Does free trade really reduce growth? Further testing using the economic freedom index

Niclas Berggren
Henrik Jordahl

RATIO Näringslivets
forskningsinstitut

ratio.se

Box 3203
103 64 Stockholm

Besöksadress:
Sveavägen 59, 4tr

Does free trade really reduce growth?

Further testing using the economic freedom index[*]

NICLAS BERGGREN[1] & HENRIK JORDAHL[2]

[1]The Ratio Institute, P.O. Box 5095, SE-102 42 Stockholm, Sweden; E-mail: niclas.berggren@ratio.se;

[2]Department of Economics, Uppsala University, P.O. Box 513, SE-751 20 Uppsala, Sweden; E-mail: henrik.jordahl@nek.uu.se

Abstract. While studies of the relationship between economic freedom and economic growth have shown it to be positive, significant and robust, it has rightly been argued that different areas of economic freedom may have quite different effects on growth. Along that line, Carlsson and Lundström (2002) present the surprising result that "International exchange: Freedom to trade with foreigners" is detrimental for growth. We find that "Taxes on international trade" seems to drive this result. However, using newer data and a more extensive sensitivity analysis, we find that it is not robust. Least Trimmed Squares-based estimation in fact renders the coefficient positive.

1.   Introduction

In later years, the empirical growth literature has been expanded to include institutional measures of various kinds and, most recently, *economic freedom* as a potential explanatory variable. This is a term that denotes the degree to which an economy is market-oriented, in terms of economic institutions, fiscal and monetary policies, and certain outcomes. Several studies, using the fairly new Economic Freedom of the World Index (EFI) from The Fraser Institute,[1] have identified a positive empirical relationship between economic freedom and growth.[2] However, as the exact interpretation of a composite variable is somewhat unclear, it is important to delve deeper and investigate in what exact way economic freedom can be beneficial for growth. Such an approach has been taken by e.g. Carlsson and Lundström

---

[1] Another economic freedom index is published by the Heritage Foundation in cooperation with the *Wall Street Journal* (O'Driscoll, Holmes and O'Grady, 2002). The EFI and this other index are relatively similar in the overall implications, but since the EFI has been used more extensively in academic contexts (partly because the other index only goes back to 1995 and because it uses more subjective variables), it is the one used here.

[2] For a survey, see Berggren (2003).

(2002).[3] They show that some elements of economic freedom are growth-enhancing, whereas others have no discernable, or even a negative, effect. The most surprising result is perhaps that the area "International exchange: Freedom to trade with foreigners" exerts a negative influence on economic growth.

Ever since the days of Adam Smith, economists have argued that free trade increases the wealth of nations. The basic argument is that specialization on what one does relatively best entails rewards for everyone, even for those who do everything better than everybody else, in an absolute sense. Auxiliary arguments have also been proffered, e.g. that trade involves technology diffusion, transmission of knowledge and ideas, sharper competition, and an increase in market size in the presence of increasing returns to scale. Through these complementary mechanisms, trade can stimulate improvements in both physical and human capital as well as marginal factor productivity growth and, ultimately, national incomes.

However, there have always been dissenters within the economics profession, generally focusing on various so-called market failures (in either factor or product markets). For instance, John Stuart Mill advocated infant-industry protection, and John Maynard Keynes argued for tariffs when there was high domestic unemployment.[4] In recent years, the development of "strategic" trade theory and theories of oligopolistic competition have led some economists to question the ability of free trade to bring about better economic performance.[5] Externalities and global commons, not least in the environmental area, have caused additional free-trade skepticism.

Against this, the traditional pro-trade view has again been defended, as described by Bhagwati (2001) and Bhagwati and Srinivasan (2001), by arguments like the following: i) oftentimes the distortion in question is domestic and should be addressed by means of domestic policy in conjunction with free trade; ii) there is no reason to expect these theoretically described distortions to be important *de facto*; and iii) introducing protectionism into the political arena may, given how politics really works, yield more distortions than the original market distortions, through rent seeking, retaliation etc. And while earlier theoretical growth models, such as the Solow version, indicated that trade is of no importance for growth, newer models, in which the steady-state growth rate is not an exogenous constant, imply that trade can generate growth.[6]

There are, then, theoretical arguments both to support the contention that free trade improves economic performance (relative to protectionism) and the opposite view. Hence, this is, in the end, an empirical issue. The bulk of the literature supports the view that

---

[3] Cf. Ayal and Karras (1998).

[4] See Bhagwati (1994).

[5] See e.g. Krugman (1987).

[6] See e.g. Ben-David and Loewy (1998) and Srinivasan (1999a, 1999b).

free trade and trade openness does have, at least some, positive effects on efficiency and growth.[7] Some recent historical studies contain the interesting finding that such positive effects appear to be a recent, post-1970-phenomenon. Clemens and Williamson (2002) actually find that before World War II, higher tariffs were associated with higher growth.[8]

The contribution of this paper is threefold: first, we use a new version of the EFI and conduct more extensive sensitivity analyses to see if the Carlsson & Lundström (2002) result on trade openness holds; second, we decompose the index even further, down to its most basic elements, to get more information on what, exactly, drives the result; and third, by using the EFI, we are able to control for the growth effects of other market-oriented policy changes that often take place at the same time as trade liberalization (for a specification, see Appendix 1).

We run cross-country regressions, encompassing from 37 to 81 countries (depending on the model specification) over the period 1970-2000.[9] Both the area of the index, "Freedom to exchange with foreigners," as well as its five components "Taxes on international trade," "Regulatory trade barriers," "Actual size of trade sector compared to expected size," "Difference between official exchange rate and black market rate," and "International capital market controls" and their subcomponents are included as explanatory variables, along with standard variables from the empirical growth literature.

The results indicate that the area "Freedom to exchange with foreigners" is, indeed, detrimental for growth. In this regard, we replicate the result of Carlsson and Lundström (2002), as in finding that the area "Legal structure and property rights" exerts a

---

[7] See e.g. Dollar (1992), Sachs and Warner (1995), Harrison (1996), Barro (1997), Sala-i-Martin (1997), Edwards (1998), Frankel and Romer (1999), Dollar and Kraay (2001, 2002), Lindert and Williamson (2001), Ferreira and Rossi (2001), Greenaway *et al.* (2002), Irwin (2002a), Irwin and Terviö (2002), Tybout (2003), and the survey provided in Berg and Krueger (2003). Rodriguez and Rodrik (2000) claim that the results in this literature are less trustworthy than has been claimed due to poor measures and methods; but Baldwin (2003) maintains that there are credible studies to the effect that openness is growth-enhancing *in combination with* a stable and nondiscriminatory exchange rate system, responsible fiscal and monetary policies and an absence of corruption. In fact, Rodrik (1998) finds a similar result: that trade exerts a positive, albeit small, effect on growth in sub-Saharan Africa in the "right" institutional environment. Bhagwati and Srinivasan (2001) likewise think there is a strong empirical case for free trade but criticize the usage of cross-country regressions to demonstrate it; rather, case studies are quoted and recommended.

[8] Along the same lines, O'Rourke (2000), in studying the pre-1914 period, finds that trade openness was negatively related to growth. Vamvakidis (2002) finds no support for a positive growth-openness connection before 1970 – the correlation is, indeed, negative for the period 1920–1940. Again, only after 1970 does openness entail growth. Irwin (2002b) argues that the positive relationship between tariffs and growth was driven by outliers, especially fast-growing Argentina and Canada, who used tariffs as a way of raising government revenue without protecting manufacturing.

[9] The aggregate EFI is available for the years 1970 (54 countries), 1975 (72 countries), 1980 (105 countries), 1985 (111 countries), 1990 (113 countries), 1995 (123 countries) and 2000 (123 countries).

strongly positive influence. Contrary to them, we also find that the positive effect of the area "Sound money" attains statistical significance, but that the area "Size of government" does not. When decomposing the index further in the area "Freedom to exchange with foreigners," we find that one of its components, "Taxes on international trade," seems to be the decisive factor behind the result. That is, the higher these taxes, the higher the growth rate. Decomposing the index even further, down to its most basic elements, does not yield more precise results.

However, our more extensive sensitivity analysis (compared to that of Carlsson and Lundström, 2002) reveals that the negative result for "Freedom to exchange with foreigners" is not all that robust to changes in the sample or the specification of the model. In fact, using Least Trimmed Squares to identify outliers and Reweighted Least Squares to perform estimations without the outliers we get the result that "Freedom to exchange with foreigners" exerts a positive influence on growth! Likewise, looking at various subsamples of countries reveals that the negative effect primarily holds for some types (such as democratic, poor, and non-OECD countries) but not for others. This should make one cautious in accepting the finding of a negative relationship.

The structure of the paper is as follows. The next section presents the data, followed by a section presenting the results, a sensitivity analysis, and a discussion of the results and how they can be understood. Concluding remarks close the paper.

2. The data

Our data set consists of averages of economic freedom measures (1970–1995) and macroeconomic variables (1975–2000) for as many countries as possible. The variables used are specified in Table 1.

Table 1. Variable specifications and descriptive statistics for the countries included in the Table 4 regressions

Variable name	Variable definition	# obs	Mean	Std dev	Max value	Min value	Source
ΔY	Average annual percentage change in 1995 constant USD per capita, 1975–2000	78	1.284	2.018	6.160	-4.808	WDI
Y_{75}	Initial (1975) real GDP per capita in 1000 constant 1995 USD.	78	5.969	8.484	37.520	.149	WDI
Y_{7074}	Average real GDP per capita in 1000 constant 1995 USD, 1970–1974	78	5.813	8.892	44.165	.134	WDI
INV	Average annual gross capital formation, per cent of GDP, 1975–2000	78	22.520	5.382	39.177	10.768	WDI
INV_{7074}	Average annual gross capital formation, per cent of GDP, 1970–1974	78	23.088	7.189	46.169	9.419	WDI
SCHOOL	Percentage of "secondary school complete" in the total population, 1975	78	7.609	8.534	49.100	.020	BL
EFI	Economic freedom index, average 1970-1995	78	5.551	1.043	8.557	3.067	GL
EFI_1	Size of government: Expenditures, taxes, and enterprises, average 1970–1995	78	5.440	1.512	9.535	2.418	GL
EFI_2	Legal structure and security of property rights, average 1970–1995	78	5.091	1.619	8.410	2.023	GL
EFI_3	Access to sound money, average 1970–1995	78	6.311	1.702	9.580	1.795	GL
EFI_4	Freedom to exchange with foreigners, average 1970–1995	78	5.660	1.450	9.608	2.512	GL
EFI_5	Regulation of credit, labor, and business, average 1970–1995	78	5.445	.858	7.497	2.835	GL
EFI_{4A}	Taxes on international trade, average 1970–1995	78	5.813	2.252	9.900	.208	GL
EFI_{4B}	Regulatory trade barriers, average 1970–1995	37	6.691	1.624	9.300	3.330	GL
EFI_{4C}	Actual size of trade sector compared to expected size, average 1970–1995	78	5.041	2.064	10.000	.207	GL
EFI_{4D}	Difference between official exchange rate and black market rate, average 1970–1995	78	7.397	2.476	10.000	0	GL
EFI_{4E}	International capital market controls, average 1970–1995	78	2.874	2.627	9.885	0	GL
EFI_{4CDE}	$(EFI_{4C} + EFI_{4D} + EFI_{4E})/3$	78	5.104	1.700	9.569	1.012	GL
EFI_{4Ai}	Revenue from taxes on international trade as a percentage of exports plus imports, average 1970-1995	78	6.215	2.399	10.000	.458	GL
EFI_{4Aii}	Mean tariff rate, average 1970–1995	74	5.853	2.428	10.000	0	GL
EFI_{4Aiii}	Standard deviation of tariff rates, average 1970–1995	66	5.086	2.625	10.000	0	GL
EFI_{4Ei}	Access of citizens to foreign capital markets and foreign access to domestic capital markets, average 1970-1995	37	8.018	1.302	9.540	4.660	GL
EFI_{4Eii}	Restrictions on the freedom of citizens to engage in capital market exchange with foreigners - index of capital controls among 13 IMF categories, average 1970–1995	78	2.793	2.666	10.000	0	GL

Note: WDI = World Development Indicators CD-Rom (World Bank, 2001); BL = Barro and Lee dataset at <http://www.nber.org/pub/barro.lee>; GL = Gwartney and Lawson (2002) or <http://www.freetheworld.com>.
Note: EFI_{4Bi} and EFI_{4Bii} are not included in any regressions since data on the former are only available for the year 2000, and hence, they are not included in this table.
Note: All variables of the EFI are specified in Appendix 1 and range from 0 ("no economic freedom") to 10 ("full economic freedom"). The components of the EFI, as well as weighting schemes, have changed in the various editions that have been published. Hence, when comparing studies, one needs to be careful to clarify which editions are used.

The estimations are made on the basis of country averages of annual data for the time periods mentioned, except for Y75 and SCHOOL, which measure initial values, and except in the case of EFI data, which are only available at, and thus averaged over, five-year intervals. Since institutional variables, such as the EFI, are likely to have a long-run influence on economic growth, we have chosen to work with a cross-section rather than with a panel of countries.

The EFI spans only a period of 30 years with no more than seven observations for each country. This leaves little time-series variation, especially if we would have used ten- or fifteen-year averages to avoid problems of short-run dynamics; and of course any fixed-effects specification throws away the between-country variation. We have chosen not to work with initial or instrumented values (with the initial values as instruments) of the EFI. Such procedures are often used to handle endogeneity, but this problem will not be solved if the initial values of the EFI are themselves correlated with unobserved variables that are related to growth, or if the EFI depends on expected growth rates in the future. In addition, the quantity and arguably also the quality of the EFI components improve over time, making the focus on initial levels less desirable.

The choice of explanatory variables is such as to include those that have generally been shown to be significantly and robustly related to growth (see e.g. Levine and Renelt, 1992 and Sala-i-Martin, 1997; cf. de Haan and Sturm, 2000, 2001). The EFI is added, in various ways, to investigate if it adds explanatory power, as we hypothesize it might.

One advantage of using the EFI in testing this is that, unlike many other studies (as pointed out by e.g. Baldwin, 2002, and Clemens and Williamson, 2002) that use rather narrow measures of openness and that do not include other policy variables as regressors, it enables us to control for the growth effects of other market-oriented policy changes that often take place at the same time as trade liberalization.

In central respects, the choice of variables, as well as the model specifications, mirror the Carlsson and Lundström (2002) study. Unlike their study, our include data for the EFI from 1995 and data for the other variables for the period 1996–2000. Moreover, the Fraser Institute constantly tries to improve the quality of the EFI, and new parts have been added in the latest version.

Table 2 clarifies the way in which the central EFI area of concern in our study has changed from the version of index published in 2000 (see Gwartney and Lawson, 2000) and the one used here, published in 2002.

Table 2. A comparison of the 2000 and 2002 versions of the EFI with regard to free trade

International exchange: Freedom to trade with foreigners (17.1 %)	Freedom to exchange with foreigners (20 %)
A Taxes on international trade	A Taxes on international trade
i) Revenue from taxes on international trade as a percent of exports plus imports (23.3 %))	i) Revenue from taxes on international trade as a percentage of exports plus imports (6.7 %)
ii) Mean tariff rate (24.6 %)	ii) Mean tariff rate (6.7 %)
iii) Standard deviation of tariff rates (23.6 %)	iii) Standard deviation of tariff rates (6.7 %)
B Non-tariff regulatory trade barriers	B Regulatory trade barriers.
i) Percent of international trade covered by non-tariff trade restraints (19.4 %)	i) Hidden import barriers: No barriers other than published tariffs and quotas (10.0 %))
ii) Actual size of trade sector compared to the expected size (9.1 %)	ii) Costs of importing: The combined effect of import tariffs, licence fees, bank fees, and the time required for administrative red-tape raises costs of importing equipment by (10.0 %)
	C Actual size of trade sector compared to expected size (20 %)
	D Difference between official exchange rate and black market rate (20 %)
	E International capital market controls
	i) Access of citizens to foreign capital markets and foreign access to domestic capital markets (10.0 %)
	ii) Restrictions on the freedom of citizens to engage in capital market exchange with foreigners' index of capital controls among 13 IMF categories (10.0 %)

Note: The numbers in brackets are the assigned weights in the 2000 version of the EFI (determined by principal-components analysis in 2000 and by simple averages in 2002).

3. The results

3.1 The regression results

As a first step, in order to see if the results of several other studies can be replicated, we regress real per capita GDP growth (ΔY_i) on the summary index of economic freedom (EFI) using the following specification:

$$\Delta Y_i = \alpha + \beta_1 Y75_i + \beta_2 INV_i + \beta_3 SCHOOL_i + \delta EFI_i + \varepsilon_i, \qquad (1)$$

where growth (ΔY) and the investment share of GDP (INV) are country averages between 1975 and 2000 and where percentage of "secondary school complete" in the total population in 1975 (SCHOOL) is an initial value.[10] To control for convergence, GDP per capita in 1975 (Y75) is also included. EFI is measured as country averages between 1970 and 1995 since we expect the index to have a lagged effect on growth. The use of levels instead of changes is

---

[10] For empirical arguments on why a stock rather than a flow is preferable for this kind of human-capital proxy (as in Romer's, 1990, theoretical model), see Gemmell (1996) and Pritchett (1996).

consistent with endogenous growth theory, where certain policy variables are assumed to affect economic growth.[11]

Equation (1) is estimated by 2SLS. Y75 and INV have been instrumented with the average GDP per capita between 1970 and 1974 (Y7074) and the average investment share of GDP between 1970 and 1974 (INV7074). This is to ensure that β_1 is not biased due to measurement error and that β_2 is not overestimated due to endogeneity (as one can easily imagine that growth causes investment as well as the other way around).[12]

As can be seen in Table 3, economic freedom has a positive and statistically significant effect on growth, and the three control variables are all statistically significant with the predicted signs.[13]

Table 3. Estimation with the summary EFI

	Coefficient	Std. Error
EFI	.8603**	.1768
Y75^{IV}	-.1307**	.0367
INV^{IV}	.1455*	.0640
SCHOOL	.0709*	.0296
Constant	-6.5136**	1.4174
R-squared	.48	
# obs.	81	

Note: The dependent variable is ΔY. The two variables with the superscript IV refer to instrumented variables with EFI, SCHOOL, Y7074 and INV7074 as instruments. Huber-White robust standard errors are used.
Note: * indicates significance at the 5 percent level. ** indicates significance at the 1 percent level.

We continue by studying the five areas that together make up the summary index in order to get a clearer picture of what, more exactly, in the EFI that affects growth, and in what way. This specification (called the first specification in Table 4) is written

$$\Delta Y_i = \alpha + \beta_1 Y75_i + \beta_2 INV_i + \beta_3 SCHOOL_i + \Sigma_j \delta_j EFI_{ji} + \varepsilon_i, \qquad (2)$$

where EFI_{ji} is area j (j=1, 2, 3, 4, 5) of the EFI in country i. As before, 2SLS is used.

---

[11] Since economic growth is a stationary variable, Jones (1995) has questioned theories in which permanent changes in policy variables have permanent effects on growth. See Lundström (2003: 52) for a reply concerning the relationship between growth and levels of economic freedom.

[12] Cf. Barro and Sala-i-Martin (1995: 431) and Temple (1999: 129).

[13] If nothing else is mentioned, all reported regressions pass a skewness/kurtosis test and a Shapiro-Wilk W test for normally distributed residuals, and a linktest for specification errors.

Table 4. Estimation with the five areas of the EFI

	First specification		Second specification	
	Coefficient (std. error)	Variance inflation factor	Coefficient (std. error)	Variance inflation factor
EFI_1 Size of government	.0965 (.1258)	1.33	.0592 (.1276)	1.39
EFI_2 Legal structure and property rights	.8050** (.1341)	2.93	.7737** (.1361)	2.94
EFI_3 Sound money	.3720* (.1556)	2.16	.3742* (.1510)	2.17
EFI_4 Freedom to exchange with foreigners	-.4043* (.1727)	2.71	-1.3246* (.5372)	40.40
$EFI_4{}^2$			.0774* (.0382)	39.63
EFI_5 Regulations	.1179 (.2940)	1.97	.1637 (.2965)	1.97
$Y75^{IV}$	-.1403* (.0204)*	2.94	-.1420** (.0213)	2.98
INV^{IV}	.0943 (.0586)	1.20	.1051 (.0560)	1.20
SCHOOL	.0364 (.0292)	2.11	.0358 (.0291)	2.11
Constant	-5.6037** (1.4988)		-3.1662 (2.1328)	1.97
R-squared	.58		.60	
# obs.	78		78	
Condition number	4.2		18.9	

Note: The dependent variable is ΔY. The two variables with the superscript IV refer to instrumented variables with EFI_j, j = 1,…,5, SCHOOL, Y7074 and INV7074 as instruments in the first specification, with $EFI_4{}^2$ added in the second specification. Huber-White robust standard errors are used.
Note: Values for Y75 and EFI_4 for all countries included in these regressions are presented in Table A2. Two scatterplots of these values are presented in Figures A1 and A2.
Note: * indicates significance at the 5 percent level. ** indicates significance at the 1 percent level.

According to the estimates of the first specification in Table 4, three of the five areas of the EFI have a statistically significant effect on growth. In particular, we reproduce Carlsson and Lundström's (2002) surprising negative effect of area 4 "Freedom to exchange with foreigners,"[14] as well as their positive effect of area 2 "Legal structure and property rights". Contrary to Carlsson and Lundström we also find that the positive effect of the third area "Sound money" attains statistical significance, but that the first area "Size of government" does not.[15] Table 4 also includes variance inflation factors and the condition number for the explanatory variables. Neither of these indicators suggests that severe multicollinearity (presumably due to close resemblance of certain areas) is at hand in the first specification.

---

[14] It has been argued by Bhagwati (1999) that free trade and freedom for capital are two distinct phenomena with different effects on e.g. growth. Consequently, we ran a regression like the first specification in Table 4 but excluding components 4B (for reasons outlined below in connection with Table 5) and 4E "International capital market controls." The effect of this new variable on growth is negative but insignificant.

[15] We get very similar results if we instead use PPP-adjusted or chain-weighted growth rates. The most notable difference is that the negative effect of EFI_4 only attains statistical significance at the ten percent level with PPP-adjusted growth rates.

As can be seen, a second specification with the square of EFI_4 has also been estimated.[16] Investigating the effects of the squares of the EFI variables is not something directly suggested by theoretical considerations, but neither is it discouraged. The results from the first specification hold, and the fact that EFI_4^2 is positive and significant implies a U-shaped functional form which, however, is associated with non-positive growth throughout the EFI range of 0-10. An EFI_4 value of about 8.5 yields the most negative effect, while values both to its left and its right are associated with less negative growth. As can be expected, signs of collinearity are evident between EFI_4 and its square.

The surprising finding that area 4 "Freedom to exchange with foreigners" reduces growth calls for further examination. A natural step is to disaggregate this area into its five components. Table 5 contains the estimation results from such a disaggregation. The table contains three specifications. Component 4B "Regulatory trade barriers" is excluded from the second and the third specifications since it is only available for 37 countries. In consequence, the gain in efficiency from excluding component 4B is probably worth the cost in terms of risking omitted variable bias. Moreover, the variance inflation factors of EFI_2 and Y75 both improve from possibly troublesome levels, and the residuals become normally distributed, when component 4B is excluded. In the third specification, the average of the components 4C, 4D, and 4E is used rather than the individual components. As before, 2SLS is used.

---

[16] The reason for only including the square of EFI_4 is that results (not included here) show that when all EFI variables are squared, only EFI_4^2 turns out significant; and when all EFI variables are squared one at a time, again, only EFI_4^2 turns out significant. In addition, EFI_4 is our central variable of interest in the first place.

Table 5. Estimation with the five components of area 4 of the EFI

	First specification		Second specification		Third specification	
	Coefficient (std. error)	Variance inflation factor	Coefficient (std. error)	Variance inflation factor	Coefficient (std. error)	Variance inflation factor
EFI_1 Size of government	.3195 (.2392)	1.83	.0513 (.1531)	1.50	.1146 (.1186)	1.32
EFI_2 Legal structure and property rights	.7360* (.3144)	5.54	.7546** (.1342)	3.00	.8002** (.1357)	2.99
EFI_3 Sound money	.1712 (.1874)	3.98	.2801* (.1307)	2.03	.2709 (.1307)	2.00
EFI_{4A} Taxes on international trade	-.2264 (.1644)	3.02	-.2172 (.1098)	2.67	-.2316* (.1090)	2.64
EFI_{4B} Regulatory trade barriers	.1656 (.2003)	2.19				
EFI_{4C} Actual size of trade sector compared to expected size	.3391 (.1968)	3.11	-.1368 (.1037)	1.63		
EFI_{4D} Difference between official exchange rate and black market rate	.3692* (.1678)	3.13	.0534 (.0806)	1.76		
EFI_{4E} International capital market controls	-.3829 (.2086)	3.43	-.0040 (.0902)	2.21		
EFI_{4CDE}					-.0662 (.1309)	2.60
EFI_5 Regulations	-.5538 (.5903)	2.56	.0515 (.2883)	1.97	.0263 (.2894)	1.96
$Y75^{IV}$	-.0754 (.0398)	5.00	-.1405** (.0246)	3.88	-.1244** (.0246)	3.26
INV^{IV}	-.0092 (.0547)	1.92	.1408* (.0614)	1.38	.1169* (.0566)	1.24
SCHOOL	.0028 (.0146)	1.81	.0435 (.0308)	2.13	.0458 (.0304)	2.12
Constant	-4.2075 (2.1932)		-5.9795** (1.5218)		-5.8214** (1.4444)	
R-squared	.55		.62		.59	
# obs.	37		78		78	
Condition number	6.99		5.09		4.6	

Note: The dependent variable is ΔY. The two variables with the superscript IV refer to instrumented variables with EFI_j, $j = 1, 2, 3, 5$, EFI_{4k}, $k = A,..., E$ (in the first specification; in the second, B is excluded; in the third, C, D, and E are measured as a composite), SCHOOL, Y7074 and INV7074 as instruments. Huber-White robust standard errors are used.
Note: * indicates significance at the 5 percent level. ** indicates significance at the 1 percent level.

Focusing on the second specification in Table 5, we see that none of the four components in area 4 of the EFI turns out statistically significant; but component 4A "Taxes on international trade" is very close (with a significance level of 5.2 %). The third specification, where the other components of area 4 are put together into a composite measure, renders component 4A statistically significant. Hence, this variable appears to be behind the negative effect of free trade on growth: the higher the tariffs, the higher the growth rate (as economic freedom, which is the measure used in the regressions, and tariffs are negatively related by definition). Furthermore, 4A is the only component that attains statistical significance if we include component 4A to 4E one at a time.[17] Table 5 includes variance inflation factors and the condition number for the explanatory variables. Neither of these indicators suggests that severe multicollinearity is at hand.

---

[17] The estimates are available upon request.

Finally, we decompose area 4 "Freedom to exchange with foreigners" even further, down to its most basic elements. Component 4A is made up of three subcomponents: 4Ai "Revenue from taxes on international trade as a percentage of exports plus imports," 4Aii "Mean tariff rate," and 4Aiii "Standard deviation of tariff rates." Component 4E is made up of two subcomponents: 4Ei "Access of citizens to foreign capital markets and foreign access to domestic capital markets," and 4Eii "Restrictions on the freedom of citizens to engage in capital market exchange with foreigners." Component 4B is also made up of two subcomponents, but since one of them (4Bii "Cost of importing") is only available in the year 2000, they cannot be included in the regressions. The results are not very impressive; see Appendix 3 for details. Of all the included explanatory variables in the first specification, only EFI_2, EFI_{4D} and INV are statistically significant. However, the first specification in Table A1 suffers from the same problems as the first specification in Table 5: the sample consists of only 37 countries, some of the variance inflation factors are rather high, and the residuals are not distributed normally. In order to increase the number of included countries we again exclude EFI_{4B}, and also replace EFI_{4Ei} and EFI_{4Eii} with EFI_{4E}, since EFI_{4Eii} is only available for a limited number of countries. But there are still few discernible effects of the included subcomponents: only Y75 and EFI_2 are significant. In the second specification, residuals are distributed normally, but some signs of multicollinearity are present. However, if we replace EFI_4 in the first specification in Table 4 with EFI_{4Ai}, EFI_{4Aii}, and EFI_{4Aiii} one at a time, only EFI_{4Aii} "Mean tariff rate" attains statistical significance.[18]

To conclude, although the last disaggregation is not very informative, if any subcomponent is behind the effect of EFI_{4A} "Taxes on international trade", it is possibly EFI_{4Aii} "Mean tariff rate." The higher this rate, the higher the growth rate.

3.2. *Sensitivity analysis*

We have carried out two types of sensitivity analysis in order to detect whether the EFI results are robust: a test of the sensitivity of the results to the specification of the model and some tests of the sensitivity of the results to the sample.

The first test entails using two types of methods, the Extreme Bounds Analysis used by Levine and Renelt (1992) and the less strict robustness test of Sala-i-Martin (1997). The former reports an upper and a lower bound for parameter estimates based on a number of regressions with different combinations of regressors; a coefficient is defined to be robust if its two bounds have the same sign. The latter thinks this approach too demanding and instead argues in favor of analyzing the entire distribution of the parameter estimates, defining robustness as holding when the averaged 90 percent confidence interval of a

---

[18] The estimates are available upon request.

coefficient does not include zero. Like Sturm and de Haan (2002a) we use an unweighted version of this test.[19] This sensitivity analysis includes 16 of the 22 variables that according to Sala-i-Martin (1997) appear to be "significant," as well as Life Expectancy. We have excluded the variables that are similar to the EFI variables. This gives rise to the following list of included variables:

1. Regional variables: Sub-Saharan Africa (dummy), Latin America (dummy), Absolute Latitude.
2. Political variables: Political Rights, Civil Liberties, Number of Revolutions and Coups, War dummy.
3. Religious variables: Fraction Buddhist, Fraction Muslim, Fraction Catholic, Fraction Protestant. (We have not been able to find Fraction Confucian.)
4. Types of investment: Equipment Investment, Non-Equipment Investment.
5. Primary sector production: Fraction of Primary Products in Total Exports, Fraction of GDP in Mining.
6. Former Spanish Colonies.
7. Life Expectancy.[20]

For each regression we add one of the 680 possible triplets of the above variables to equation (2). The results are reported in Table 6, with and without the Type of investment variables, which, when included, reduce the sample to almost half the size.

Table 6. Significance shares for the EFI variables when altering the model specification

N=680					N=455				
	10 % sign	5 % sign	10 % sign	5 % sign		10% sign	5% sign	10% sign	5% sign
	%	%	#	#		%	%	#	#
EFI$_1$	3.971	.294	27	2	EFI$_1$	4.654	.440	21	2
EFI$_2$	95.294	87.794	648	597	EFI$_2$	99.560	98.462	453	448
EFI$_3$	58.824	34.412	400	234	EFI$_3$	84.176	51.429	383	234
EFI$_4$	40.441	23.088	275	157	EFI$_4$	51.868	40.230	236	183
EFI$_5$	.147	.000	1	0	EFI$_5$	1.099	.000	5	0

Note: The first five columns include equipment and non-equipment investment whereas the latter five do not. "N" refers to the number of regressions run.

EFI$_4$ "Freedom to exchange with foreigners" is not robustly related to growth. Even when excluding the Type of investment variables and using the 10 percent significance level the share of statistically significant coefficients is a meager 52 percent. The only area of the EFI that passes the test (of significance at the 10 percent level in at least 90 percent of the

regressions) is EFI$_2$ "Legal structure and property rights."[21] In their sensitivity analysis, Carlsson and Lundström (2002) only varied the included areas of the EFI.[22] We have shown that their claim that "Freedom to exchange with foreigners" is negatively and robustly related to growth does not appear to stand when other explanatory variables are incorporated in the sensitivity analysis.

The second type of test investigates whether only certain countries drive the results, i.e. if outliers that are not representative have a decisive influence on the estimated coefficients. The first method used is Least Trimmed Squares (LTS), the idea of which is to fit the majority of the data and, after that, to identify outliers as the cases with large residuals (see Sturm and de Haan, 2002a).[23] After this identification, we use Reweighted Least Squares (RLS) for inference by giving outliers (defined as countries with a residual the absolute value of which is greater than 2.5 times the standard error of the LTS regression) the weight zero and other countries the weight one. This procedure concentrates on the observations that best approximates the estimated model. The advantage of LTS compared with single-case diagnostics like Cook's distance and DFITS is that it can handle cases with several jointly influential observations.

The estimates in Table 7 reveal that EFI$_4$ is *positively* correlated with growth when 24 outlying observations are excluded. The sign of EFI$_3$ (now negative) also changes with the exclusion. The estimates in Table 7 should of course not be seen as evidence of a positive relationship between free trade and growth, but at least they indicate that measurement errors (which are common in the national accounts of less developed countries) or parameter heterogeneity (which is likely in cross country regressions) might explain the negative coefficient for EFI$_4$ in Table 4.[24]

---

[21] The critical extreme bounds for EFI$_3$ and EFI$_4$ are reported in Table A4.

[22] We have performed this type of analysis as well (although it might be problematic to use a method which looks at the effect of eliminating variables thought to be of relevance for growth). When eliminating up to three of the EFI variables and re-estimating the model (14 times per EFI area), we only found EFI$_2$ to be robust at the 10 and 5 percent levels. EFI$_4$ only obtained a significance share of 21.4 % (5 % level) and 35.7 % (10 % level).

[23] We minimize the sum of the 44 smallest residuals, ((observations+parameters+1)/2) which is the default in SAS.

[24] The definition of outliers is of course arbitrary. If we instead only use the 61 countries with a residual that is smaller than 4 times the standard error of the LTS regression, the coefficient for EFI$_4$ is positive but not statistically significant. The smallest number of countries that we can drop in this procedure and still get a positive coefficient is 14: Bangladesh, Democratic Republic of Congo, Egypt, India, Indonesia, Jamaica, Malta, Nicaragua, Pakistan, South Korea, Syria, Thailand, Venezuela, Zambia. To do away with the statistical significance of the negative coefficient for EFI$_4$ we only need to drop Egypt and the Democratic Republic of Congo.

Table 7. Least Trimmed/Reweighted Least Squares estimation with the five areas of the EFI

	Coefficient (std. error)
EFI_1 Size of government	.0845 (.0585)
EFI_2 Legal structure and property rights	.4134** (.0719)
EFI_3 Sound money	-.4324** (.0590)
EFI_4 Freedom to exchange with foreigners	.2675** (.0695)
EFI_5 Regulations	.6949** (.1273)
$Y75^{IV}$	-.0546* (.0169)*
INV^{IV}	.2294** (.0257)
SCHOOL	.0231 (.0125)
Constant	-9.0788** (.0731)
R-squared	.87
# obs	54

Note: The dependent variable is ΔY. The two variables with the superscript IV refer to instrumented variables with EFI_j, j = 1,...,5, SCHOOL, Y7074 and INV7074 as instruments. Huber-White robust standard errors are used.
Note: * indicates significance at the 5 percent level. ** indicates significance at the 1 percent level.
Note: The following 24 countries are given weight zero: Bangladesh, Bolivia, Chile, Democratic Republic of Congo, Egypt, India, Indonesia, Jamaica, Malta, Mauritius, New Zealand, Nicaragua, Pakistan, Papua New Guinea, South Africa, South Korea, Sri Lanka, Syria, Thailand, Tunisia, Turkey, United Arab Emirate, Venezuela, Zambia.
Note: All observations are used to construct the instruments in the first stage regressions.

In addition, we have varied the sample manually in various ways, dividing the sample into different groups in order to see if the results (using 2SLS) hold only for countries with certain characteristics. The divisions that have been undertaken, and the basic results, are the following:[25]

1. Rich or poor: The negative effect of EFI_4 holds for poor countries (with Y75 less than the median) and is positive but not statistically significant for rich countries.

2. Democratic or non-democratic: The effect of EFI_4 is positive in less democratic countries, as measured by the variables Avgpolright (not statistically significant) and Avgcivillib (statistically significant at the 10 percent level); and the effect is negative and statistically significant for more democratic countries.

3. OECD or non-OECD: The negative effect of EFI_4 holds for non-OECD countries and is positive but not statistically significant for OECD countries (only 20 of them).

4. OPEC or non-OPEC: The negative effect of EFI_4 holds for non-OPEC countries and is negative but not statistically significant for the OPEC countries: hence, the negative effect of EFI_4 does not stem from the oil-exporting countries and the theoretical possibility of their combining high growth and relatively high tariffs.

---

[25] See Table A3 for variable definitions. All estimations are available on request.

5. Continents and groups of countries: The negative result for EFI_4 holds when excluding Tiger economies in Asia (with a theoretical possibility of their being closed but fast-growing); there is a particularly strong negative effect of EFI_4 in Latin America; otherwise few interesting results are obtained.

3.3. Discussion

Finding that free trade exerts a negative influence on growth – as found not only by us in our 2SLS regressions but also by Carlsson and Lundström (2002) – is surprising. But the fact that many other studies have found the opposite result, as mentioned above, should make one cautious, as should, indeed, our own findings that the result is not really robust. Having noted that it is not robust, there are several alternative explanations of the seemingly negative relationship:

i)   The relationship between free trade and growth might be a contingent one. Grossman and Helpman (1991) point out that trade might reduce growth in countries that do not specialize in research and development or other growth-promoting activities. The estimates from our different divisions of the sample give some support for such an interpretation.

ii)   Even if there is a partial correlation between area 4 of the EFI and growth, the causality is unclear, especially given the model specification using averages. It could be that higher growth rates lead to higher tariffs rather than the other way around. It could also be that the two are jointly determined. In fact, Dawson (2003) finds no evidence of causality, using the Granger test, in either direction between this area of the EFI and growth (using the 2001 version of the index).

iii)   The effect of one variable, such as free trade, is not always manifested in the coefficient of the variable itself but through other variables that are themselves related to growth. One such candidate is investment.[26] If we estimate the first specification in Table 4 without investment, the coefficient for EFI_4 becomes less

---

[26] Levine and Renelt (1992: 953–956) find a non-robust relationship between trade and growth but a robust, positive relationship between trade and investment, as between investment and growth. If one removes investment in the regressions, the relationship between trade and growth turns strong, suggesting an effect of trade on growth via investment. Note, however, that the scope of trade is not the same thing as trade openness. Of the former, unlike the latter, Sala-i Martin (1997) finds a robust, negative effect. De Haan and Sturm (2000: 17–18) find that economic freedom does not affect growth through investments. Rodrik, Subramanian and Trebbi (2002) find that certain institutions are the most crucial factor for economic development: when such institutions are controlled for, trade often turns insignificant and, interestingly, negative. The other areas of the EFI might be considered our version of their institutions. It bears noting that they find that trade influences institutions in a positive manner.

negative (-.27) and statistically insignificant. Thus free trade might promote growth through investment. The correlation coefficient between EFI_4 and INV is .29 and when regressing INV on EFI_4 and a constant, the coefficient for EFI_4 (1.28) is highly statistically significant. The same is true if we also include the other areas of the EFI in the regression.

iv) Less free trade could induce more growth if trade and foreign direct investment (FDI) are substitutes and if it is combined with freedom for FDI.[27]

v) Perhaps some countries are able to act as price makers on the international market, using trade policy strategically, and it may be that they have higher growth rates.

vi) It might be that looking at EFI ratings without taking the strategic dimensions of trade policy into account, such that nations could choose to act on the basis of how they expect others to act, misses many important factors.

vii) It is possible to question the way the EFI measures area 4, both in terms of the variables used in components and subcomponents, and in terms of how they are actually measured. Some subjective measures (from the Global Competitiveness Report) are used (although in some model specifications above, they are not included); the weights applied could be questioned (although that is less of a problem when running regressions on the decomposed index); the way in which the actual measures are transformed into index figures ranging from 0 to 10 can be questioned (for details, see Appendix 2); some countries have no EFI scores for the early five-year periods covered, and it could be that there is some systematic effect involved involving them; etc.

viii) It could be that cross-country regression studies do not use a methodology suitable to investigating the effect of free trade on growth, as Bhagwati and Srinivasan (2001) have argued at length. Some main points of criticism: regression analyses are seldom based on firm theoretical ground and when they are, the linkage between theoretical and empirical specifications is often weak; the problem of causality; and the explanatory variables are often measured badly. We do think this view to be overly pessimistic but recognize the need to study the whole body of literature before making policy pronouncements.

Hence, we recommend great caution in using the empirical findings reported here and, e.g., by Carlsson and Lundström (2002) with regard to proposing a certain trade policy.

---

[27] For example, Helpman, Melitz and Yeaple (2003) show that tariffs reduce the exports/FDI ratio; and Keller and Yeaple (2003) show that a reduction in this ratio is beneficial for growth. Whether trade and FDI are substitutes or complements is not clear in several other studies: see, e.g., Balasubramanyam, Salisu and Spasford (1996), Goldberg and Klein (1999), and Blonigen (2001).

4   Concluding remarks

It is widely believed that free trade is growth-promoting, and a number of studies confirm this result. However, the relatively new dataset that forms the Economic Freedom Index has been used to show the opposite result (Carlsson and Lundström, 2002). In using a newer version of the index, and hence partly new data, we likewise find that the area "Freedom to exchange with foreigners" is associated with slower growth. By decomposing the index even further, we can establish that the component "Taxes on international trade" seems to drive this result – the higher these taxes, the higher the growth.

However, performing a sensitivity analysis reveals that this negative result is not robust. A robustness test of the model specification reveals that "Freedom to exchange with foreigners" is significant in only 40 percent of the cases at the 5 percent significance level and in only 52 percent of the cases at the 10 percent level. Furthermore, the results are sensitive to the sample used. When using LTS to identify outliers and RLS for inference, the variable turns out significant and *positive*. Likewise, dividing the sample of countries into different groups reveals that the negative result only holds for some types of countries whereas other types are characterized by a positive result. (Carlsson and Lundström, 2002, do not perform these kinds of tests.) The implication is that the negative result reported in OLS and 2SLS regressions should be interpreted with great caution.

Decomposing the index, we not only find the negative result in the area "Freedom to exchange with foreigners" but also positive results in the areas "Legal structure and property rights" and "Sound money." The controversial issue of whether a large government is growth-reducing or not is not solved here, as the area "Size of government" does not turn out significant. (In the LTS/RLS analysis, the coefficient of "Sound money" changes sign and "Regulations becomes positive and significant.)

By using the EFI rather than more narrow measures of openness, we are able to control for the growth effects of other market-oriented policy changes that often take place at the same time as trade liberalization – and hence, we avoid a methodological problem encountered by many other cross-country studies in this area. So clearly, there is scope for more detailed studies of the free trade-growth relationship (as well as between other areas of the index and growth). In the paper, we have identified several actual and potential weaknesses of the tests thus far, such as unclear causality, outliers, model specification, country selection, data quality, etc. We have tried to resolve a few of these problems. Nevertheless, caution is recommended when it comes to presenting policy advice.

Appendix 1: The areas, components, and subcomponents of the EFI

1 Size of Government: Expenditures, Taxes, and Enterprises
    A General government consumption spending as a percentage of total consumption
    B Transfers and subsidies as a percentage of GDP
    C Government enterprises and investment as a percentage of GDP
    D Top marginal tax rate (and income threshold to which it applies)

2 Legal Structure and Security of Property Rights
    A Judicial independence: The judiciary is independent and not subject to interference by the government or parties in disputes (GCR)
    B Impartial courts: A trusted legal framework exists for private businesses to challenge the legality of government actions or regulation (GCR)
    C Protection of intellectual property (GCR)
    D Military interference in rule of law and the political process (ICRG)
    E Integrity of the legal system (ICRG)

3 Access to Sound Money
    A Average annual growth of the money supply in the last five years minus average annual growth of real GDP in the last ten years
    B Standard inflation variability in the last five years
    C Recent inflation rate
    D Freedom to own foreign currency bank accounts domestically and abroad

4 Freedom to Exchange with Foreigners
    A Taxes on international trade
        i Revenue from taxes on international trade as a percentage of exports plus imports
        ii Mean tariff rate
        iii Standard deviation of tariff rates
    B Regulatory trade barriers.
        i Hidden import barriers: No barriers other than published tariffs and quotas (GCR)
        ii Costs of importing: The combined effect of import tariffs, licence fees, bank fees, and the time required for administrative red-tape raises costs of importing equipment by (10 = 10% or less; 0 = more than 50%) (GCR)
    C Actual size of trade sector compared to expected size.
    D Difference between official exchange rate and black market rate
    E International capital market controls
        i Access of citizens to foreign capital markets and foreign access to domestic capital markets (GCR)
        ii Restrictions on the freedom of citizens to engage in capital market exchange with foreigners – index of capital controls among 13 IMF categories.

5 Regulation of Credit, Labor, and Business
    A Credit Market Regulations
        i Ownership of banks: Percentage of deposits held in privately owned banks
        ii Competition: Domestic banks face competition from foreign banks (GCR)
        iii Extension of credit: Percentage of credit extended to private sector
        iv Avoidance of interest rate controls and regulations that lead to negative real interest rates
        v Interest rate controls: Interest rate controls on bank deposits and/or loans are freely determined by the market (GCR)
    B Labor Market Regulations
        i Impact of minimum wage: The minimum wage, set by law, has little impact on wages because it is too low or not obeyed (GCR)
        ii Hiring and Þring practices: Hiring and firing practices of companies are determined by private contract (GCR)
        iii Share of labor force whose wages are set by centralized collective bargaining (GCR)
        iv Unemployment Benefits: The unemployment benefits system preserves the incentive to work (GCR)
        v Use of conscripts to obtain military personnel
    C Business Regulations
        i Price controls: Extent to which businesses are free to set their own prices

ii Administrative conditions and new businesses: Administrative procedures are an important obstacle to starting a new business (GCR)

iii Time with government bureaucracy: Senior management spends a substantial amount of time dealing with government bureaucracy (GCR)

iv Starting a new business: Starting a new business is generally easy (GCR)

v Irregular payments: Irregular, additional payments connected with import and export permits, business licenses, exchange controls, tax assessments, police protection, or loan applications are very rare (GCR)

Note: GCR = Global Competitiveness Report; ICRG = International Country Risk Guide

Appendix 2: Data description for area 4 "Freedom to exchange with foreigners"

A Taxes on international trade

i Revenue from taxes on international trade as a percentage of exports plus imports
The formula used to calculate the ratings for this component was: (Vmax - Vi) / (Vmax - Vmin) multiplied by 10. Vi represents the revenue derived from taxes on international trade as a share of the trade sector. The values for Vmin and Vmax were set at 0% and 15%, respectively. This formula leads to lower ratings as the average tax rate on international trade increases. Countries with no specific taxes on international trade earn a perfect 10. As the revenues from these taxes rise toward 15% of international trade, ratings decline toward zero. (Note that, except for two or three extreme observations, the revenues from taxes on international trade as a share of the trade sector are within the 0% to 15% range).

ii Mean tariff rate
The formula used to calculate the 0-to-10 rating for each country was: (Vmax - Vi) / (Vmax - Vmin) multiplied by 10. Vi represents the country's mean tariff rate. The values for Vmin and Vmax were set at 0% and 50%, respectively. This formula will allocate a rating of 10 to countries that do not impose tariffs. As the mean tariff rate increases, countries are assigned lower ratings. The rating will decline toward zero as the mean tariff rate approaches 50%. (Note that, except for two or three extreme observations, all countries have mean tariff rates within this 0% to 50% range.)

iii Standard deviation of tariff rates.
Compared to a uniform tariff, wide variation in tariff rates exerts a more restrictive impact on trade and, therefore, on economic freedom. Thus, countries with greater variation in their tariff rates should be given lower ratings. The formula used to calculate the 0-to-10 ratings for this component was: (Vmax - Vi) / (Vmax - Vmin) multiplied by 10. Vi represents the standard deviation of the country's tariff rates. The values for Vmin and Vmax were set at 0% and 25%, respectively. This formula will allocate a rating of 10 to countries that impose a uniform tariff. As the standard deviation of tariff rates increases toward 25%, ratings decline toward zero. (Note that, except a few very extreme observations, the standard deviations of the tariff rates for the countries in our study fall within this 0% to 25% range.)

B Regulatory Trade Barriers

i Hidden import barriers: No barriers other than published tariffs and quotas.

ii Costs of importing: the combined effect of import tariffs, licence fees, bank fees, and the time required for administrative red-tape raises costs of importing equipment by (10 = 10% or less; 0 = more than 50%). This component is based on survey responses to this question obtained from the *Global Competitiveness Report 2000*.

C Actual size of trade sector compared to expected size
Regression analysis was used to derive an expected size of the trade sector based on various structural and geographic characteristics. The actual size of the trade sector was then compared with the expected size for the country. If the actual size of the trade sector is greater than expected, this figure will be positive. If it is less than expected, the number will be negative. The percent change of the negative numbers was adjusted to make it symmetrical with the percent change of the positive numbers. The following formula was used to place the figures on a 0-to-10 scale: (Vi - Vmin) / (Vmax - Vmin) multiplied by 10. Vi is the country's actual value for the component. Vmax and Vmin were set at 100% and -50%, respectively. (Note that -50% is symmetrical with +100%.) This procedure allocates higher ratings to countries with large trade sectors compared to what would be expected, given their population, geographic size, and location. On the other hand, countries with small trade sectors relative to the expected size receive lower ratings.

D Difference between official exchange rate and black market rate
The formula used to calculate the 0-to-10 ratings for this component was the following: (Vmax - Vi) / (Vmax - Vmin) multiplied by 10. Vi is the country's black-market exchange rate premium. The values for Vmin and Vmax were set at 0% and 50%, respectively. This formula will allocate a rating of 10 to countries without a black-market exchange rate; *i.e.*, those with a domestic currency that is fully convertible without restrictions. When exchange rate controls are present and a black market exists, the ratings will decline toward zero as the black market premium increases toward 50%. A zero rating is given when the black market premium is equal to, or greater than, 50%.

E International capital market controls

i Access of citizens to foreign capital markets and foreign access to domestic capital markets.

ii Restrictions on the freedom of citizens to engage in capital market exchange with foreigners – index of capital controls among 13 IMF categories.

The IMF reports on 13 different types of capital controls. This component is based on the number of capital controls levied. The 0-to-10 rating is constructed by taking 13 minus the number of capital controls divided by 13 and multiplied by 10.

Note: For sources, see Gwartney and Lawson (2002: 26–28).

Appendix 3: Various tables and figures

Table A1. Estimations with the subcomponents of area 4 of the EFI

	First specification		Second specification	
	Coefficient (std. error)	Variance inflation factor	Coefficient (std. error)	Variance inflation factor
EFI_1 Size of government	.2545 (.3229)	2.20	.1506 (.2326)	1.93
EFI_2 Legal structure and property rights	1.0403* (.4910)	6.85	.6166* (.2381)	5.21
EFI_3 Sound money	.1379 (.1664)	4.15	.2337 (.1561)	2.30
EFI_{4Ai} Revenue from taxes on international trade	-.5374 (.3354)	5.82	-.1510 (.1504)	3.08
EFI_{4Aii} Mean tariff rate	-.0604 (.1480)	4.22	-.0260 (.1555)	3.56
EFI_{4Aiii} Standard deviation of tariff rates	.2915 (.2238)	2.59	-.0547 (.1247)	2.09
EFI_{4B} Regulatory trade barriers	-.0025 (.3127)	3.65		
EFI_{4C} Actual size of trade sector compared to expected size	.4500 (.2227)	3.49	.1383 (.1450)	2.05
EFI_{4D} Difference between official exchange rate and black market rate	.5574* (.2070)	3.83	.0831 (.1131)	2.07
EFI_{4E} International capital market controls			-.0416 (.1221)	2.30
EFI_{4Ei} Access to capital markets	.0725 (.4135)	2.16		
EFI_{4Eii} Restrictions on capital market exchange with foreigners	-.3803* (.1766)	3.86		
EFI_5 Regulations	-.9073 (.8399)	2.86	.1374 (.3841)	2.04
$Y75^{IV}$	-.0809 (.0567	5.15	-.0959* (.0421)	5.42
INV^{IV}	-.0545 (.1338)	2.06	.0535 (.0957)	1.72
SCHOOL	.0114 (.0204)	1.82	.0362 (.0331)	2.07
Constant	-2.8501 (2.8116)		-4.1813* (1.9538)	
R-squared	.56		.41	
# obs.	37		66	
Condition number	9.78		6.95	

Note: The dependent variable is ΔY. The two variables with the superscript IV refer to instrumented variables with, in the first specification, EFI_j, j = 1, 2, 3, 5, EFI_{4k}, k = B, C, D, EFI_{4An}, n = i, ii, iii, EFI_{4Ep}, p= i, ii, SCHOOL, Y7074 and INV7074, and in the second specification, EFI_j, j = 1, 2, 3, 5, EFI_{4k}, k = B, C, D, E, EFI_{4An}, n = i, ii, iii, SCHOOL, Y7074 and INV7074 as instruments. Huber-White robust standard errors are used.
Note: * indicates significance at the 5 percent level. ** indicates significance at the 1 percent level.

Table A2. Values for Δ_{75} and EFI4 for the countries included in the regressions presented in Table 4

Country	ΔY	EFI_4
Algeria	.416	4.075
Argentina	.511	3.170
Australia	2.045	6.677
Bangladesh	2.168	2.512
Barbados	1.721	5.060
Belgium	1.760	9.107
Benin	.440	5.237
Bolivia	-.006	5.663
Botswana	5.117	6.760
Brazil	1.208	3.407
Cameroon	.822	5.348

Canada	1.670	7.665
Central Afr. Rep.	-1.044	5.160
Chile	3.383	5.567
Colombia	1.385	4.247
Congo, Dem. R.	-4.808	5.037
Congo, Rep. Of	.442	6.323
Costa Rica	1.513	5.920
Denmark	1.616	7.022
Dominican Rep.	2.114	4.453
Ecuador	.519	5.253
Egypt	3.713	3.958
El Salvador	.068	4.777
Finland	2.151	6.532
France	1.730	6.663
Ghana	-0.511	3.267
Greece	1.934	5.283
Guatemala	0.485	5.602
Guinea-Bissau	-0.287	3.940
Guyana	0.300	5.260
Haiti	-1.245	3.805
Honduras	.471	5.896
Hong Kong	4.515	9.608
Hungary	1.633	4.338
Iceland	2.284	4.632
India	3.260	3.296
Indonesia	3.983	5.712
Israel	1.757	5.142
Italy	2.002	7.215
Jamaica	-.614	5.898
Japan	2.493	6.333
Kenya	.364	5.900
Kuwait	-2.075	6.907
Malawi	.441	5.438
Malaysia	3.984	7.783
Mali	.632	5.510
Malta	5.845	6.098
Mauritius	4.137	5.153
Mexico	1.407	4.922
New Zealand	0.725	7.150
Nicaragua	-2.811	4.953
Niger	-1.455	5.304
Norway	2.874	7.158
Pakistan	2.556	4.300
Pap. New Guinea	.290	6.440
Paraguay	1.360	5.648
Peru	-.233	3.788
Philippines	.810	5.178
Senegal	.183	5.277
Singapore	5.125	9.467
South Africa	-.617	6.453
South Korea	6.160	6.160
Sri Lanka	3.340	4.480

Sweden	1.359	7.248
Switzerland	.670	7.337
Syria	2.008	4.107
Thailand	4.887	5.873
Togo	-.656	5.638
Trinidad & Tob.	1.909	4.614
Tunisia	2.472	5.083
Turkey	2.088	3.538
Unit. Arab Em.	-3.408	8.318
United Kingdom	1.948	7.620
United States	2.054	7.690
Uruguay	1.835	7.083
Venezuela	-.982	6.643
Zambia	-2.348	5.528
Zimbabwe	.154	4.905

Sources: See Table 1.

Table A3. Variable specifications and descriptive statistics for the countries included in the sensitivity analysis

Variable name	Variable definition	# obs	Mean	Std dev	Max value	Min value	Source
Afr	Dummy for sub-Saharan countries; 1 for yes, 0 otherwise	78	.2308	.424	1.000	.000	LMI
Lac	Dummy for Latin American countries; 1 for yes, 0 otherwise	78	.2821	.453	1.000	.000	LMI
Latitude	Degrees of absolute latitude	78	23.966	16.672	63.892	.513	HJ
Avgpolright	Average index number for political rights, 1975–2000	76	3.369	1.828	6.577	1.000	FH
Avgcivillib	Average index number for civil liberties, 1975–2000	76	3.491	1.613	6.769	1.000	FH
Revc	Average number of revolutions and coups per year, 1960–84	73	.187	.249	1.15	.000	LR
War	Dummy for countries that participated in at least one external war over the period 1960–85	76	.355	.482	1.000	.000	BL
Bud	Fraction of Buddhists 1980, percent	77	3.5195	14.60	92.100	.000	WCE
Mus	Fraction of Muslims 1980, percent	77	17.364	32.15	99.400	.000	WCE
Cat	Fraction of Catholics 1980, percent	77	35.952	37.97	99.700	.100	WCE
Prot	Fraction of protestants 1980, percent	77	13.970	23.67	100.000	.000	WCE
Equip	Equipment share of investment, averaged for 1970–85	47	.053	.033	.177	.015	DLS
Nequip	Non-equipment share of investment, averaged for 1970–85	47	.148	.058	.285	.028	DLS
Mining	Fraction of GDP in mining, 1988, percent	78	.261	1.764	15.617	-.014	HJ
Fppte	Share of manufacturing exports in total exports 1970	72	.288	.295	1.040	.000	SW
Spacol	Dummy for former Spanish colonies; 1 for yes, 0 otherwise	78	.231	.424	1.000	.000	Mixed sources
Lifeexp	Life expectancy in years	78	60.746	10.552	75.498	37.112	WDI

Note: The numbers of observations refer to the regression used with the highest number of observations for any variable.

Note: LMI = A Database of Labor Market Indicators Across Countries, Rama and Artecona (1999); HJ = Data Appendix from Hall and Jones (1999) <http://emlab.berkeley.edu/users/chad/datasets.html> ; FH = Freedom House Country Ratings, Annual Survey of Freedom Country Scores <www.freedomhouse.org>; LR = Levine and Renelt (1992) <www.http://www.worldbank.org/research/growth/ddlevren.htm>; BL = Barro and Lee dataset <http://www.nber.org/pub/barro.lee>; WCE = World Christian Encyclopedia (Barrett, 1982); DLS = De Long and Summers (1991); SW = Sachs and Warner (1995); WDI = World Development Indicators CD-Rom (World Bank, 2001).

Note: The minimum value of Mining, -.014, is reported in the original source (Iceland), as is the maximum value of Fppte, 1.04 (Pakistan).

Table A4. The ten "worst" regressions for EFI₂, EFI₃ and EFI₄ when testing the sensitivity of the model specification

	EFI₂		EFI₃		EFI₄	
1	-.135	boq	-.188	abo	.368	aho
2	-.073	beq	-.183	bho	.345	ajo
3			-.183	bko	.345	abo
4			-.171	hio	.335	aco
5			-.170	bio	.333	hoq
6			-.162	ino	.332	ano
7			-.160	bjo	.331	aop
8			.155	iko	.322	aoq
9			-.153	fio	.311	boq
10			-.153	fho	.309	joq

Note: The first row gives the critical extreme bound for EFI₃ (the lowest bound for a 95 percent confidence interval) and EFI₄ (the highest bound for a 95 percent confidence interval). The second row gives the critical extreme bound in absence of the variable combination in the first row et cetera.
Note: a = Sub-Saharan Africa, b = Latin America, c = Absolute Latitude, d = Political Rights, h = Fraction Buddhist, i = Fraction Muslim, k = Fraction Catholic, n = Fraction Protestant, o = Fraction of Primary Products in Total Export, p = Former Spanish Colonies, q = Life Expectancy
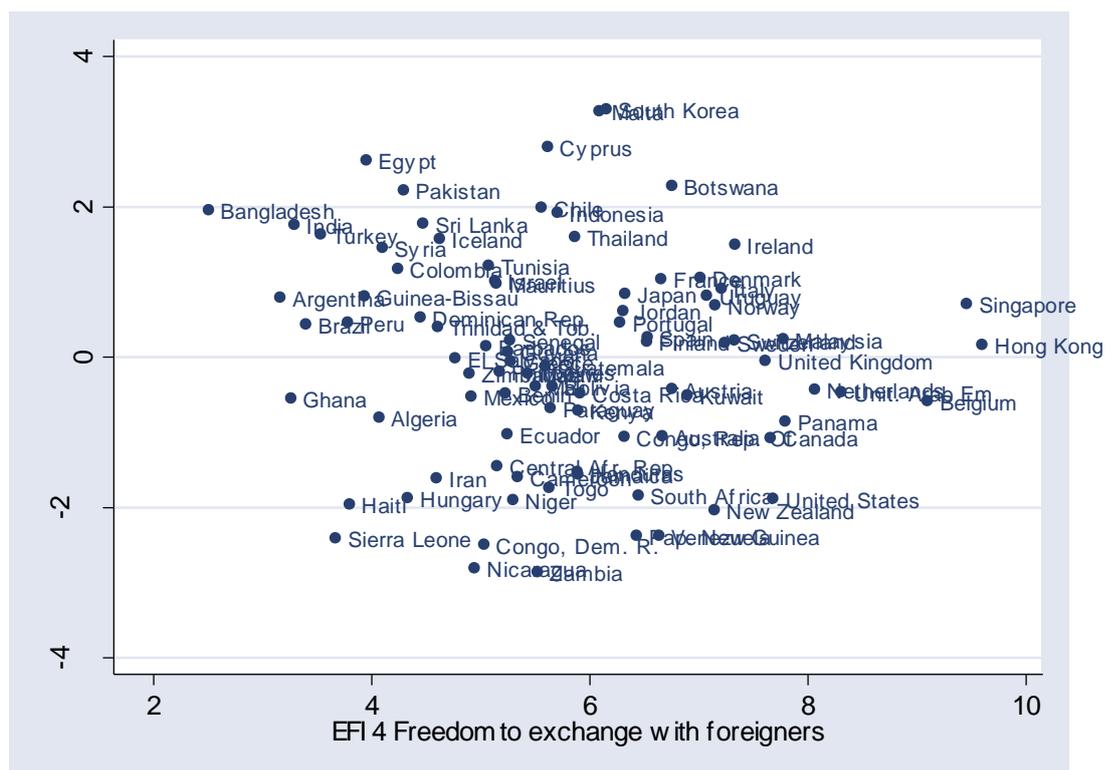*Note:* Equipment Investment and Non-Equipment Investment are not included in the regressions.

Figure A1. Values for EFI and ΔY for the countries included in the regressions presented in Table 4
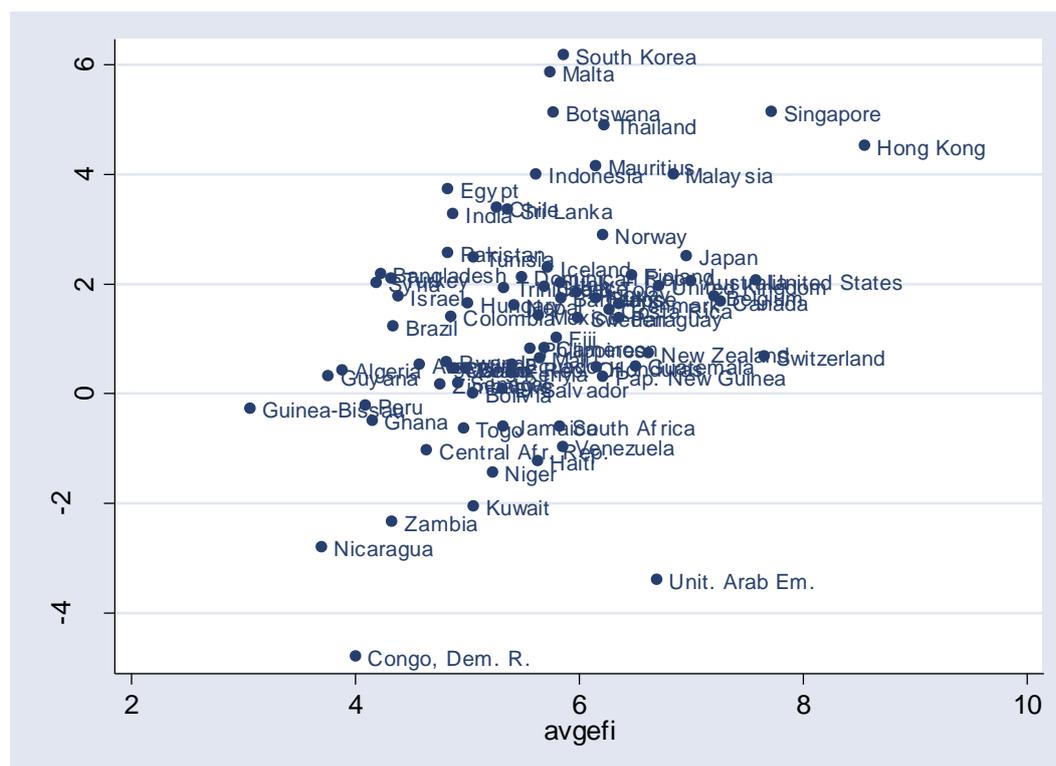
Sources: See Table 1.

Figure A2. Residuals from a regression with EFI$_{1-3,5}$ and Y75, INV and SCHOOL as regressors

Sources: See Table 1.

References

Ayal, E.B. and Karras, G. (1998). Components of economic freedom and growth: An empirical study. *Journal of Developing Areas* 32(3): 327–338.

Balasubramanyam, V.N., Salisu, M. and Spasford, D. (1996). Foreign direct investment and growth in EP and IS countries. *The Economic Journal* 106(434): 92–105

Baldwin, R.E. (2003). Openness and growth: What's the empirical relationship? NBER working paper no. 9578. Cambridge, MA: National Bureau of Economic Research.

Barrett, D.B. (Ed.) (1982). *World christian encyclopedia: A comparative study of churches and religions in the modern world AD 1900-2000*. Oxford: Oxford University Press.

Barro, R.J. and Sala-i-Martin, X. (1995). *Economic growth*. Boston: McGraw-Hill.

Barro, R.J. (1997). *Determinants of economic growth: A cross-country empirical study*. Cambridge, MA: The MIT Press.

Ben-David, D. and Loewy, M.B. (1998). Free trade, growth, and convergence. *Journal of Economic Growth* 3 (July): 143–170.

Berg, A. and Krueger, A.O. (2003). Trade, growth, and poverty – A selective survey. IMF working paper no. 03/30. Washington, DC: International Monetary Fund.

Berggren, N. (2003). The benefits of economic freedom: A survey. *The Independent Review* 8(2) forthcoming.

Bhagwati, J. (1994). Free trade: Old and new challenges. *Economic Journal* 104(423): 231–246.

Bhagwati, J. (1999). Economic freedom: Prosperity and social progress. Paper presented to the Conference on Economic Freedom and Development, Tokyo, June 17–18.

Bhagwati, J. (2001). Confronting "conventional" threats to free trade: The postwar revolution in the theory of commercial policy. Working Paper No. 119. Stockholm: The European Institute of Japanese Studies, Stockholm School of Economics.

Bhagwati, J. and Srinivasan, T.N. (2001). Outward orientation and development: Are revisionists right? In D. Lal and R.H. Snape (Eds.), *Trade, development, and political economy: Essays in honor of Anne O. Krueger*. New York: Palgrave.

Blonigen, B.A. (2001). In search of substitution between foreign production and exports. *Journal of International Economics* 53(1): 81–104.

Carlsson, F. and Lundström, S. (2002). Economic freedom and growth: Decomposing the effects. *Public Choice* 112(3-4): 335–344.

Clemens, M.A. and Williamson, J.G. (2002). Why did the tariff-growth correlation reverse after 1950? NBER working paper no. 9181. Cambridge, MA: National Bureau

of Economic Research.

Dawson, J.W. (2003). Causality in the freedom-growth relationship. *European Journal of Political Economy* forthcoming.

De Long, B. and Summers, L.H. (1991). Equipment investment and economic growth. *Quarterly Journal of Economics* 106(2): 445–502.

Dollar, D. (1992). Outward-oriented developing economies really grow more rapidly: Evidence from 95 LDCs, 1976-85. *Economic Development and Cultural Change* (April): 523–544.

Dollar, D. and Kraay, A.C. (2001). Trade, growth, and poverty. World Bank Policy Research Department Working Paper No. 2615. Washington, DC: World Bank.

Dollar, D. and Kraay, A.C. (2002). Institutions, trade, and growth. Mimeo. Washington, DC: World Bank.

Edwards, S. (1998). Openness, productivity and growth: what do we really know? *Economic Journal* 108 (March): 383–398.

Ferreira, P. C. and Rossi, J.L. (2001). New evidence on trade liberalization and productivity growth. Mimeo. Rio de Janeiro: Fundacao Getulio Vargas.

Frankel, J. A. and Romer, D. (1999). Does trade cause growth? *American Economic Review* 89(3): 379–399.

Gemmell, N. (1996). Evaluating the impacts of human capital stocks and accumulation on economic growth: Some new evidence. *Oxford Bulletin of Economics and Statistics* 58(1): 9–28.

Goldberg, L.S. and Klein, M.W. (1999). International trade and factor mobility: An empirical investigation. NBER Working Paper No. 7196. Cambridge, MA: National Bureau of Ecconomic Research.

Greenaway, D., Morgan, W.W. and Wright, P.W. (2002). Trade liberalisation and growth in developing countries. *Journal of Development Economics* 67(1): 229–244.

Grossman, G. and Helpman, E. (1991). *Innovation and growth in the global economy.* Cambridge, MA: The MIT Press.

Gwartney, J.G. and Lawson, R.A. (2000). *Economic freedom of the world: 2000 annual report.* Vancouver: The Fraser Institute.

Gwartney, J.G. and Lawson, R.A. (2002). *Economic freedom of the world: 2002 annual report.* Vancouver: The Fraser Institute.

Haan, J. de and Sturm, J.-E. (2000). On the relationship between economic freedom and economic growth. *European Journal of Political Economy* 16(2): 215–241.

Haan, J. de and Sturm, J.-E. (2001). How robust is the relationship between economic freedom and economic growth? *Applied Economics* 33(7): 839–844.

Hall, R.E. and Jones, C.I. (1999). Why do some countries produce so much more output per

worker than others? *Quarterly Journal of Economics* 114(1): 83–116.

Harrison, A. (1996). Openness and growth: A time-series, cross-country analysis for developing countries. *Journal of Development Economics* 48(2): 419–447.

Helpman, E., Melitz, M.J. and Yeaple, S.R. (2003). Export versus fdi. NBER Working Paper No. 9439. Cambridge, MA: National Bureau of Economic Research.

Irwin, D.A. and Terviö, M. (2002). Does trade raise income? Evidence from the twentieth century. *Journal of International Economics* 58(1): 1–18.

Irwin, D.A. (2002a). *Free trade under fire*. Princeton: Princeton University Press.

Irwin, D.A. (2002b). Interpreting the tariff-growth correlation of the late 19th century. *American Economic Review* 92(2): 165–169.

Jones, C. (1995). Times series tests of endogenous growth models, *Quarterly Journal of Economics* 110(2): 495–525.

Keller, W. and Yeaple, S.R. (2003). Multinational enterprises, international trade, and productivity growth: Firm level evidence from the United States. NBER Working Paper No. 9504. Cambridge, MA: National Bureau of Economic Research.

Krugman, P. (1987). Is free trade passe? *Journal of Economic Perspectives* 1(2): 131–144.

Levine, R. and Renelt, D. (1992). A sensitivity analysis of cross-country growth regressions. *American Economic Review* 82(4): 942–963.

Lindert, P.H. and Williamson, J.G. (2001). Does globalization make the world more unequal? NBER Working Paper No. 8228. Cambridge, MA: National Bureau of Economic Research.

Lundström, S. (2003). *On institutions, economic growth and the environment*. Doctoral dissertation. Gothenburg: University of Gothenburg.

O'Driscoll, G.P., Holmes, K.R. and Kirkpatrick, M. (Eds.) (2002). *2002 index of economic freedom*. New York: Dow Jones and Co.

O'Rourke, K.H. (2000). Tariffs and growth in the late 19th century. *Economic Journal* 110 (April): 456–483.

Pritchett, L. (1996). Where has all the education gone? World Bank Working paper No. 1581. Washington, DC: The World Bank.

Rama, M. and Artecona, R. (1999). A database of labor market indicators across countries. Development Research Group. Washington, D.C.: World Bank.

Rodriguez, F. and Rodrik, D. (2000). Trade policy and economic growth: A skeptic's guide to the cross-national evidence. In B. Bernanke and K. Rogoff (Eds.), *NBER Macro Annual 2000*. Cambridge, MA: National Bureau of Economic Research.

Rodrik, D. (1998). Trade policy and economic performance in sub-Saharan Africa. NBER Working Paper No. w6562. Cambridge, MA: National Bureau of Economic

Research.

Rodrik, D., Subramanian, A. and Trebbi, F. (2002). Institutions rule: The primacy of institutions over geography and integration in economic development. NBER Working Paper No. w9305. Cambridge, MA: National Bureau of Economic Research.

Romer, P. (1990). Endogenous technological change. *Journal of Political Economy* 98(5): S71–S102.

Sachs, J.D. and Warner, A. (1995). Economic reform and the process of global integration. *Brookings Papers on Economic Activity* 1: 1–118.

Sala-i-Martin, X.X. (1997). I just ran two million regressions. *American Economic Review* 87(2): 178–183.

Srinivasan, T.N. (1999a). Trade orientation, trade liberalization, and economic growth. In G. Saxonhouse and T.N. Srinivasan (Eds.), *Development, duality, and the international economic regime: Essays in honor of Gustav Ranis.* Ann Arbor: The University of Michigan Press.

Srinivasan, T.N. (1999b). As the century turns: Analytics, empirics and politics of development. In G. Ranis, S.-C. Hu and Y.-P. Chu (Eds.), *The political economy of comparative development into the 21st century: Essays in memory of John C.H. Fei*, volume 1. Cheltenham: Edward Elgar.

Sturm, J.-E. and Haan, J. de (2002a). How to deal with outlying observations and model uncertainty in cross-country growth regressions? Unpublished manuscript. Department of Economics, University of Groningen.

Sturm, J.-E. and Haan, J. de (2002b). How robust is Sala-i-Martin's robustness analysis? Unpublished manuscript. Department of Economics, University of Groningen.

Temple, J. (1999). The new growth evidence. *Journal of Economic Literature* 37 (March): 112–156.

Temple, J. (2000). Growth regressions and what the textbooks don't tell you. *Bulletin of Economic Research* 52(3): 181–205.

Tybout, J.R. (2003). Plant- and firm-level evidence on "new" trade theories. In W.M. Aldrich, J. Harrigan and E.K. Choi (Eds.), *Handbook of International Trade*. Oxford: Blackwell.

Vamvakidis, A. (2002). How robust is the growth-openness connection? Historical evidence. *Journal of Economic Growth* 7(1): 57–80.

World Bank (2001). *World Development Indicators CD-Rom*. Washington, DC: World Bank.