegal (1986, 1991)	98	90	0.92	0.43	CFA
Tanzania (1986, 1992)	30	33	1.10	0.07	−145.2
Zaire (1984, 1990)	24	25	1.04	0.14	−13.1
Average	41	38	0.94	0.29[c]	
Latin America					
Colombia (1984, 1992)	61	12	0.20	0.13	−36.1
Peru (1988, 1992)	57	17	0.30	0.22	106.7
Costa Rica (1985, 1992)	53	15	0.28	0.13	−15.8
Brazil (1987, 1992)	51	21	0.41	0.02	9.5
Venezuela (1989, 1991)	37	19	0.51	0.05	0.2
Chile (1984, 1991)	35	11	0.31	0.11	−14.5
Argentina (1988, 1992)	29	12	0.41	0.05	43.7
Mexico (1985, 1987)	29	10	0.34	0.03	3.7
Average	44	15	0.35	0.74[c]	

Years given in parenthesis are pre-reform and current.

[a]Unweighted average nominal tariff (tends to be biased upwards), rounded Ratio is Current Pre-Reform—lower ratio implies greater tariff reductions.

[b]Tax dependence is tariff revenue as proportion of tax revenue in 1984.

[c]Figure is the rank correlation between countries ranked in descending order of tax dependence against descending order of tariff ratio; i.e. a high positive correlation implies that countries most dependent on tariffs are least able to reduce average tariffs.

[d]Import-weighted average nominal tariff.

information content such indexes can be a rich resource. Their key constraint is that, having a degree of subjectivity, they are less valuable when it comes to comparative analysis.[2]

2.2. Evidence on the impact of liberalisation

Establishing whether or not liberalisation has impacted on growth is not straightforward, for three reasons. First we need to frame an appropriate counterfactual. Is it sensible to assume a continuation of pre-existing policies and performance? In practical terms this may be all one can do, but it does have an important shortcoming: some liberalisations which are policy conditioned are initiated at a time of crisis and this clearly gives rise to a potential endogeneity problem (which we address below). Second, how does one disentangle the effects of trade reforms from other effects? Third, supply responses will differ from economy to economy: how long should one wait before conducting an assessment of reforms?

Broadly speaking, three methodologies have been widely used; cross-country, time series and computable general equilibrium modelling. We disregard the last, since CGE modelling tends to be used for scenario analysis rather than evaluating outcomes. The cross-country literature falls into two genres, 'with–without' and 'before–after'. 'With–without' has been used by *inter alia* World Bank (1990) and Mosley et al. (1991). It involves taking a sample of countries subject to trade reforms, matching them with non-reform comparators and ascribing any difference to the reform programme. 'Before–after', which is again used by World Bank (1990) and Mosley et al. (1991), introduces a time dimension in that it compares 'with–withouts' for a few years before and a few years after. In some cases, like PMC (1991), it is only the 'withs' that are examined, in that case for 3 years before and after.

Examples of time series analysis include Harrigan and Mosley (1981), PMC (1991), Greenaway and Sapsford (1994), Greenaway et al. (1997). Harrigan and Mosley (1981) focus on SALs as one of a number of possible determinants of growth, export and investment performance in a standard growth model. Greenaway and Sapsford (1994) use a structural break approach in a neo-classical growth model; Greenaway et al. (1997) model growth as a smooth transition process then search for evidence of a coincidence of 'take off' and liberalisation.

The study which reports the most favourable growth enhancing effects for liberalisation is PMC (1991) who evaluate 36 liberalisation episodes in 19 countries. Moreover, they conclude that more rapid growth of real GDP is secured with minimal transitional costs (in unemployment and fiscal constraints). These

[2] For critiques of that methodology, see Collier (1993) and Greenaway (1993).

conclusions were challenged by Greenaway (1993) and Collier (1993) largely on the grounds that the underlying measure of liberalisation is flawed. Moreover, Greenaway et al. (1997) look specifically at the timing of the PMC episodes and find no systematic evidence of a connection between trade reforms and growth acceleration. In some cases, there is a positive correlation, in some a negative correlation, in others no apparent correlation whatsoever. This seems to be the story where the remaining evidence is concerned. There are many cases where a positive link from liberalisation to growth is reported; equally there are many cases where no association is reported. Moreover, as Rodriquez and Rodrik (1999) show, many of the reported results are not very robust to changes in specification and/or sample frame. Given the diversity of components of liberalisation programmes, the range of indicators used and the fact that dynamics are rarely modelled, this is perhaps not surprising.

3. Modelling liberalisation in a panel framework

To investigate the impact of such potential shortcomings, we constructed a dataset of up to 73 countries.[3] For this sample, we estimate a 'core' new growth theory model of the type which has now become standard. We then introduce liberalisation. Rather than using a single measure, we take those of Sachs and Warner (1995), Dean et al. (1994) and one based on World Bank (1993). (The characteristics of each are explained below.) For each, we estimate a dynamic panel model to evaluate the short run impact and transitional effects of liberalisation on the growth of real per capita GDP.

3.1. The core growth model

Following the work of Levine and Renelt (1992), which searched for a set of robust variables to model growth and the theoretical contributions to the new growth theory literature following Romer (1990), a degree of convergence on the most appropriate empirical specification for modelling growth has occurred.[4] Most models include as explanatory variables: investment; population growth; initial per capita GDP; and initial human capital. We include these, together with terms of trade variable and our liberalisation proxies. The former is included because our samples include developing countries and the empirical literature demonstrates clearly that terms of trade shocks have a significant impact on growth.[5] Liberalisa-

[3] Details of dataset construction are available from the authors on request.
[4] For a recent review of evidence, see Temple (1999).
[5] See the literature around the Bevan et al. project, for example Bevan et al. (1993).

tion is included for obvious reasons. Thus our base specification is one which is fundamentally a Levine–Renelt 'core variables' specification, with the addition of the terms of trade and liberalisation. The approach is very much in keeping with the work of, *inter alia*, Barro (1991), Easterly and Levine (1997) and Sachs (1997) though as we shall see below in contrast to that work our estimating model is dynamic rather than static. The base specification is[6]

$$\Delta \ln y_{i,t} = \beta_1 \ln y_{i,65} + \beta_2 \mathrm{SCH}_{i,65} + \beta_3 \Delta \ln \mathrm{TTI}_{i,t} + \beta_4 \Delta \ln \mathrm{POP}_{i,t} + \beta_5 \left(\frac{\mathrm{INV}}{\mathrm{GDP}} \right)_{i,t} + \beta_6 \mathrm{LIB}_{i,t} + \Delta \varepsilon_{i,t} \quad (1)$$

where $y_{i,t}$ = real GDP per head; ln $y_{i,65}$ = real GDP per head as at 1965; $\mathrm{SCH}_{i,65}$ = level of secondary school enrolment as at 1965; $\mathrm{TTI}_{i,t}$ = terms of trade index; $\mathrm{POP}_{i,t}$ = population; $([\mathrm{INV}]/[\mathrm{GDP}])_{i,t}$ = the ratio of gross domestic investment to GDP; $\mathrm{LIB}_{i,t}$ = dummy capturing liberalisation episode.

Specifications of this type have been widely used, not to model movements from one steady state to another but to investigate the transitional effects of liberalisation and other policy switches, by for example Easterley (1993), Fischer (1993) and Boone (1996). Although they have been widely used, Eq. (1) may be dynamically mis-specified. We therefore specify a second estimating equation of the form

$$\Delta \ln y_{i,t} = \alpha \Delta \ln y_{i,t-1} + \beta_1 \ln y_{i,65} + \beta_2 \mathrm{SCH}_{i,65} + \beta_3 \Delta \ln \mathrm{TTI}_{i,t} + \beta_4 \Delta \ln \mathrm{POP}_{i,t} + \beta_5 \left(\frac{\mathrm{INV}}{\mathrm{GDP}} \right)_{i,t} + \beta_6 \mathrm{LIB}_{i,t} + \Delta \varepsilon_{i,t} \quad (2)$$

where $y_{i,t-1}$ are lags of GDP per head. This has an obvious intuitive appeal in that it models growth in a dynamic context and permits us to track the short run effects of liberalisation. However, including lags induces a correlation between the error term and the lagged dependent variable. To provide consistent estimates, an instrumental variable procedure is adopted, which instruments the lagged dependent variable. Although a number of candidates are possible, the Arellano and Bond (1991) approach is adopted as this will generate the most efficient estimates.[7] (As we report later, we also estimate our model using an alternative procedure to investigate whether our results are robust to changes in estimation methodology.)

[6] All data series are drawn from World Bank data series and the Barro–Lee data series. Full details are available from the authors on request.

[7] Consistency of the GMM estimator requires lack of second order serial correlation in the dynamic formulation, so tests for this are presented with the results. Overall instrumental validity is also examined using a Sargan test of over-identifying restrictions.

3.2. Indicators of liberalisation

As we saw earlier, one of the key difficulties in trying to assess the relationship between liberalisation and growth is gaining an accurate measure of the point at which a country is deemed to have liberalised. Clearly such a process does not happen instantaneously but it is possible to suggest when moves toward greater market freedoms occurred. The simplest option is to use a statement of intent, such as the date when a World Bank SAL is agreed, for example, on the grounds that this signals the beginning of reform. Thus, our first indicator of liberalisation is a dummy variable, which is activated at the time of a country's first SAL (or equivalent World Bank intervention). The advantage of this approach is that it is extensive in its breadth of coverage of developing countries. While accepting that the receipt of a Bank loan does not necessarily imply immediate liberalisation, it is a signal of intent.

Our second indicator uses a range of data, and draws on the work of Dean et al. (1994) who examine post-1985 liberalisation in a sample of 32 developing countries. Timing of liberalisation is assessed by reference to four indicators: tariffs, quotas, export impediments and promoters and exchange rate misalignment. The authors evaluate levels and changes in tariffs, quotas and so on and then identify a year (or years) when liberalisation has taken place. In contrast to the SAL indicator therefore, which proxies intent, the Dean et al. (1994) indicator is based on outcomes of trade reforms. As with the SAL indicator, this again enters our model as a dummy variable.

Our final indicator draws upon Sachs and Warner (1995) who develop a measure of movement from "closed" to "open" trade policy regimes. Using the Summers and Heston (1991) 'international comparisons' dataset, they assess whether an economy is open or closed by reference to five criteria: non-tariff barrier coverage; average tariffs; the black-market exchange rate premium; whether the economy is socialist or not; whether a state monopoly exists over major exports. As Sachs and Warner (1995) concede, there is a degree of arbitrariness in their measure in that the critical average tariff level is deemed to be 39% and the critical level for coverage of NTBs is also deemed to be 39%. Many would regard these levels as too high to be consistent with an economy being 'open'. Nonetheless, it offers a further alternative to our SAL and the Dean et al. (1994) indicators. Again we enter this in our estimating equation as a dummy variable.[8]

4. Empirical results

The results of estimating Eqs. (1) and (2) are reported in Tables 2–4. Refer first to Table 2. Here the model is estimated using the Sachs–Warner liberalisation

[8] The Sachs–Warner indicator is in fact one of the most widely used in growth analysis. Recent examples include Sala-i-Martin (1997) and Burnside and Dollar (2000).

Table 2
Growth equations incorporating Sachs and Warner liberalisation index

Variable	1		2		3	
	Coefficient	*t*-ratio	Coefficient	*t*-ratio	Coefficient	*t*-ratio
Constant	0.043	2.118**	0.042	1.941*	0.001	0.214
$\Delta \ln y_{t-1}$					0.500	9.508**
$\Delta \ln y_{t-2}$					0.076	1.329
$\Delta \ln y_{t-3}$					0.324	8.284**
$\ln y_{65}$	−0.010	−4.286**	−0.008	−2.813**	−0.003	−5.717**
SCH_{65}	0.007	2.869**	0.009	3.408**	0.003	3.722**
ΔlnTTI	0.029	2.630**	0.031	2.867**	0.031	5.141**
ΔlnPOP	−0.681	−1.840*	−1.171	−3.221**	−0.411	−6.133**
INV/GDP	0.114	3.258**	0.125	2.925**	0.005	0.554
Sachs1	0.027	6.457**				
Sachs2			−0.008	−0.963	0.010	2.001**
$Sachs2_{t-1}$			0.008	0.926	0.017	4.286**
$Sachs2_{t-2}$			0.015	1.966**	0.020	5.576**
1st Order serial correlation	3.786**		3.756**		−1.639	
2nd Order serial correlation	1.439		2.073**		−0.986	
Sargan Test					0.634	
No. of countries	69		69		69	
Period	1975–1993		1975–1993		1975–1993	

(a) Heteroskedastic robust asymptotic *t*-ratios are in parentheses.
(b) The Sargan Test for the validity of the set of instruments is defined as Prob($J > \chi^2_p$), where p is the number of over-identifying instruments.
(c) Time dummies are not reported.
* Indicates significance at the 90% level.
** Indicates significance at the 95% level.

proxy. Column 1 refers to the base specification with the Sachs–Warner index included on the basis of a 0 prior to and 1 after reform. In other words, liberalisation is picked up in the form of an intercept shift, which measures average annual per capita growth changes following reform. All of the independent variables have the predicted sign. Thus, a low initial GDP and high initial level of schooling are associated with faster growth in GDP per capita as are a higher investment ratio and favourable terms of trade movement. Faster population growth is associated with slower GDP per capita growth and liberalisation appears to have on average a favourable and substantial (2.7%) impact on growth in the years following liberalisation.[9] All of the coefficient estimates are statistically significant most at the 5% level at least.

[9] For the benchmark Sachs–Warner equation report a growth effect of 2.44% for their dummy.

Table 3
Growth equations incorporating Dean et al. (1994) liberalisation index

Variable	1		2		3	
	Coefficient	*t*-ratio	Coefficient	*t*-ratio	Coefficient	*t*-ratio
Constant	0.020	1.026	0.023	1.146	0.034	5.491**
$\Delta \ln y_{t-1}$					0.624	6.454**
$\Delta \ln y_{t-2}$					−0.139	−2.173**
$\ln y_{65}$	−0.006	−3.023**	−0.007	−3.330**	−0.005	−4.708**
SCH_{65}	0.008	2.664**	0.008	2.711**	0.004	2.454**
ΔlnTTI	0.027	1.655*	0.028	1.767*	0.003	0.382
ΔlnPOP	−1.068	−4.436**	−1.034	−4.215**	−0.634	−4.697**
INV/GDP	0.214	6.418	0.220	6.544**	0.101	3.287**
dean1	0.009	1.777*				
dean2			−0.001	−0.132	−0.005	−0.924
$dean2_{t-1}$			0.002	0.289	0.004	0.803
$dean2_{t-2}$			0.018	2.380**	0.011	2.615**
1st Order serial correlation	3.763**		3.814**		−2.470**	
2nd Order serial correlation	2.324**		2.620**		0.048	
Sargan Test					0.916	
No of countries	73		73		73	
Period	1986–1993		1986–1993		1986–1993	

(a) Heteroskedastic robust asymptotic *t*-ratios are in parentheses.

(b) The Sargan Test for the validity of the set of instruments is defined as $\text{Prob}(J > \chi_p^2)$, where p is the number of over-identifying instruments.e

(c) Time dummies are not reported.

* Indicates significance at the 90% level.

** Indicates significance at the 95% level.

To look more closely at the timing of reform on growth, column 2 allows for the same base specification but the liberalisation proxy (Sachs 2) switches on in the year of liberalisation only. This therefore indicates the growth impact of reform in the first year only rather than an average post reform effect. Lags pick up the impact of reform in subsequent years. The magnitude, signs and significance of the independent variables are robust to this change, with population growth increasing in significance. What is most interesting, however, is the arrangement of signs on the liberalisation indicator: negative (but insignificant) in year 1; positive (but insignificant) in year 2 and positive, larger and significant in year 3; suggesting evidence of a *J* curve type effect of liberalisation on per capita GDP growth.

Equations like those in columns 1 and 2 are routinely used in studies of liberalisation (see for example Easterly and Levine, 1997; Sachs, 1997) yet there are indications of mis-specification. Although first order serial correlation would be expected in differenced equations of this form, as the bottom panel reveals,

Table 4
Growth equations incorporating World Bank Index

Variable	1		2		3		4	
	Coefficient	*t*-ratio	Coefficient	*t*-ratio	Coefficient	*t*-ratio	Coefficient	*t*-ratio
Constant	0.067	3.861**	0.072	4.352**	0.034	5.424**	0.037	5.727**
$\Delta \ln y_{t-1}$					0.541	7.476**	0.512	7.176**
$\Delta \ln y_{t-2}$					−0.077	−2.598**	−0.085	−2.791**
$\ln y_{65}$	−0.009	−3.775**	−0.009	−4.249**	−0.005	−6.414**	−0.005	−6.827**
SCH_{65}	0.010	3.271**	0.010	3.273**	0.004	3.513**	0.004	3.866**
ΔlnTTI	0.001	0.028	0.005	0.280	0.002	0.299	0.003	0.504
ΔlnPOP	−1.510	−5.219**	−1.479	−5.028**	−0.966	−7.580**	−0.996	−7.633**
INV/GDP	0.155	3.099**	0.153	3.276**	0.089	5.164**	0.094	5.393**
W.Bank1	0.064	1.067						
W.Bank2			−0.004	−0.641	−0.004	−0.814		
$W.Bank2_{t-1}$			0.005	0.614	0.009	1.748*		
$W.Bank2_{t-2}$			0.000	0.013	−0.002	−0.680		
Crisis							0.001	0.324
$Crisis_{t-1}$							0.001	0.157
$Crisis_{t-2}$							−0.004	−1.051
NonCrisis							−0.021	−1.922*
$NonCrisis_{t-1}$							0.030	2.884**
$NonCrisis_{t-2}$							0.002	0.401
1st Order serial correlation		2.929**		3.291**		−2.713**		−2.554**
2nd Order serial correlation		0.869		0.573		−0.531		−0.314
Sargan Test						0.722		0.624
No. of countries	73		73		73		73	
Period	1979–1991		1979–1991		1979–1991		1979–1991	

(a) Heteroskedastic robust asymptotic *t*-ratios are in parentheses.
(b) The Sargan Test for the validity of the set of instruments is defined as Prob($J > \chi_p^2$), where p is the number of over-identifying instruments.
(c) Time dummies are not reported.
* Indicates significance at the 90% level.
** Indicates significance at the 95% level.

there is evidence of second order serial correlation in column 1 which is indicative of dynamic mis-specification. To correct for this an instrumental variables approach in a dynamic setting as per Eq. (2) above was estimated and the results reported in column 3. First of all, note that the Sargan test for the validity of instruments is satisfied and also note that the second order serial correlation problem has been dealt with. From the upper panel, we see that all the independent variables have the predicted sign and all apart from the investment ratio are statistically significant. The liberalisation effect is positive and significant in all 3 years, with a contemporaneous impact effect of just under 1%, with an additional 1.5% in year 2 and 2% in the subsequent year. Again, a lagged reaction to trade reform is suggested though this time without the initial decline in GDP per capita.

Table 3 reports results using the Dean et al. (1994) indicator. Columns 1, 2 and 3 have exactly the same interpretation as in Table 2. Dean 1 and Dean 2 proxies of liberalisation should be interpreted in the same way as Sachs 1 and 2: the first is an average year on year growth impact of reform and the second examines timing issues. As with Table 2, coefficients have the expected sign in columns 1 and 2 and all, apart from the terms of trade variable, are statistically significant. From column 1, we see that liberalisation has a positive impact on growth though this is only significant at the 90% level and somewhat smaller in magnitude than with the Sachs–Warner measure (0.9%). The arrangement of signs in column 2 is negative (and insignificant), positive (and insignificant) and positive (and significant) in year 3, again pointing to a *J* curve reaction. Again, however, there are problems of serial correlation and so we estimate our dynamic equation with instruments on the lagged dependent variables, the results of which are reported in column 3. All the independent variables have the expected sign and are significant (apart, again,

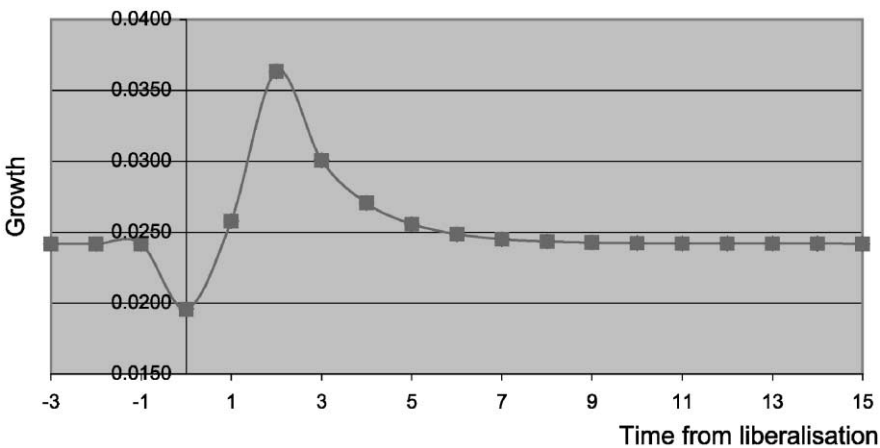

Fig. 1. Impact of liberalisation on growth (Dean et al., 1994).

from the terms of trade), suggesting a robust specification and the diagnostics suggest an appropriately specified equation. The arrangement of signs and significance on the liberalisation variable still points to a *J* curve response, with the strongest effect (1.1%) coming through in the third year (with this coefficient estimate also being statistically significant). Fig. 1 illustrates the path graphically.

In Table 3, we turn to the results when using the World Bank SAL indicator where we take the commencement of a SAL as our marker for liberalisation. The pattern of results is qualitatively similar to those for the other two indicators. In the base equations (columns 1 and 2), all coefficients have the expected sign and, with the exception of the terms of trade proxy, are statistically significant. In column 1, the liberalisation proxy suggests an improvement in GDP per capita growth of 0.6% but this is not statistically significant. In column 2, we report a negative/positive/positive arrangement of signs but again none are significant. Finally, in the dynamic equation (column 3) all coefficient estimates have the expected sign and, with the exception of TTI, all are significant. Here we find a negative/positive/negative arrangement of signs on the liberalisation variable though on this occasion none are statistically significant.

5. Discussion, interpretation and robustness

We have reported results for a base 'new growth' model similar to that used by many analysts. Since we feel there are good reasons for believing this to be a mis-specified growth model, we have also estimated a dynamic version. Because the 'measurement' of liberalisation is controversial, rather than confine ourselves to a single measure we have three different indicators. Overall, a number of findings come through. First, the outcomes for our core growth model are as expected: initial GDP, initial schooling, the investment ratio, population growth and (sometimes) terms of trade changes are all influential in determining cross-country patterns of growth. Second, we get similar patterns of results on the liberalisation effect across several measures of markers for liberalisation. This is especially interesting, in part because we have explored the dynamics of liberalisation to good effect and in part because of the consistent story which seems to be revealed. This is that the short run impact of liberalisation on the growth of real GDP per capita is unlikely to be instantaneous: we have clear evidence of a *J* curve effect, evidence which is consistent across samples and measures of liberalisation. Third, orders of magnitude for impact effects (1 year) and medium-run effects (3 years) exhibit some consistency but also some differences. The growth effects are strongest when the Sachs–Warner index is used and weakest with the SAL indicator. This is not surprising since the Sachs–Warner indicator is effectively a measure of ex post openness, i.e. it only includes as 'liberalised' those which have actually opened. By contrast, the SAL indicator is ex ante; in

effect it is a statement of intent to liberalise. That being so, it includes trade reformers, which are destined to fail as well as reformers destined for success.

But how robust are our results? We ran an exhaustive series of robustness tests using both Arellano–Bond and generalised instrumental variables regression. The latter suggested a simpler form of dynamic specification than Arellano–Bond. When this specification was estimated, however, the results were little different from those reported above (details are available from the authors on request). As a second check on robustness, we standardised the sample frame by number of countries (69) and time period (1986–1991). With regard to the former, dropping four countries from the Dean and World Bank samples made no material difference to the results. Setting a common sample period had more of an impact, which is not surprising for two reasons: we discard a great deal of useful information and we shorten the time period significantly. Nevertheless, the broad picture remains similar, with the same core variables being significant and a *J* curve pattern of short run growth effects. The only change of note is that the Sachs–Warner results weaken, which is not surprising since, in general, this dates liberalisation earlier than the other two. (Again, detailed results are available from the authors on request.)

As a third check, we investigate whether dropping investment or the terms of trade variables from the estimating equation had an impact. The former is of particular interest since, as well as affecting the level of investment, it could be argued that the coefficient on investment might be affected by liberalisation (or other policy reforms which accompany liberalisation). We experimented both by dropping investment from the regression and instrumenting it. In neither case are the main conclusions relating to the impact of reforms altered, though the magnitude of coefficient estimates are sensitive to the inclusion of investment and the way in which it is instrumented. Conducting similar experiments with the terms of trade variable had no material impact. (Detailed tables of results are available from the authors on request.)

One interesting, and consistent, finding is the lack of significance of the World Bank SAL indicator. Many SALs are introduced contemporaneously with IMF Stabilisation Loans, which in turn are often introduced in crisis conditions. Thus there may be a potential endogeneity problem here. Thus, as a fourth robustness check, we explicitly distinguished between 'crisis' and 'non-crisis' countries in the sample by reference to the timing of their SAL vis-à-vis their stabilisation loan. Specifically, if a stabilisation loan was agreed 12 months before or after a SAL, we treated this as a crisis case; those where the timing was outside this interval were treated as non-crisis. The results of re-estimating our growth equation with this refinement are reported in column 4 of Table 4. As can be seen, the coefficient estimates are smaller in magnitude for the 'crisis' countries and none are significant. Not only are the coefficients larger for the non-crisis countries, they are also statistically significant. This suggests two things. First, there may well be differences between liberalisation outcomes in countries where trade

reforms are forced on by a crisis as a consequence of the less favourable initial conditions. Second, it reinforces the point made earlier about care being taken in the choice of liberalisation proxies.

6. Conclusions

In this paper, we have tested a dynamic model of growth in the context of several samples and, more importantly, several measures of liberalisation. Our results suggest that liberalisation may impact favourably on growth of real GDP per capita. However, the effect would appear to be lagged and relatively modest. That is not so surprising since liberalisations vary in their depth and intensity and never amount to an immediate shift to free trade. The liberalisations, which are picked up, are often first rather than final steps. Through time of course economies become more open, partly as a consequence of incremental trade reforms but also due to other factors: reductions in transportation and communication costs, technological change and so on. The pay-off to this increased openness may be greater, as manifested in consistently higher coefficients from the Sachs–Warner proxy.

Our results suggest that at least four factors may be at work in explaining why the previous literature on the growth effects of liberalisation is so inconsistent. First there is the obvious point that sample sizes and composition vary as do methodological approaches. Second, different analysts have used different measures; some are ex ante indicators of liberalisation, some are ex post and others are clearly indicators of openness. Third it is clear that many models which have been estimated are mis-specified. Fourth, it is important to model the dynamics in order to distinguish between impact and medium run effects.

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