On Globalization and the Growth of Governments*

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November 2005

Abstract

This paper investigates the relationship between trade openness and the size of government, both theoretically and empirically. We show that openness can increase the size of governments through two channels: (1) a terms of trade externality, whereby trade lowers the domestic cost of taxation and (2) the demand for insurance, whereby trade raises risk and public transfers. We provide a unified framework for studying and testing these two mechanisms. First, we show how their relative strength depends on a key parameter, the elasticity of substitution between domestic and foreign goods. Second, while the terms of trade externality leads to inefficiently large governments, the increase in public spending due to the demand for insurance is optimal. We show that large volumes of trade may result in welfare losses if the terms of trade externality is strong enough while small volumes of trade are always beneficial. Third, we provide new evidence on the positive association between openness and the size of government and test whether it is consistent with the terms of trade externality or the demand for insurance. Our findings suggest that the positive relationship is remarkably robust and that the terms of trade externality may be the driving force behind it, thus raising warnings that globalization may have led to inefficiently large governments.

JEL Classification: F1, H1

Keywords: Openness; Government Size; Terms of Trade Externality; Elasticity of Substitution between Imports and Exports.

*We are very grateful to Jaume Ventura for many insightful discussions. We also thank Daron Acemoglu, Alessandra Bonfiglioli, Giovanni Bruno, Carlo Devillanova, Jordi Gali', Fabrizio Onida, Rick van der Ploeg, Michele Ruta and seminar participants at CREI, UPF, EUI, CESPRI, Bocconi University and the IADB conference in Kiel for comments. All errors are our own. Gino Gancia thanks the Spanish Ministerio de Ciencia y Tecnologia (grant SEC2002-03816), and the RTN grant "Macroeconomic Policy Design for Monetary Unions" for financial support.

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1 Introduction

The link between globalization and the size of governments is a major issue, yet not a fully understood one. According to some authors, integration of markets should reduce the effectiveness of domestic policies and put competitive pressure to reduce government activism. Since a large public sector may cause a loss of international competitiveness (e.g., Alesina and Perotti, 1997), it may lower the demand for exports and employment, and favor the outflow of mobile factors (e.g., Gordon, 1983, Wilson, 1987, Persson and Tabellini, 1992). This suggests that more economic integration will tend to reduce tax rates, leading to smaller governments and perhaps a downsizing of the welfare state. Yet, the empirical evidence shows that openness to trade is associated with larger governments. This pattern was first unveiled by Cameron (1978) for 18 OECD countries and extended to a much broader sample in a seminal paper by Rodirk (1998).[1] The positive association is not limited to the cross section. On average, international trade and public sectors have grown together and a majority of countries that opened their markets have experienced significant increases in public expenditure.

This stylized fact is often viewed as puzzling. The main explanation put forward in the literature is due to Rodrik (1997, 1998), who argues that public spending may provide insurance in economies subject to the risk originating from international markets. If exposure to risk grows with trade openness, so does the demand for public insurance.[2] In this view, the growth of governments in the era of globalization should be welcome as the optimal response to the intrinsic riskiness of open markets.

In this paper, we suggest an alternative and less optimistic view. Building on insights from models of non-cooperative fiscal policy in open economies, we argue that trading countries tend to have larger governments because they benefit from a terms of trade externality that reduces the domestic cost of taxation. Since governments behaving non-cooperatively do not internalize the cost of taxation that trade shifts abroad in the form of higher export prices, they react to market integration by increasing public spending.[3]

[1] Other studies investigating the correlation between openness and government size include the UN-World Public Sector Report (2001), Garrett (2001), Islam (2004) and Garen and Trask (2005). Some authors are skeptical about the robustness of this empirical regularity. Notably, Alesina and Wacziarg (1998) argue that it may be spuriously driven by country size, because small countries tend to have large public sectors and be very open. While their point is certainly valid, our empirical results in Section 3 suggest that the correlation between government size and openness is robust to the inclusion of country size.

[2] There are different channels through which globalization may increase risk. Rodrik (1997) emphasizes that globalization may raise the elasticity of demand for labor, thereby exacerbating the effect on wages of domestic productivity shocks. Rodrik (1998) argues instead that open countries are more exposed to the terms of trade variability induced by external shocks.

[3] See Persson and Tabellini (1995) for a survey of the literature on fiscal policy in open economies. In particular, van der Ploeg (1987), Turnovsky (1988), Devereux (1991), Andersen et al. (1996) have

To explore these two explanations, we build a stylized model in which both forces are at work. In particular, we study a world economy where benevolent governments set labor taxes unilaterally to finance country-specific public goods and provide insurance against idiosyncratic shocks through transfers. We then show how the size of governments depends on the degree of trade openness and key parameters.

First, in a world of open countries, an expansion of the public sector crowds out exports and leads to a terms of trade improvement that spreads the cost of taxation beyond national borders.[4] This happens irrespective of countries being large or small, provided that they produce goods that are not perfect substitutes.[5] In particular, the domestic cost of taxation is lower the higher the trade share in a country and the lower the elasticity of substitution between import and exports, as low substitutability implies strong terms of trade movements. The equilibrium size of the public sector is thus higher in open countries producing differentiated goods. From the world perspective, when all governments raise taxation in response to more trade openness, the result is overprovision of public goods and no change in the terms of trade for any country, as policies offset each other. Taking this effect into account, we show that the net impact of trade on world welfare may become negative, as the gains from trade may fail to compensate the inefficiency arising from uncoordinated policies. In particular, we show that while low volumes of trade are always beneficial, market integration might become welfare-reducing beyond a critical level.

Second, in a world with uncertainty arising from idiosyncratic productivity shocks, the government can use transfers to act as a provider of insurance. In the spirit of Newbery and Stiglitz (1984) and Rodrik (1997), we show that the demand for public insurance and the equilibrium size of transfers may rise with trade openness. The reason is that in a closed economy changes in relative prices across sectors provide insurance against productivity shocks, as prices rise when output falls. International competition with producers of close

shown that public expenditure shifting demand in favor of domestic goods may bring about a terms of trade improvement leading to overspending. More recently, Corsetti and Pesenti (2001) and Galí and Monacelli (2005) have built important models of international transmission of monetary and fiscal policies in the presence of such terms of trade effects. Yet, all these papers are focused on issues other than the relationship between the size of government and the volume of trade. Most surprisingly, terms of trade externalities have never been used to explain the empirical association between openness and the size of government, nor have been compared to other possible explanations. The purpose of this paper is precisely to fill this gap.

[4] Another way to interpret this result is to say that government spending on non-traded public goods shifts demand in favor of domestic products and thus raises wages relative to the rest of the world.

[5] That countries produce differentiated goods seems a reasonable assumption. For example, even a small developing country like Madagascar, exporter of vanilla (a commodity), does not have to take the price of its export as given, since Malagasy vanilla is generally considered of higher quality than that produced in other countries. Moreover, in the final section of the paper we show that the assumption that countries do not produce homogeneous goods finds substantial empirical support.

substitutes poses instead a limit to price variability thereby reducing the stabilizing role of prices and increasing the expenditure for transfers. Thus, more openness exposes an economy to higher income risk the larger the elasticity of substitution between imports and exports. Comparing this result with the previous, we learn that terms of trade movements, and thus the elasticity of substitution between domestic and foreign products, have contrasting effects on the link between globalization and the size of government: while they introduce an externality that leads to excessive taxation, they also tend to stabilize income in international markets, thus lowering the demand for public insurance in sectors exposed to foreign competition.

In the second part of the paper we turn to the empirical analysis. We start by showing new evidence on the positive association between openness and government size. Using a large dataset comprising 150 countries observed over half a century (1950-2000) we show that this empirical regularity is remarkably robust to the estimation procedure and the inclusion of controls. Our panel dataset allows us to move beyond the cross-sectional analysis most of previous work relied upon and document new facts: not only that the correlation between openness and government holds over time, but that it has grown stronger in recent decades. Then, we start exploring its determinants. As a preliminary step, we show that there is no evidence of a positive association between openness and government transfers for social security and welfare, casting doubts that globalization has raised significantly the demand for public transfers. Likewise, we find that exposure to external shocks in the form of terms of trade volatility seems unable to explain the variation in government size.

Next, we look for evidence in support of the explanation based on terms of trade externalities. First, we show that the level of economic activity of a country affects its terms of trade: following Acemoglu and Ventura (2002), we find that countries growing faster than average experience a deterioration of their terms of trade, suggesting that the elasticity of substitution between import and export is not too high. We also show that, consistent with our mechanism, government expenditure lowers private production, which in turn leads to a terms of trade improvement, and that public expenditure has no other direct effect on the terms of trade. Finally, we perform two tests suggesting that the relationship between openness and government size is indeed contingent on the elasticity of substitution between import and export being low. First, we show that this elasticity has fallen over time at the same time as the relationship between openness and government size has grown stronger. Second and more important, we find that the sub-sample of countries characterized by a relatively stronger association between openness and government size is also characterized by a much lower elasticity of substitution between domestic and

foreign goods. Thus, the evidence seems in favor of the view based on the terms of trade externality.

The paper is organized as follows. Section 2 builds a simple model linking imperfect trade integration to the size of government and derives the main results. Section 3 presents empirical evidence on the relationship between openness and government size and on the specific explanations proposed in the paper. Section 4 concludes.

2 A Simple Model of Trade and Governments

We construct a simple static model of a world economy with a large number N of identical countries and a continuum $[0,1]$ of industries. Each industry produces differentiated goods and countries are specialized in different varieties. Consumers enjoy utility from the consumption of differentiated goods and a country-specific public good. Governments of each country have two functions: to produce public goods (e.g., education, defense, civil infrastructures) financed through taxation and to provide public insurance against idiosyncratic shocks (e.g., social security and welfare) through transfers. Governments choose taxation and transfers unilaterally so as to maximize utility of domestic citizens. Trade takes place because consumers like variety. However, we consider a situation of imperfect trade integration where trade may not be allowed in all industries. We then use the model to explore how the degree of trade openness can affect the expenditure on public goods and transfers.

2.1 The World Economy

Consumers in all countries are risk-averse and share the same preferences represented by the following expected utility function:

$$EU = E\frac{C^{1-\rho}}{1-\rho}, \quad \rho > 0 \tag{1}$$

where ρ is the coefficient of relative risk-aversion and

$$C = \left[\exp \int_0^1 \log Y_j dj\right]^{\eta} G^{1-\eta}, \ \eta \in (0,1)\,, \tag{2}$$

where Y_j is the subutility derived from consumption of differentiated goods produced in sector $j \in [0,1]$ and G is the consumption of a country-specific public good. The parameter η captures consumer preferences for private versus public goods.

The world we describe contains a large number of small countries, indexed by $i \in$

$\{1, ..., N\}$, each specialized in the production of a single variety i in every sector j.[6] Full specialization follows from the Armington assumption that goods are differentiated by the country of origin.[7] Preferences for differentiated goods in each sector j are represented by a CES subutility function:

$$Y_j = N^{\nu+1} \left(\frac{1}{N} \sum_{i \in N} y_{j,i}^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}}, \ \sigma > 1, \ \nu \geq 0, \tag{3}$$

where $y_{j,i}$ is the variety produced by country i in sector j and $\sigma > 1$ is the elasticity of substitution between varieties produced in different countries.[8] Equation (3) is a generalization, introduced by Benassy (1998), of the well known Dixit-Stiglitz preferences. Its special property is that the term $N^{\nu-1/(\sigma-1)}$ allows us to disentangle the elasticity of substitution between product varieties from the preference for variety. From (3), greater variety is associated with higher utility whenever $\nu > 0$. To see this, suppose $y_{i,j} = y$ and that all countries are identical. Then, the sub-utility derived in the typical country from consumption in sector j will be $N^{\nu} y$, which is increasing in N if $\nu > 0$. The standard Dixit-Stiglitz preferences are a special case of (3) for $\nu = (\sigma - 1)^{-1}$. We follow the more general formulation because distinguishing between the elasticity of substitution and the preference for variety will be important for welfare analysis.

We model imperfect economic integration between countries by assuming that in some sectors goods can be freely traded in international markets, while in others trade costs are prohibitive. Accordingly, the unit measure of sectors is partitioned into two subsets of traded and nontraded industries. Sectors are ordered such that those with an index $j \leq \tau \in [0, 1]$ are subject to negligible trade costs and the others, with an index $j > \tau$, face prohibitive trade costs. We refer to "globalization" as an increase in the measure τ of traded goods, i.e., the fall in trade costs (from prohibitive to zero) in some sectors. Although this is a stylized description of reality, it accords well with the observation that there are areas of economic activity where the degree of market integration is low.[9] An important advantage of this approach to imperfect international integration is that it offers

[6] The assumption that countries are small makes the game played by governments non-strategic, in the sense that governments do not react to any change of policy in any (small) foreign countries. This assumption is for convenience and is not essential for the results.

[7] For example, Italian wine is different from French or Spanish wine. The same can be said of many other goods. The fact that specialization is here assumed is just a simplification as it would be possible to derive it as the equilibrium outcome of more general models.

[8] The assumption $\sigma > 1$ rules out immiserizing growth. For the main results, a milder restriction is sufficient.

[9] There is also growing evidence that trade between countries has increased more along the extensive margin (more goods are traded today than in the past) than along the intensive margin (higher volumes of trade in the same goods). As shown, for instance, by Broda and Weinstein (2004), the number of product varieties imported by the US over the last three decades has increased by a factor of four.

a very simple measure of trade openness with an empirical counterpart. In particular, note that given symmetry and a unit elasticity of substitution in (2), expenditure is divided evenly across sectors. Together with the assumption that each country is small and thus exports its entire domestic production of the traded goods, this implies that τ is the share of imports (or exports, given balanced trade) in private spending.

In any traded sector ($j \leq \tau$), maximization of (3) subject to a budget constraint yields CES demand functions with a price-elasticity of σ:

$$\frac{p_{j,i}}{Q_j} = N^{\nu-(\nu+1)/\sigma} \left(\frac{Y_j}{y_{j,i}} \right)^{1/\sigma}, \tag{4}$$

where

$$Q_j \equiv N^{-\nu} \left(\frac{1}{N} \sum_{i \in N} p_{j,i}^{1-\sigma} \right)^{\frac{1}{1-\sigma}} \tag{5}$$

can be interpreted as the ideal price index in sector j, i.e., the minimum cost of one unit of Y_j. Given that each country exports all its production and imports all its consumption of traded goods,[10] equation (4) gives the terms of trade of country i in sector j: the price of export relative to the price of the imported basket. Note that a fall (rise) of domestic production improves (worsens) the country's terms of trade. This happens despite each country being small, because countries are specialized in the production of goods that are imperfect substitutes. In any nontraded sectors ($j > \tau$), instead, each country i only consumes its own domestic output, $y_{j,i}$.

2.2 Country Equilibrium

Consider now a single country. For simplicity, we focus on a symmetric case in which all countries share the same parameters. We remove the index i with the understanding that, unless otherwise stated, all variables now refer to a single country. Labor is the only factor of production and is employed by competitive firms to produce both private and public goods. Labor productivity in any sector j is assumed to be the realization of a random variable π that takes value $\overline{\pi} = 1 + \epsilon$ (with $0 \leq \epsilon < 1$) in good states and $\underline{\pi} = 1 - \epsilon$ in bad states. Good and bad states are equally likely and each industry j in each country i is subject to independent realizations of π. That is, shocks are uncorrelated across sectors and countries.[11] Moreover, we assume that workers must choose the sector of employment

[10] This is true as N goes to infinity. It is taken as an approximation when the number of countries is large.

[11] We assume that the number of countries N is large enough so that the law of large numbers applies. This means that there is no aggregate uncertainty.

before the realization of the productivity shock and cannot move everafter. We take this as a fair representation of a short-run equilibrium in which labor mobility is not perfect. If the economy repeats itself and shocks are uncorrelated over time, this equilibrium will also prevail in the long-run, provided that frictions to labor mobility prevent workers from exploiting short-run gains from positive temporary shocks. Given that markets are competitive, workers are paid the value of their marginal product:

$$w_j = p_j \pi_j. \tag{6}$$

Under complete markets, workers would be able to fully insure the idiosyncratic productivity shock. Although in the following we rule out private insurance markets, or else there would be no role for public insurance, we allow the government to stabilize income by way of transfers. Since workers are risk-averse, providing full insurance is the optimal strategy for a benevolent government who seeks to maximize utility of its citizens. Thus, we assume that government transfers are such that all workers in sector j have an ex-post income equal to the expected wage in the sector, $E(w_j)$. Anticipating this, workers allocate themselves across sectors so as to maximize the expected wage, as if they where risk-neutral. Given that sectors are ex-ante identical and that expenditure is equally allocated between them, workers spread evenly across sectors and all have the same ex-post income w.

In the public sector, we assume that one unit of labor can be employed to produce one unit of the public good, G. The public sector is not subject to uncertainty, because it is intended as a large set of activities over which idiosyncratic shocks are averaged out.[12] To finance public production, the government sets a tax g on labor income, so that the total tax revenue is gwL, where L is the country labor force and w the average wage rate.[13] Without uncertainty, the public sector has to pay the average wage and thus provision of the public good can be found as:

$$G = gL, \tag{7}$$

which is also employment in the public sector. Given that gwL is total spending on public goods while wL is the country's GDP, g is also the share of government production in GDP.

[12] See also Galí (1994) and Fátas and Mihov (2001) on this point. They find evidence of a robust negative correlation between various measures of government size and per capita GDP volatility in OECD countries.

[13] This form of taxation is not crucial for the results, because the key assumption is not on how the government raises tax revenues, but rather on how these are spent. When taxes are spent on domestically produced public goods, an increase in taxation shifts resources towards domestic goods and thus raises wages. Of course, having more complex tax instruments would certainly affect the equilibrium, but the above intuition would in general hold.

Imposing labor market clearing, $\int_0^1 L_j dj + gL = L$, and recalling that L_j is constant across sectors, we can solve for employment and production in any sector $j \in [0,1]$:

$$L_j = (1-g)\,L. \tag{8}$$

$$y_j = \pi_j\,(1-g)\,L \tag{9}$$

To study the decision problem faced by the government, we first need to solve for the utility of the representative agent at a given level of taxation. As a preliminary step, it will prove useful to define consumption of any single nontraded good and traded basket in a world without uncertainty (i.e., for $\epsilon = 0$). In this case, country consumption of nontraded goods is equalized across industries and given by:

$$Y_n \equiv (1-g)\,L. \tag{10}$$

Note that an increase in government production g lowers Y_n one to one because it shifts labor out of the private sector. Consumption of any traded basket Y_j can instead be found dividing the expenditure allocated to a sector, $wL\,(1-g)$, by the ideal price index:

$$Y_\tau \equiv \frac{pL\,(1-g)}{Q} = \left[(1-g)\,L\right]^{\frac{\sigma-1}{\sigma}} N^{\nu-(\nu+1)/\sigma}\,(Y_w)^{\frac{1}{\sigma}}, \tag{11}$$

where we have used (6), (9), (4) and Y_w is world consumption of any traded basket when $\epsilon = 0$. Equation (11) shows that an increase in government production g does not reduce traded consumption, Y_τ, one to one as long as it brings about a terms of trade improvement: by means of (4), the fall in domestic production $L\,(1-g)$ is partially compensated by a rise in p/Q so that income falls less than proportionally in traded sectors.

Finally, aggregating over industries and following the conventional assumption that the public good is non-rival, the utility function (2) of the representative agent in the presence of uncertainty reduces to:

$$C = \left[\frac{(\Omega_n Y_n)^{1-\tau}\,(\Omega_\tau Y_\tau)^{\tau}}{L}\right]^{\eta} G^{1-\eta}, \tag{12}$$

where the terms $\Omega_n \equiv \left(1-\epsilon^2\right)^{1/2} \leq 1$ and $\Omega_\tau \equiv \left[\frac{1}{2}\,(1+\epsilon)^{\frac{\sigma-1}{\sigma}} + \frac{1}{2}\,(1-\epsilon)^{\frac{\sigma-1}{\sigma}}\right]^{\frac{\sigma}{\sigma-1}} \leq 1$ quantify the utility cost of fluctuations in consumption across sectors due to productivity shocks and are inverse measures of consumption risk, for a given income.[14] Note that

[14] To find (12), note that consumption of a nontraded good is $\pi_j L_j$ while consumption of a traded basket

$\Omega_n = \Omega_\tau = 1$ in case of no uncertainty (i.e., for $\epsilon = 0$), while both Ω_n and Ω_τ are decreasing in ϵ. That is, utility falls with the variance of shock (ϵ^2) because consumers would like to smooth consumption across sectors. Moreover, $\Omega_n \leq \Omega_\tau$ because in traded industries the fall in consumption of varieties hit by negative shocks is partially compensated by the rise in consumption of varieties subject to positive shocks, the more so the higher is the degree of substitutability across varieties: as $\sigma \to \infty$ compensation is full and $\Omega_\tau = 1$.

2.3 Openness and Public Goods

Government spending on public goods (g) is chosen in each country so as to maximize the utility of its representative citizen, taking world prices, Q, and production, Y_w, as given. Substituting (7), (10) and (11) into (12), and noting that U (1) is an increasing function of C (12), the objective function of the government becomes:

$$\underset{g}{Max}\ C = \left[\Omega_n (1-g)\right]^{(1-\tau)\eta} \left[\Omega_\tau (1-g)^{\frac{\sigma-1}{\sigma}} N^{\nu-(\nu+1)/\sigma} \left(\frac{Y_w}{L}\right)^{\frac{1}{\sigma}}\right]^{\tau\eta} (gL)^{1-\eta}, \qquad (13)$$

which leads to the first order condition:[15]

$$\frac{\eta}{1-g}\left(1-\frac{\tau}{\sigma}\right) = \frac{1-\eta}{g}. \qquad (14)$$

The left hand side of (14) is the marginal cost of taxation. It can be interpreted as the product of the marginal utility of private consumption multiplied by the fall in private consumption due to an increase in taxation. The volume of trade, τ, lowers the cost of taxation because, as just seen, income in traded sectors falls less than proportionally with g. The right hand side is instead the marginal value of public production, which is proportional to the preference for the public good, $1-\eta$, and declines with g because of decreasing marginal utility. Solving (14) yields:

$$g = \frac{1-\eta}{1-\eta\tau/\sigma}. \qquad (15)$$

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is $\left(\int_0^\tau w_z L_z dz\right) / (\tau Q_j)$, where $w_z = Q_z (\pi_z)^{\frac{\sigma-1}{\sigma}} N^{\nu-\frac{\nu+1}{\sigma}} (Y_z/L_z)^{\frac{1}{\sigma}}$. Noting that $Q_z = Q_j$, $\forall z, j \in [0,\tau]$ and $Y_z = \Omega_\tau Y_w$, $\forall z \in [0,\tau]$, and substituting into (2) yields (12), once definitions (10) and (11) are used.

[15] $\sigma > \tau$ guarantees that the second order condition is satisfied.

Not surprisingly, it is easy to see that g is higher the stronger the preference for the public good, $(1-\eta)$.[16] More interestingly:

$$\frac{\partial g}{\partial \tau} = \frac{(1-\eta)\,\eta/\sigma}{(1-\eta\tau/\sigma)^2} > 0, \tag{16}$$

so long as σ is finite. Thus, the size of the public sector grows with openness. By now, the intuition for this result should be clear and can be summarized saying that trade lowers the domestic cost of taxation because of a terms of trade improvement. Clearly, this depends on the possibility for a country to affect its terms of trade, as can be seen from the sign of the cross derivative:

$$\frac{\partial^2 g}{\partial \tau \partial \sigma} < 0.$$

Thus, the effect of trade on the public sector is stronger the lower the elasticity of substitution between goods, because a lower elasticity of substitution implies that prices (the terms of trade) react more. From (16) it is easy to see that the relationship is convex: it becomes stronger the higher is trade openness, as shown in Figure 1, where (16) is plotted against τ for high (dotted line) and low (solid line) σ.[17] Moreover, (15) implies that g increases when σ falls as long as there is some trade, $\tau > 0$. That is, more product differentiation increases the size of the public sector in open economy. Per capita government spending is instead independent of country size, L. This is a special implication of Cobb-Douglas preferences and is due to the exact cancellation of two opposite effects: on the one hand, a larger population lowers the per-capita cost of the public good, on the other it raises the optimal level of provision.[18]

Finally, note that our result is reminiscent of the optimal tariff argument, whereby a small import tariff or export tax can be welfare enhancing when they bring about a terms of trade improvement. Indeed, our model builds on the same assumption that domestic policies can affect the terms of trade and suggests that even the most basic form of taxation is likely to have such terms of trade effects. However, our result is more general than the optimal tariff argument. In fact, while trade policy is by now restricted in most countries by international trade agreements, income taxes are still viewed as an issue of national

[16] This is guaranteed as long as $\sigma > \tau$, also implying $g < 1$.

[17] The parameters used to draw Figure 1 are the following: $\eta = 0.8$, $\sigma = 1.5$ (solid line), $\sigma = 3$ (dotted line). Although the model is too simple to be used for quantitative analysis, this choice of parameters is consistent with the empirical evidence presented in Section 3. Remarkably, the reaction of public spending to a change in openness implied by the model and displayed in the figure is compatible with estimates reported in the empirical section.

[18] See Alesina and Wacziarg (1998) for more details on the relationship between population and the size of government.

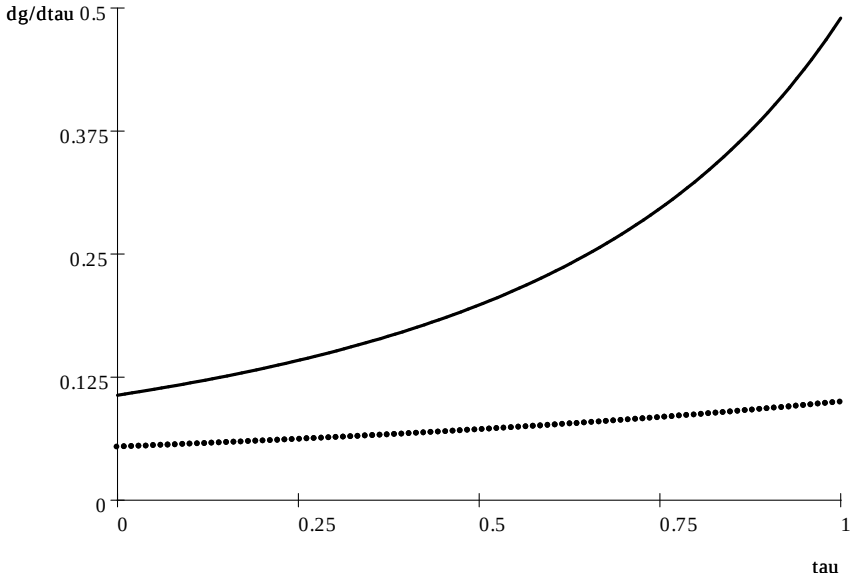

Figure 1: Openness and the Size of the Public Sector

sovereignty. More important, our result is independent from the optimal tariff argument: as shown in the Appendix, equation (15) holds unaffected even when an optimal tariff is already in place.

2.4 Openness and Public Insurance

We now consider the other component of the size of government, the amount of redistribution through transfers required to insurance workers from idiosyncratic productivity shocks, and study how it varies with openness. Given that labor is not mobile, workers in different sectors may receive different wages, depending on the realization of the productivity shock π_j. Having ruled out private insurance markets and given risk-aversion, it is easy to show that the government maximizes social welfare by perfectly smoothing the income process of each worker through transfers.

In this setting, openness affects aggregate demand for insurance because risk is borne by workers in traded and nontraded sectors in a very different way. To see this, note that price movements tend to offset fluctuations in productivity: prices rise whenever output falls and thus low productivity in bad times is partially compensated. Given our assumptions, compensation is full in nontraded sectors because demand for nontraded goods has a unitary price elasticity so that no transfer is needed to stabilize income. This can be seen by computing the equilibrium wage offered in a nontraded sector after the

realization of the productivity shock:

$$w_j = \frac{w(1-g)L}{L_j} = w, \quad j > \tau$$

where w is the average wage and $w(1-g)L$ is after-tax income allocated to the consumption of good j. The latter equality follows from (8). As the model has no aggregate uncertainty, $VAR(w_{j>\tau}) = 0$ in nontraded industries.

This is not the case in the traded sectors where there is foreign competition. While the share of world income allocated to a given traded sector is constant due to Cobb-Douglas preferences, its distribution across countries depends on productivity because the elasticity of substitution vis-a-vis foreign varieties, σ, is higher than one, so that the relative price of domestic varieties does not react enough to provide full insurance. Using (9) and (4), equilibrium wage in a traded sector, $w_j = p_j y_j / L_j$, and its variance can be found as:

$$\begin{aligned} w_j &= Q_j \left(\pi_j\right)^{\frac{\sigma-1}{\sigma}} N^{\nu-\frac{\nu+1}{\sigma}} \left(\frac{Y_j}{L_j}\right)^{\frac{1}{\sigma}}, \quad j \leq \tau \qquad (17) \\ VAR(w_{j\leq\tau}) &= \left(1-\frac{1}{\sigma}\right)^2 VAR\left(\pi\right), \end{aligned}$$

where we have used the fact that, by the law of large numbers, $VAR\left(Y_j\right) = VAR\left(Q_j\right) = 0$. Income in traded sectors fluctuates more with productivity the higher is σ, as foreign competition with producers of close substitutes removes the stabilizing role of prices. Thus, our simple framework well-captures the argument that trade, by exposing sectors to foreign competition, makes the derived demand for labor more elastic, implying that shocks to productivity result in much greater earnings volatility.[19]

To study the effect of trade on the size of government through the demand for public insurance, we define public spending on insurance as the total transfer T needed to stabilize wages as a share of GDP. This can be computed as the expected transfer per sector producing traded goods, integrated over the measure of traded sectors and divided by the value of total production:

$$\frac{T}{GDP} = \frac{(1-g)}{2} \int_0^\tau \frac{|w_j - w|}{w} dj. \qquad (18)$$

[19] See Rodrik (1997), Chapter 2, for a more extensive discussion of this argument and some empirical evidence. A similar point is made in Newbery and Stiglitz (1984). Also, di Giovanni et al. (2005) shows evidence that trade openness increases sectoral volatility.

Using (17) and $\int_{\tau}^{1} w_j dj = \frac{\tau}{1-\tau} \int_{0}^{\tau} w_j dj$ yields:

$$\frac{T}{GDP} = \frac{(1-g)\,\tau}{2} \cdot \frac{\left(\overline{\pi}/\underline{\pi}\right)^{\frac{\sigma-1}{\sigma}} - 1}{\left(\overline{\pi}/\underline{\pi}\right)^{\frac{\sigma-1}{\sigma}} + 1}. \tag{19}$$

It is easy to see that, holding constant spending on public goods g, the total transfer increases with trade openness τ, the more so the higher are σ and the variance of productivity. As $\sigma \to 1$ the need for insurance disappears. Thus, the lower the elasticity of substitution between import and export, the lower the need for a risk-mitigating role of the public sector in open countries.[20]

2.5 Welfare

We now confront the solution to the government problem with the world optimum. Given that redistribution is costless and substitutes for missing insurance markets, it is easy to prove that the increase in transfers due to higher openness is globally efficient. However, the level of taxation chosen unilaterally is not, because governments do not consider the cost of taxation that trade shifts on foreigners. A world social planner, instead, would internalize the cost of public spending for the world economy. To capture this in our symmetric set up, it suffices to modify the objective function of the government so as to take into account that the equilibrium g will be identical across countries and will thus affect world output. Substituting $Y_w = N^{\nu}(1-g)$ into (13) and rearranging yields:

$$\underset{g}{Max}\; C = \left[N^{\nu\tau}\left(\Omega_n\right)^{(1-\tau)}\left(\Omega_\tau\right)^{\tau}(1-g)\right]^{\eta}(gL)^{1-\eta}. \tag{20}$$

From the first order condition, it is easy to verify that world welfare is maximized when each country sets the size of the public sector equal to:

$$g = 1 - \eta, \tag{21}$$

which is the level chosen in autarky. It follows immediately that, as market integration (τ) increases, governments behaving non-cooperatively move further away from the globally efficient solution. The reason is that, in the presence of specialization and trade, rising taxes is a *beggar-thy-neighbor* policy at the expenses of foreign countries and the incentive

[20] For other shocks, like shifts in the demand curve or global shocks, the elasticity of demand plays no role in determining a country's exposure to risk. However, given that both supply and demand shocks matter and that the world economy as a whole is likely to be less volatile then any single country, it follows that an increase in openness will expose an economy to more income risk the higher the elasticity of substitution between imports and exports.

to use such a policy is higher the larger the trade share.

When all countries set g uncooperatively, world welfare may even decline with globalization (an increase in τ). In particular, this will happen if the inefficiency from excessive public spending outweighs the gains from trade, given by the value of consuming foreign varieties. Thus, welfare losses from globalization will be unlikely when the gains from trade are big, i.e., when there is a large number of countries N, a strong preference for variety ν and a high substitutability across varieties σ so that consumption risk is lower in traded sectors (i.e., $\Omega_\tau > \Omega_n$). To see this, take equation (20) and note that, holding the tax rate constant, utility is increasing in trade (τ) whenever $N > 1$, $\nu > 0$ and/or $\Omega_\tau > \Omega_n$. Moreover, given that public spending on public goods converges to the globally optimal level when the elasticity of substitution increases, the inefficiency from trade is lower when σ is high. Formally, substituting g from (15) into (20), the condition for trade to be welfare-improving can be derived as:

$$\nu \log N + \log \frac{\Omega_\tau}{\Omega_n} > \frac{1}{\sigma - \tau} - \frac{1}{\sigma - \eta\tau}, \tag{22}$$

where the left hand side is the marginal benefit from trade and the right hand side is the marginal cost due to inefficient public spending worldwide. Clearly, condition (22) is more likely to be satisfied when N, ν and σ are high. However, we can say more. When $\tau = 0$, the right hand side of (22) becomes zero, so that welfare gains from small volumes of trade are guaranteed as long as $N > 1$ and $\nu > 0$. The reason is that the distortion is proportional to the trade share while the marginal benefit of trade does not depend on the level of international integration. Therefore, small volumes of trade bring about first order gains but only second order losses.

On the contrary, as $\tau \to 1$ the condition for welfare gains becomes:

$$\nu (\sigma - 1) \log \frac{N\Omega_\tau}{\Omega_n} > \frac{1 + \eta}{\sigma - \eta}, \tag{23}$$

which may be violated if ν and σ are low, even when N is large. This suggests that trade may be beneficial at first, but welfare-reducing beyond a critical level. That is, there may be an optimal level of international integration. This case is illustrated in Figure 2, where the level of utility is plotted against the trade share τ for two different values of the gains from trade.[21] Although this result may depend on the chosen functional forms and specific assumptions on the gains from trade, it nonetheless shows that there are situations in which

[21] Figure 2 is drawn for $\eta = 0.8$ and $\sigma = 1.5$, values that are consistent with the evidence reported in the empirical section. However, the choice of the gains from trade remains largely arbitrary. Figure 2 shows two cases: $\nu \log (N\Omega_\tau/\Omega_n) = 0.3$ (solid line) and $\nu \log (N\Omega_\tau/\Omega_n) = 0.2$ (dotted line).

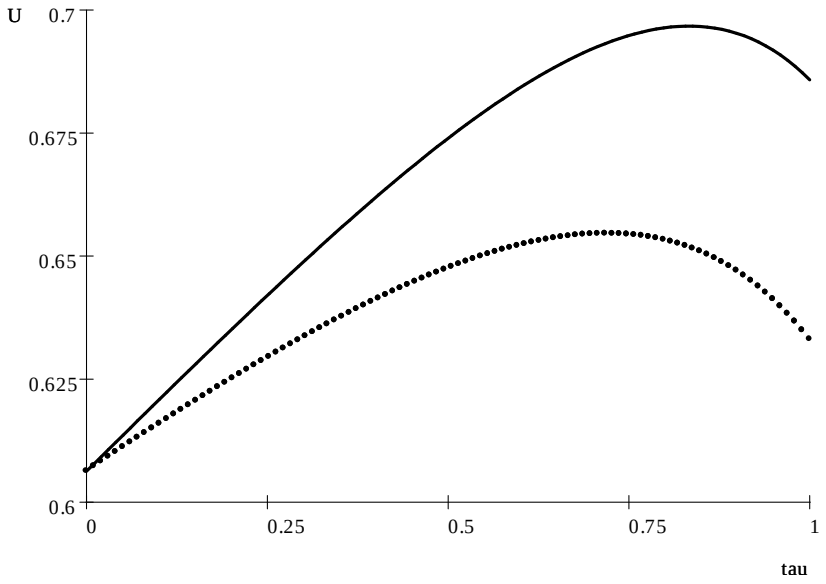

Figure 2: Trade Openness and Welfare

the benefits from integration may fail to compensate for the inefficiency of uncoordinated policies in a global world.

We close this section by summarizing the main implications of the model in the following Propositions.

Proposition 1 *Openness increases the size of governments through two channels: (1) the terms of trade externality, whereby trade lowers the domestic cost of taxation and (2) the demand for insurance, whereby trade raises risk and public transfers. The first mechanism is inefficient from the standpoint of world welfare, while the second is optimal.*

Proposition 2 *The strength of the terms of trade externality relative to the demand for insurance is determined by the elasticity of substitution between domestic and foreign goods* σ*. As* $\sigma \to 1$ *the demand for insurance vanishes, while the terms of trade externality becomes stronger. As* $\sigma \to \infty$ *the terms of trade externality disappears, while the demand for insurance becomes stronger.*

3 Empirical Evidence

In this section, we provide new evidence on the positive association between openness and government size and its main determinants. We start by showing that this empirical regularity is remarkably robust and that it has strengthened overtime. Next, we ask

what drives it. We present evidence that exposure to terms of trade risk does not seem capable of explaining the variation in government size, that openness does not increase the expenditure for transfers and welfare, and that the association between openness and government size is contingent on a low elasticity of substitution between domestic and foreign goods. All these results support the explanation based on the terms of trade externality.

3.1 Openness and Government Size: Some New Evidence

We start by exploring the robustness of the relationship between openness and government size. The Penn World Tables (release 6.1, PWT henceforth) provide data on a panel of about 150 countries observed over half a century (1950-2000) and allow to update and extend the evidence reported in Rodrik (1998) and Alesina and Wacziarg (1998), among others. In particular, the new dataset can be used to go beyond the cross-sectional regressions most of previous work relied upon. In our analysis, we use three measures of the size of government. First, our preferred measure is general government consumption expenditure (abbreviated as government consumption) as a share of GDP, reported in the PWT at current and constant prices.[22] This variable is a fairly good proxy for general government production, g, in our theoretical model.[23] Second, we use data on central government expenditure from the World Bank website. This measure includes transfers and investment by the central government, but excludes expenditure by the lower levels of government and is available from 1972 to 1999 for a subset of countries only. The simple correlation between the two proxies for government size is fairly low (.23). Third, we use data on central government transfers for social security and welfare (drawn from the World Bank website) to test for the existence of a positive correlation between openness and public transfers. As for the trade openness measure, we follow the previous literature (and our model) in using the share of imports plus exports over GDP (from the PWT).

Table 1 reports Fixed-Effects estimates using government consumption as the depen-

[22] According to the UN Report (2001), it is unclear whether it is better to measure government consumption at current or constant prices. Both measures are probably biased in opposite directions, since the former understates and the latter overstates the size of government in low-income countries. In our empirical analysis we use both measures. It is reassuring, however, that in our sample the two proxies are very highly correlated (the simple correlation between the two proxies ranges from a minimum of .91 in the early 70s to a maximum of .99 in the late 90s).

[23] General government production equals the value of all goods and services produced by employees of the State (at all levels of government) and distributed without charge or at prices which are not economically significant. General government consumption expenditure equals instead the general government production (less any fees collected) plus government purchases of goods and services that are distributed without charge to the community. Government consumption is generally larger than government production. See the UN report (2001) for a detailed analysis of the degree of comparability of these data across countries and overtime.

dent variable. All variables except shares are in logs. They are computed as five-year averages from 1950-54 to 1990-94 and as six-year averages in the last period (1995-00). We always control for time dummies, population and per capita income. Time dummies are included to avoid spurious results due to correlation of our variables of interest with time effects.[24] Population takes into account that larger countries are less open and may also have smaller governments due to scale economies (Alesina and Wacziarg, 1988). Finally, per capita income controls for the Wagner's law, according to which the level of development may affect the availability of tax bases and hence public spending.

In column (1), government consumption and openness are measured at current prices. The coefficient of openness is positive and significant well beyond the one percent level. It suggests that a 1 percentage point increase in the openness ratio brings about a .06 percentage point increase in the government share of GDP. In column (2), where government consumption and openness are measured at constant prices, the coefficient of openness is still significant beyond the one percent level. In columns (3)-(6), we run Fixed-Effects regressions for the sub-periods 1950-1975 and 1975-2000, measuring both ratios at current and constant prices. The coefficient of openness is positive and significant at the one percent level in both sub-periods and under both specifications, but it is larger in the second sub-period, suggesting that the positive association between openness and government size has strengthened overtime. In column (7), we follow the standard practice of excluding from the sample outlier countries with a trade share larger than 200 percent (Hong Kong, Singapore and Luxembourg) and find little effects on the estimates. In column (8), openness is lagged one five-year period and is still significant beyond conventional levels. Finally, in column (9), we add two variables that may capture the effect of external shocks on government spending: the standard deviation of the terms of trade (lagged one period) and its interaction with lagged openness. The interaction term takes into account that more open economies may be more exposed to external shocks and hence demand more public insurance. Note, however, that the coefficients of both controls are insignificant, whereas the size and significance of the coefficient of lagged openness are unaffected.

In Table 2, we re-run some of the above Fixed-Effects regressions using other measures of government size. In columns (1)-(3), the dependent variable is the central government expenditure as a percentage of GDP. We run the baseline specification in column (1), use lagged instead of current openness in column (2), and add the terms of trade variability

[24] The inclusion of time-dummies is not sufficient to avoid spurious results if the main variables are non-stationary. On this respect, we have performed panel unit root tests on our measures of openness and government consumption using the t-test based on OLS estimates. The test is advocated, among others, by Bond et al. (2002) due to its relatively high power. The null hypothesis of a unit root is always rejected at the one percent level.

and its interaction with openness in column (3). Note that the coefficient of openness is always positive and significant, at the 5 percent level in the first specification and beyond the one percent level in the latter two. The coefficient is also larger, on average, than in Table 1. Recall, however, that Table 2 refers to more recent decades, in which the relation between openness and government size seems to be stronger. In columns (4)-(6) of Table 2, we repeat the same specifications using central government transfers for social security and welfare as the dependent variable. Investigating the relationship between openness and this type of expenditure is interesting because, if trade increases the demand for insurance, this may show up in a surge of public transfers. Yet, the evidence does not lend support to this hypothesis, as the coefficient of openness is now either insignificant or wrong signed. Note, also, that the terms of trade risk does not seem to affect any kind of government expenditure.

In Table 3, we run Random-Effects regressions for the three measures of government size and for selected specifications. Interestingly, when using government consumption or central government expenditure as the dependent variable, our estimates are similar to the Fixed-Effects estimates shown earlier. In contrast, the coefficient of openness is negative and significant when government transfers are the dependent variable, while in no case the terms of trade variability seems to play any role.

In Table 4, we run cross-sectional regressions for each period from 1955-59 to 1995-00, using government consumption as the dependent variable. All variables are period averages, with openness lagged one period. The regressions also include the log of population and the log of per capita income, whose coefficients are not reported to save space, and exclude outliers with a trade share greater than 200 percent. The most interesting feature of Table 4 is that the size and significance of the coefficient of openness increase almost monotonically overtime, thereby confirming that the relationship between openness and government size has become stronger.

In Table 5, we perform a final robustness check using data on the latest cross-section (1995-00) and the three measures of government expenditure. In particular, the dependent variable is government consumption in columns (1)-(3), central government expenditure in columns (4)-(5) and transfers for social security and welfare in columns (6)-(7). We also use different proxies for the terms of trade variability. In particular, in column (1), we proxy for terms of trade variability by computing the standard deviation of the terms of trade over the entire period 1960-2000. In column (2), we interact this term with lagged openness. In column (3), we proxy for terms of trade variability with the standard deviation of the log changes in the terms of trade over the period 1960-2000 and also interact it with lagged openness. Note that the coefficient of openness is always very

precisely estimated and large in magnitude while none of the proxies involving terms of trade variability is ever significant. The same is true when using central government expenditure or expenditure for social security and welfare as the dependent variable, while the coefficient of openness is insignificant when using government transfers.[25]

Overall, Tables 1 to 5 suggest that: 1) the positive association between openness and government size emphasized by Rodrik (1998) is a remarkably robust stylized fact; 2) this empirical regularity is not mediated by country size; 3) it has grown stronger overtime; 4) finally, it is driven neither by public transfers nor by terms of trade shocks. Next, we look for evidence in support of the mechanisms driving this correlation in our model.

3.2 Estimating the Terms of Trade Effect

A crucial feature of our model is that the growth of private output and exports induces a deterioration of the terms of trade, implying that the elasticity of substitution between domestic and foreign goods is not too high. This "terms of trade effect" regulates the strength of the externality whereby trade lowers the cost of taxation. At the same time, it weakens the link between globalization and governments through the demand for insurance because of the compensatory role of price adjustments. Therefore, estimating the terms of trade effect is particularly important to understand which mechanism is more likely to be the driving force behind the stylized fact. In this section we start by asking whether the data are consistent with the notion that fast growing countries experience a terms of trade deterioration. Next, we will ask whether the positive association between openness and government size is contingent on the presence of strong terms of trade effects, as in the externality view, or weak terms of trade effects, as for the insurance mechanism.

To start with, we need a strategy to identify the terms of trade effect, equal to $1/\sigma$ in equation (4). Estimation of σ poses a standard identification problem: it represents a parameter of world demand for domestic products. To identify it, we need to isolate variation in domestic supply orthogonal to changes in the terms of trade.[26] To address this problem, we follow Acemoglu and Ventura (2002), who suggest to instrument the growth rate of output using a convergence equation *à la* Barro and Sala-i-Martin (1995). The idea is to isolate the source of variation in growth rates that is due to a country's

[25] We have also performed other experiments, not reported to save space, including other variables which are often used in the literature, such as the dependency ratio, the urbanization rate, the type of regime, the ethno-linguistic fractionalization, the land area and regional dummies. We found that these controls generally leave unaffected the significance of the coefficient of openness. Given that most of these variables vary little over time, they are implicitly controlled for in our fixed-effects regressions. Additional results for the cross-section can be found in Rodrik (1998).

[26] In the presence of demand shocks, like changes in preferences in favor of goods exported by a country, output and the terms of trade would move in the same direction (if supply is not perfectly rigid).

distance from its steady-state. Then, under the reasonable assumption that the growth rate due to convergence is exogenous to the terms of trade, it can be used to estimate $1/\sigma$.

In particular, we estimate cross-sectional regressions of the form:

$$dp_i = \gamma dy_i + X_i'\delta + \varepsilon_i \tag{24}$$

where dp_i is the average growth rate of the terms of trade over the period of analysis, dy_i is the average growth rate of private output, X_i' is a set of controls and $\gamma = -1/\sigma$ captures the terms of trade effect. We estimate (24) by Instrumental Variables (IV), instrumenting dy_i with the following convergence equation:

$$dy_i = \beta y_{0i} + Z_i'\alpha + \xi_i \tag{25}$$

where y_{0i} is private output at the beginning of the period, Z_i' is a set of covariates that determine the steady state income and $\beta < 0$ captures the speed of conditional convergence toward the steady state. In addition to helping solve the identification problem, equation (25) also allows to test another assumption of our theory: that the growth of the public sector crowds out output of the private sector (see equation 8) and that it has no other direct effect on the terms of trade. To do so, in some specifications of equation (25) we also include among the covariates Z_i' the level and growth rate of the public sector (whose expected sign is negative).

We start by estimating (24) and (25) for the period 1960-2000 (or nearly so, depending on data availability). The growth rate of the terms of trade is measured as the annual growth rate of export prices minus the growth rate of import prices from the PWT. Output of the private sector is measured as real GDP net of government consumption, from the same source. Table 6 reports the main results. The upper panel displays the first stage regressions for the growth rate of private GDP. The mid panel reports Instrumental Variables estimates for the growth rate of terms of trade. The first line (in bold) gives estimates of $\gamma = -1/\sigma$, while the bottom lines of this panel report two tests for the quality of our instruments: the value of the F-statistic of excluded instruments and the p-value of Hansen's J-statistic of over-identifying restrictions. Finally, for sake of comparison, the bottom panel reports Ordinary Least Squares estimates of the terms of trade effect.

In column (1), we start with a baseline specification where we control for steady state relative income by including the initial level of two proxies of human capital that feature prominently in cross-country growth regressions: educational capital (proxied with the log of average years of schooling) and the log of life expectancy (the former variable is drawn from the Barro-Lee dataset, the latter from the World Bank website). Both coefficients

are positive, but only the latter is precisely estimated. The convergence parameter is negative, as expected, and significant at the one percent level. Note, also, that the value of the F-statistic of excluded instruments is very high, suggesting that our instruments are strong, and the p-value of the J-statistic suggests against their endogeneity. Moving to the second stage, we find that terms of trade effects are strong and significant at the one percent level. The point estimate implies that a 1 percentage increase in the growth rate of private output brings about a 0.32 percentage fall in the terms of trade, equivalent to an elasticity of substitution σ of 3.

In column (2), we add the log change in average years of schooling and treat it as an included instrument to control for a possible direct effect of the growth of human capital on the terms of trade. We find no evidence of such an effect. Note, also, that both included and excluded instruments are now significant at the one percent level in the first stage regression; in particular, the initial level and the growth rate of educational capital seem to have a strong, positive impact on the growth rate of private GDP. In columns (3) to (6), we perform some further robustness checks. In column (3), we use secondary education instead of years of schooling as a proxy for educational capital and find no change in the main results (however, the p-value of the test of over-identifying restrictions is now only marginally insignificant at the 10 percent level). In column (4), we treat the growth of educational capital as an excluded rather than an included instrument, to see whether the results are affected by our choice of how to treat the instruments. They are not. Similarly, results are unchanged in column (5), where we use overall GDP instead of private GDP as the instrumented variable, and in column (6), where we exclude four OPEC countries (Algeria, Indonesia, Iran and Venezuela) from the sample. In all cases, the terms of trade effect is significant at the one percent level and the same order of magnitude.

In column (7), we add the initial level and growth rate of government consumption. We treat the former as an excluded instrument to see whether it negatively affects steady state private income, and the latter as an included instrument to see whether the growth of government has also a direct effect on the terms of trade. Adding more covariates in the first stage regressions brings the convergence parameter closer to the typical value of about 2 percent a year. More importantly, consistent with our model, both the level and growth rate of government consumption have a negative impact on the growth rate of private output and are significant at the one percent level. Furthermore, the coefficient of the growth rate of government consumption is insignificant and practically equal to zero in the second stage regression, suggesting that government size affects the terms of trade only indirectly, through its effect on private output. Finally, the estimated terms of trade

effect is unchanged and still significant at the one percent level.[27]

In column (8), we add the initial level of the black market premium and its change overtime. We treat the former as an excluded instrument and hence as a further control for the steady state relative income. However, we treat the latter as an included instrument because the black market premium has effects similar to trade restrictions and thus its variation is likely to affect the change in the terms of trade directly. We also add as an included instrument a dummy for diversified exporters (from the World Bank website). Note that the coefficient of the change in the black market premium is positive, as expected, and significant at the one percent level, but is quantitatively small. The coefficient of the dummy for diversified exporters is also positive, but it is significant at the 11 percent level only. As for the other variables, the level and growth rate of government consumption exert a strong negative impact on the growth rate of private GDP while the estimated terms of trade effect is close to 30 percent and significant at the 2 percent level.

Finally, the bottom panel of Table 6 reports OLS estimates of the terms of trade effect. Our earlier discussion suggests that OLS estimates are biased toward finding a smaller terms of trade effect (as demand shocks tend to generate a positive correlation between output growth and changes in the terms of trade). OLS estimates can therefore provide a lower bound for the terms of trade effect. Consistently, we find that the estimated coefficients are closer to zero than the IV estimates. Moreover, they are always significant at the 5 or 10 percent levels, suggesting that our IV results are not an artifact of the instrumenting strategy.

Overall, the results in Table 6 show that the terms of trade effect of output changes is large and precisely estimated. In particular, our IV estimates imply a value for the elasticity of substitution between domestic and foreign goods, σ, in the range 2.9 - 3.4, in line with the value previously reported by Acemoglu and Ventura (2002) using a different dataset. Moreover, our estimates are strikingly similar to those found by Broda and Weinstein (2004) through a very different approach: working with highly disaggregated data for the period 1972-2001, they report a median value for the elasticity of substitution in the interval 2.7-3.6.

[27] These results are interesting and in line with our theory, but must be interpreted with caution, since government output may be endogenous to private output, in which case our results may be biased. It is reassuring, however, that the estimated terms of trade effect is unchanged and that our instruments pass both tests.

3.3 The Terms of Trade Effect Overtime and Across Groups

The evidence reported so far suggests the existence of strong terms of trade externalities, yet it does not necessarily discriminate between the two mechanisms linking government size to openness. Here, we follow a simple strategy to tell them apart. Proposition 1 asserts that the link between government size and openness should grow stronger the lower is σ according to the terms of trade explanation, while the insurance mechanism implies just the opposite. Thus, if we can show that the relationship between openness and government size is contingent on the elasticity of substitution between import and export being low, we can then conclude that the evidence is consistent with the terms of trade externality as the driving force. Ideally, to make this exercise we would need different estimates of σ for each country and time period. Unfortunately this is impossible, as our estimation procedure requires both the cross-sectional and temporal variation to identify the terms of trade effect and thus σ.[28] However, we can perform two tests by estimating the elasticity of substitution in different time periods and per group of countries.

First, recall that the relationship between openness and government size has grown stronger overtime. This would be consistent with the terms of trade externality as the driving force if the elasticity of substitution has fallen overtime, for instance, because goods produced by countries engaged in international trade are becoming more and more differentiated. We can easily test this by re-estimating the terms of trade effect using more recent data. The results are reported in Table 7, where we use the same estimation procedure and specifications as in Table 6 but we use data for the sub-period 1980-2000 only.[29] Interestingly, the table shows that IV estimates of the terms of trade effect are now very large (with the expected sign) and are always significant at the 1 percent level. In particular, the coefficients imply a value of σ between 1.3 and 1.4, dropping to almost one half of the value estimated over the entire period 1960-2000.[30] OLS estimates are also larger than those relative to the whole period and are always significant at the 5 or 10 percent levels.

Second, we can estimate the elasticity of substitution σ separately for those countries that exhibit a stronger relationship between openness and government size. Again, if we find that σ is significantly lower in these countries, we may conclude that the evidence supports the explanation driven by the terms of trade externality. To perform this test, we divide the sample of countries used to estimate the relationship between openness and government size in two groups of equal size: one group includes the countries that con-

[28] The estimation procedure used by Broda and Weinstein is subject to the same limitation.
[29] To save space, the table displays only the coefficients of selected variables in the first stage regressions.
[30] Broda and Weinstein (2004) also find a substantial fall of the elasticity of substitution over time.

tributed relatively more to the positive coefficient of the openness ratio, while the second group includes the others. As a reference, we use the coefficient of the openness ratio estimated by Fixed-Effects in our baseline specification (see Table 1, column 1). Then, for each country in the sample, we compute the average difference between the regression coefficient when the observation is included and excluded, scaled by the estimated standard error of the coefficient (the so-called DF beta). Countries with a higher DF beta are those whose inclusion in the sample has a larger positive impact on the coefficient of the openness ratio. Finally, we use the median value of the DF beta to divide the groups.

Before running our crucial test, we pause to discuss the characteristics of the countries belonging to the two groups (the complete list is reported in the Appendix). Table 8 displays some descriptive statistics. The first line shows that countries with a relatively stronger association between openness and government size are larger. In fact, this group includes the largest economic powers (all the G-8 countries plus China), whereas most countries in the second group are small (India is a notable exception). Countries in the first group are also richer and better endowed with human capital (line two and three). Interestingly, they are also closer. The relatively low trade share may be driven by the larger average size while the higher indicators of trade barriers (higher black market premium, higher non-tariff barriers, lower share of duty free imports and marginally higher tariff rates) show that the less developed countries included in this group are more protectionist. These statistics suggest that countries in the first group may in fact face a lower σ because they produce more differentiated goods (due to a higher human capital) and because they are less price takers (due to the larger size). Moreover, a lower σ may also explain why they are on average more protectionist, as countries facing a lower elasticity of substitution have a stronger incentive to use tariffs to improve their terms of trade (see the Appendix).

In Table 9 we re-run the baseline Fixed-Effects regression of government consumption on the openness ratio for the countries in the first group (see column 2). For sake of comparison, the first column reports the Fixed-Effects estimates for the whole sample (from Table 1, column 1). The coefficient of the openness ratio is almost four times larger in the sub-sample than in the whole sample. To have a sense of its magnitude, consider that in this sub-sample the average trade share rose by more than 40 percentage points between 1950 and 2000. This would imply a rise in the average government share of about 9.5 percentage points.

We then estimate the terms of trade effect, $-1/\sigma$, in the two groups of countries using the same estimation procedure and specifications as in Tables 6 and 7. The results are reported in the top two panels of Table 10. To save space, the table displays only

estimates of the terms of trade effect and first stage statistics. The unreported coefficients are however very similar to those previously found. The results are striking. The terms of trade effect is very large and always significant at the 1 percent level in the sub-sample of countries with a relatively stronger association between openness and government size. In particular, IV estimates of the terms of trade effect range from 0.62 to 0.75, implying a value of σ between 1.3 and 1.6. OLS estimates are also large and very precise (most are significant at the one percent level). In contrast, in the sub-sample of countries with a weaker association between openness and government size the terms of trade effect is much smaller, ranging from 0.10 to 0.16 (IV estimates), and is never significantly different from zero. OLS estimates are even smaller and always insignificant. Note also that the first stage statistics support our choice of instruments in both sub-samples as the F-statistic is always high and the J-statistic is insignificant.[31]

Finally, the two bottom panels of Table 10 check the robustness of our results by using a different approach to splitting our sample. In particular, for each country in the sample we run a time-series regression of government consumption on the openness ratio, the log of population, the log of per capita income and a time trend. We then include in the first group those countries with a positive coefficient for the openness ratio and a standard error lower than the coefficient itself. As shown in the table, the results are similar when using this different procedure. In particular, in the first group, IV estimates of the terms of trade effect now range from 0.50 to 0.69 and are always significant between the 5 and 1 percent levels, implying a value of σ between 1.4 and 2. OLS estimates are also large and very precise. In contrast, in the second group the terms of trade effect is much smaller: IV estimates range from 0.13 to 0.17 and are never significant, except one that is significant at the 10 percent level only. OLS estimates are smaller and always insignificant. Overall, this empirical evidence consistently suggests that the positive association between openness and government size may be driven by the terms of trade externality, whereas it casts doubt on the empirical relevance of the demand for insurance mechanism.

4 Conclusion

In this paper, we have formulated and tested a model where a greater openness raises the size of governments through two mechanisms: (1) it induces a terms of trade externality that reduces the domestic cost of taxation and (2) it increases exposure to risk and thus the demand for insurance and public transfers. The relative importance of these two forces is dictated by the elasticity of substitution between imports and exports, as this elasticity is

[31] A slight exception is a single specification in the first group (see column 3), where it is marginally significant at the 10 percent level.

directly related to the income risk induced by country-specific supply shocks, and inversely related to the terms of trade externality. We have also shown that, for plausible values of the terms of trade externality, welfare may be a non-monotonic function of openness: starting from low trade volumes, a greater openness is always welfare enhancing, whereas it may lower welfare for large trade volumes. Finally, we have provided new evidence on the positive association between openness and the size of government and two tests suggesting that the terms of trade externality may be the driving force behind it.

We close with some remarks on the policy implications of our findings. It is well-known that governments in a global economy may have incentives to use tariffs to manipulate the terms of trade in their favor. By removing these incentives, the WTO principles may provide a solution to the inefficiencies that would arise under non-cooperative tariff setting (Bagwell and Staiger, 1999). As shown in this paper, however, even the simplest form of domestic taxation may produce similar terms of trade effects. Are then the WTO rules adequate to deal with this problem as well? We believe they are not, because fiscal policies are seen as a matter of national sovereignty that goes beyond the WTO jurisdiction. Other widespread forms of international economic integration do not deal with this problem either. For example, preferential trade agreements and custom unions do not involve political coordination on fiscal issues. As a result, market integration and political cooperation have followed rather independent routes. Yet, it is understood that externalities traveling through trade cannot be corrected by a single government when markets extend beyond political borders. And our paper offers an example where the mismatch between markets and political constituencies may in itself lead to inefficient policies.[32]

By imposing constraints on fiscal policy to member states, the EU may appear in this respect an exception. Even in this case, however, we think that too little has been done. Much of the debate on the coordination of fiscal policies has been centred on the Stability and Growth Pact that imposes limits to budget deficits and debt. Even if those limits may be given some economic rationale, they do not provide a solution to the inefficiency illustrated in this paper, because the latter arises from too high a level of public spending and not from excessive debt or deficits. Thus, while the EU may provide an appropriate institutional framework to achieve policy coordination, measures so far adopted seem neither necessary nor sufficient to correct fiscal externalities due to globalization.

[32] Other examples are surveyed in Persson and Tabellini (1995) while more recent ones are McLaren and Newman (2002) and Broner and Ventura (2005).

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5 Appendix

5.1 Country Groups

The countries with a relatively stronger association between openness and government size are the following:

Albania, Angola, Antigua, Argentina, Australia, Bangladesh, Belarus, Belgium, Belize, Bolivia, Brazil, Burundi, Cameroon, Canada, Central African Republic, Chad, China, Comoros, Costa Rica, Cote d'Ivoire, Czech Republic, Denmark, Dominican Republic, Ecuador, Egypt, Equatorial Guinea, Estonia, Ethiopia, France, Gambia, Germany, Greece, Guinea-Bissau, Guyana, Iceland, Iran, Israel, Italy, Jamaica, Japan, Jordan, Kyrgyzstan, Lesotho, Madagascar, Mali, Mozambique, Namibia, Nepal, Netherlands, New Zealand, Nigeria, Peru, Poland, Portugal, Romania, Russia, Sao Tome and Principe, Seychelles, Sierra Leone, Slovak Republic, Spain, Switzerland, Tanzania, Thailand, Togo, Turkey, Uganda, Ukraine, United Kingdom, Uruguay, USA, Uzbekistan, Venezuela, Vietnam.

The other countries are:

Algeria, Armenia, Austria, Azerbaijan, Barbados, Benin, Botswana, Bulgaria, Burkina Faso, Cambodia, Cape Verde, Chile, Colombia, Congo, Congo, Dem. Rep., Cuba, Cyprus, Dominica, El Salvador, Fiji, Finland, Gabon, Ghana, Grenada, Guatemala, Guinea, Haiti, Honduras, Hong Kong, Hungary, India, Indonesia, Ireland, Kazakhstan, Kenya, Latvia, Lebanon, Lithuania, Luxembourg, Macao, Macedonia, Malawi, Malaysia, Malta, Mauritania, Mauritius, Mexico, Morocco, Nicaragua, Niger, Norway, Pakistan, Panama, Papua New Guinea, Paraguay, Philippines, Republic of Korea, Rwanda, Senegal, Singapore, Slovenia, South Africa, Sri Lanka, St. Kitts & Nevis, St. Lucia, St.Vincent & Grenadines, Sweden, Syria, Taiwan, Trinidad &Tobago, Tunisia, Yemen, Zambia, Zimbabwe.

5.2 Taxation and the Optimal Tariff

In this Appendix we show that our results are unaffected when the government can use trade policy to improve the terms of trade. In particular, we consider an export tax whose revenue is redistributed to consumers, so that its only purpose is to maximize domestic income by improving the terms of trade (as in the basic optimal tariff argument). For simplicity, we consider the model with no uncertainty, i.e., we set $\epsilon = 0$. Let p_τ be the price of a traded variety inclusive of the export tax t. The after tax revenue from selling one unit, $p_\tau (1-t)$, is the wage of the worker who produced it:

$$p_\tau (1-t) = w = p_n, \tag{26}$$

where p_n is the price of a nontraded good. Thus, the effect of the export tax is to introduce a wedge between the price of exported and nontraded goods. Cobb-Douglas preferences and trade balance imply that income is evenly distributed across sectors: $p_\tau L_\tau = p_n L_n$, where L_τ and L_n are employment in the typical traded and nontraded industry, respectively. Substituting (26) yields labor allocation in each sector: $L_\tau = (1-t) L_n$. As expected, the export tax shifts labor out of exporting industries and effectively allows the government to choose employment levels in traded and nontraded sectors. With full employment, these are:

$$L_\tau = \frac{(1-t)(1-g)}{1-t\tau} L, \tag{27}$$

$$L_n = \frac{1-g}{1-t\tau} L. \tag{28}$$

Substituting (27) for $(1-g)L$ into (11) and similarly (28) into (10), we get new expressions for Y_τ and Y_n that in turn can be used with (12) to obtain the new objective function for the government:

$$\underset{\{g,\, t\}}{Max}\ U = \left(\frac{1-g}{1-t\tau}\right)^{(1-\tau)\eta} \left\{ \left[\frac{(1-t)(1-g)}{1-t\tau}\right]^{\frac{\sigma-1}{\sigma}} N^{\nu-(\nu+1)/\sigma} \left(\frac{Y_w}{L}\right)^{\frac{1}{\sigma}} \right\}^{\tau\eta} (gL)^{1-\eta}. \tag{29}$$

Then, the first order condition for t leads to:

$$t = \sigma^{-1}, \tag{30}$$

which is the well-known result that the optimal tariff or export tax is a negative function of the elasticity of foreign demand. More importantly, it is easy to verify from (29) that the first order condition for g is still given by (15) and is thus unaffected.

Table 1. Openness and Government Consumption (Fixed-Effects)

Dependent variable: Government Consumption (% of GDP)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Baseline	*Constant prices*	*1950-1975, curr. pr.*	*1950-1975, const. pr.*	*1975-2000, curr. pr.*	*1975-2000, const. pr.*	*No outliers*	*Lagged openness*	*Adding ToT variability*
Openness	**.060*** **	**.041*** **	**.045*** **	**.029*** **	**.058*** **	**.093*** **	**.069*** **	**.051*** **	**.048*** **
	(.012)	**(.008)**	**(.014)**	**(.010)**	**(.017)**	**(.015)**	**(.013)**	**(.014)**	**(.015)**
Log of GDP	-3.92***	-4.03***	-6.46***	-8.16***	-.435	-.715	-3.78***	-3.56***	-3.44***
	(.736)	(.866)	(1.03)	(1.21)	(1.46)	(1.77)	(.763)	(.860)	(.940)
Log of population	6.66***	6.07***	8.79***	6.74***	2.39	2.81	6.56***	6.94***	6.71***
	(1.40)	(1.69)	(1.93)	(2.33)	(3.21)	(3.93)	(.763)	(1.62)	(1.76)
ToT variability									-.476
									(1.09)
ToT var.×openn.									-.003
									(.014)
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
# obs.	1171	1171	602	602	691	691	1145	1005	896
# groups	168	168	122	122	168	168	165	148	146
R-squared	.28	.11	.48	.22	.07	.13	.28	.23	.23

Fixed-Effects estimates with standard errors in parentheses. ***,**,* = significant at the 1, 5 and 10 percent levels, respectively. All variables are computed as five-year averages from 1950-54 to 1990-94 and as six-year averages from 1995 to 2000. The openness and government consumption ratios are measured at constant prices in columns (2), (4), and (6) and at current prices otherwise. In column (7), three outliers (Singapore, Hong Kong and Luxembourg) with an openness ratio greater than 200 percent are excluded from the sample. In columns (8) and (9) openness is the five-year average lagged one period. *ToT variability* is equal to the standard deviation of the terms of trade lagged one period. *ToT var.×openn.* equals *ToT variability* times lagged openness. Data source: PWT 6.1.

Table 2. Openness and Government Size (Fixed-Effects)

Dependent variables: Central Government Expenditure and Expenditure for Social Security and Welfare (% of GDP)

	(1)	(2)	(3)	(4)	(5)	(6)
	Central Government Expenditure			*Social Security and Welfare*		
	Baseline	*Lagged openness*	*Adding ToT variability*	*Baseline*	*Lagged openness*	*Adding ToT variability*
Openness	**.049** **	**.108*** **	**.109*** **	**-.013** **	**-.002**	**.002**
	(.021)	**(.023)**	**(.025)**	**(.006)**	**(.007)**	**(.008)**
Log of GDP	-5.55***	-8.10***	-7.73***	-1.24**	-1.63***	-1.57***
	(1.54)	(1.65)	(1.80)	(.516)	(.571)	(.600)
Log of population	-16.77***	-18.10***	-18.86***	-7.37***	-7.48***	-7.69***
	(2.91)	(2.89)	(3.10)	(.946)	(.967)	(1.00)
ToT variability			-2.13*			-.077
			(1.24)			(.383)
ToT var.×openn.			.011			.003
			(.015)			(.004)
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes
# obs.	475	455	399	397	380	337
# groups	114	105	103	107	100	98
R-squared	.30	.33	.35	.36	.36	.39

All variables are computed as period averages for 1970-74, 1975-79, 1980-84, 1985-89, 1990-1994 and 1995-2000. In columns (2)-(3) and (5)-(6) openness is lagged one period. Data on Central Government Expenditure and expenditure for Social Security and Welfare span from 1972 to 1999. Data sources: PWT 6.1 and World Bank website.

Table 3. Openness and Government Size (Random-Effects)

Dependent variables: Government Consumption, Central Government Expenditure and Expenditure for Social Security and Welfare (% of GDP)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Government Consumption			*Central Government Expenditure*		*Social Security and Welfare*	
	Baseline	*Constant prices*	*Adding ToT variability*	*Baseline*	*Adding ToT variability*	*Baseline*	*Adding ToT variability*
Openness	**.052*** **	**.034*** **	**.044*** **	**.038** **	**.053*** **	**-.019*** **	**-.019*** **
	(.010)	**(.008)**	**(.013)**	**(.017)**	**(.019)**	**(.006)**	**(.007)**
Log of GDP	-4.68***	-4.85***	-4.02***	1.49*	1.66*	2.24***	2.66***
	(.510)	(.578)	(.586)	(.835)	(.902)	(.353)	(.378)
Log of population	-1.42***	-1.96***	-1.84***	-1.32**	-1.06*	-.403	-.558***
	(.373)	(.412)	(.403)	(.596)	(.639)	(.266)	(.281)
ToT variability			-.277		-1.57		.056
			(1.11)		(1.29)		(.431)
ToT var.×openn.			-.007		.009		.002
			(.014)		(.015)		(.005)
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
# observations	1171	1171	896	475	399	397	337
# groups	168	168	146	114	103	107	98
R-squared	.26	.22	.25	.21	.20	.45	.49

Random-effects estimates with standard errors in parentheses. See notes to Tables 1 and 2.

Table 4. Openness and Government Consumption in Different Time Periods

Dependent variable: Government Consumption (% of GDP)

	1955-59	**1960-64**	**1965-69**	**1970-74**	**1975-79**
Openness $_{-1}$	-.022	.015	-.005	.027	.089**
	(.037)	(.030)	(.032)	(.040)	(.045)
# observations	65	73	110	110	113
R-squared	.01	.01	.02	.07	.14
	1980-84	**1985-89**	**1990-95**	**1995-00**	
Openness $_{-1}$	.109**	.108***	.127***	.115***	
	(.054)	(.038)	(.038)	(.031)	
# observations	119	121	126	145	
R-squared	.35	.44	.42	.36	

Cross-section OLS estimates (with robust standard errors in parentheses) for each period from 1955-1959 to 1995-2000. All variables are period averages, except for the openness ratio which is the lagged period average. All regressions include the log of real per capita GDP and the log of population, whose coefficients are not reported in the table. All regressions exclude outlier countries with an openness ratio greater than 200%.

Table 5. Openness, Government Size and Terms of Trade Variability (1995-2000)

Dependent variables: Government Consumption, Central Government Expenditure and Expenditure for Social Security and Welfare (% of GDP)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Government Consumption			*Central Government Expenditure*		*Social Security and Welfare*	
Openness $_{-1}$	**.114*** **	**.174*** **	**.199*** **	**.071***	**-.035**	**-.001**	**-.035**
	(.030)	**(.062)**	**(.071)**	**(.042)**	**(.082)**	**(.024)**	**(.056)**
Log of GDP	-4.29***	-4.26***	-4.32***	3.38***	3.30***	4.08***	4.03***
	(.761)	(.770)	(.754)	(1.12)	(1.13)	(.594)	(.609)
Log of population	-1.34*	-1.32*	-1.32*	-1.54*	-1.32	-.593	-.560
	(.717)	(.706)	(.698)	(.911)	(.894)	(.539)	(.567)
St. dev. ToT (1960-00)	-2.40	7.39					
	(4.26)	(9.15)					
Openness-1× st. dev. ToT (1960-00)		-.133					
		(.118)					
St. dev. log change of ToT (1960-00)			4.75	-2.91	-18.3	-2.26	-7.40
			(8.92)	(6.41)	(12.3)	(4.52)	(10.3)
Openness-1× st. dev. log change of ToT (1960-00)			-.161		.246		.077
			(.103)		(.181)		(.125)
#obs.	145	145	145	74	74	59	59
R-squared	.36	.37	.38	.34	.35	.42	.43

Cross-section OLS estimates with robust standard errors in parentheses. All variables are period averages for 1995-2000, except for the openness ratio (average for 1990-1994) and the terms of trade variability, which is computed over the period 1960-2000.

Table 6. IV Estimates of the Terms of Trade Effect. Sample period: 1960 – 2000.
Dependent variable: average growth of the terms of trade

	(1) *Baseline*	(2) *Adding change in schooling*	(3) *Changing the proxy for school.*	(4) *Moving delta to the 1° st.*	(5) *Overall GDP*	(6) *Non OPEC countries*	(7) *Adding government*	(8) *Adding more controls*
First stage regressions for the growth rate of private GDP								
Log of private GDP, 1960	-.015***	-.014***	-.016***	-.014***	-.015***	-.014***	-.018***	-.017***
	(.003)	(.003)	(.003)	(.003)	(.002)	(.003)	(.002)	(.003)
Log of av. years of sch., 1960	.002	.013***		.013***	.012***	.012**	.009**	.014***
	(.002)	(.005)		(.005)	(.004)	(.005)	(.004)	(.005)
Log of life expect., 1962	.084***	.063***	.057***	.063***	.064***	.065***	.070***	.059***
	(.014)	(.015)	(.014)	(.015)	(.015)	(.016)	(.014)	(.014)
Growth of years of schooling		.017***		.017***	.016***	.015**	.013**	.018***
		(.006)		(.006)	(.006)	(.006)	(.006)	(.006)
Log of sec. schooling, 1960			.010***					
			(.003)					
Growth of sec. schooling			.006*					
			(.004)					
Log of gov. share, 1960							-.013***	-.011***
							(-.003)	(-.003)
Growth of gov. share of GDP							**-.552*** **	**-.462*** **
							(.115)	**(.143)**
Black mkt. premium, 1960								-.000
								(.000)
Change in the black mkt. premium								-.001
								(.001)
Dummy diversified exporters								.004*
								(.002)
R-squared	.48	.54	.56	.54	.57	.54	.64	.62
Second stage regressions for the growth rate of terms of trade								
Growth of private GDP	**-.318*** **	**-.307*** **	**-.343*** **	**-.330*** **	**-.319*** **	**-.312*** **	**-.309*** **	**-.292** **
	(.111)	**(.124)**	**(.124)**	**(.125)**	**(.123)**	**(.124)**	**(.105)**	**(.126)**
Growth of years of schooling		.002			.002	.003	.002	.002
		(.002)			(.002)	(.002)	(.002)	(.002)
Growth of sec. schooling			-001					
			(.002)					
Growth of gov. share of GDP							-.029	-.068
							(.111)	(.097)
Change in the black mkt. premium								.0003***
								(.0000)
Dummy diversified exporters								.005
								(.003)
F-test excluded instruments	27.4	30.2	33.9	25.9	35.7	29.1	28.9	23.4
P-value Hansen J statistic	.26	.42	.11	.40	.53	.62	.56	.53
OLS regressions for the growth rate of terms of trade								
Growth of private GDP	**-.168** **	**-.151** **	**-.171** **	**-.171** **	**-.156** **	**-.146***	**-.142***	**-.177** **
	(.076)	**(.074)**	**(.078)**	**(.078)**	**(.074)**	**(.075)**	**(.076)**	**(.086)**
# obs.	89	88	88	88	88	84	88	76

Instrumental Variables estimates of the growth rate of terms of trade with robust standard errors in parenthesis (OLS estimates in the bottom panel). The growth rate of terms of trade is measured as the annual growth rate of export prices minus the growth rate of import prices. The level (and growth rate) of private GDP is measured as real GDP net of government consumption, except in column (5), where government consumption is also included. In column (6), the four OPEC countries in our sample (Algeria, Indonesia, Iran, and Venezuela) are excluded from the sample. Data sources: PWT 6.1, Barro-Lee and World Bank website.

Table 7. IV Estimates of the Terms of Trade Effect. Sample period: 1980 – 2000.
Dependent variable: average growth of the terms of trade

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Baseline	*Adding change in schooling*	*Changing the proxy for school.*	*Moving delta to the 1° st.*	*Overall GDP*	*Non OPEC countries*	*Adding government*	*Adding more controls*
				First stage regressions for the growth rate of private GDP				
Log of private GDP, 1980	-.009*** (.003)	-.009*** (.003)	-.010*** (.003)	-.009*** (.003)	-.012*** (.004)	-.008*** (.003)	-.016*** (.004)	-.015*** (.005)
Log of gov. share, 1980							-.014*** (.005)	-.013*** (.005)
Growth of gov. share of GDP							**-.356*** (.103)**	**-.336*** (.108)**
R-squared	.25	.29	.28	.29	.32	.31	.41	.41
				Second stage regressions for the growth rate of terms of trade				
Growth of private GDP	**-.768*** (.243)**	**-.731*** (.275)**	**-.787*** (.287)**	**-.767*** (.267)**	**-.721*** (.249)**	**-.698*** (.269)**	**-.738*** (.241)**	**-.763*** (.270)**
Growth of years of schooling		.004 (.008)			.002 (.008)	.007 (.008)	.005 (.008)	.003 (.008)
Growth of sec. schooling			.000 (.008)					
Growth of gov. share of GDP							-.136 (.101)	-.134 (.103)
Change in the black mkt. premium								-.0002 (.0003)
Dummy diversified exporters								.005 (.005)
F-test ex. Instr.	14.3	12.4	9.9	13.3	13.4	11.8	15.6	10.2
P-value J stat.	.63	.70	.54	.82	.68	.81	.81	.85
				OLS regressions for the growth rate of terms of trade				
Growth of private GDP	**-.221** (.108)**	**-.195* (.107)**	**-.186* (.109)**	**-.221** (.108)**	**-.196** (.092)**	**-.186* (.113)**	**-.205** (.101)**	**-.220** (.105)**
# obs.	93	93	93	93	93	89	93	89

See notes to Table 6.

Table 8. Descriptive Statistics across Groups

	Mean	Standard deviation	Minimum	Maximum	# Observations
Countries with a stronger positive relation between openness and government size					
Population	50514	156410	68	1258821	68
Real per capita GDP	9605	9080	482	33293	66
Av. years of schooling	6.7	3.1	.8	12.2	51
Gov. share of GDP	21.8	13.0	6.6	62.1	68
Openness	78.0	39.2	20.1	179.9	68
Black market premium	7.1	49.6	0	400	65
Non-tariff barriers	25.8	13.3	0	67.2	23
Share of duty free imports	36.8	22.0	0	95.5	36
Tariffs	10.2	7.0	0	30.8	61
All other countries					
Population	33539	130283	41	1015923	63
Real per capita GDP	8338	8671	784	43990	62
Av. years of schooling	6.1	2.7	.8	11.9	52
Gov. share of GDP	21.9	12.7	4.1	63.5	63
Openness	99.0	59.8	30.4	341.6	63
Black market premium	2.5	13.2	0	100	71
Non-tariff barriers	18.8	14.6	0	53.4	20
Share of duty free imports	40.8	29.7	0	100	39
Tariffs	10.1	6.5	0	30.2	66

Countries in the upper panel of the table are those that contributed more to the positive coefficient of the openness ratio estimated in column 1 of Table 1 (i.e., countries with an average DF beta greater than the median value). Most statistics reported in the table refer to the year 2000. Data on non-tariff barriers (average for 1995-1998) are taken from Wacziarg and Welch (2003). Data on import tariffs and the share of duty free imports come instead from the WTO website (http://stat.wto.org) and refer to the early 00s.

Table 9. Openness and Government Size (Fixed-Effects in a Sub-Sample)

Dependent variable: Government Consumption (% of GDP)

	(1) *All countries*	(2) *Countries with a DF beta > median DF beta*
Openness	**.060*** **	**.222*** **
	(.012)	**(.016)**
Log of real per capita GDP	-3.919***	-6.823***
	(.736)	(1.031)
Log of population	6.662***	4.648***
	(1.398)	(1.740)
Time dummies	Yes	Yes
# observations	1171	594
# groups	168	74
R-squared	.28	.47

In column 2, the sample includes only countries with an average DF beta greater than the median value.

Table 10. IV Estimates of the Terms of Trade Effect across Groups (1960 – 2000).
Dependent variable: average growth of the terms of trade

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Baseline	*Adding change in schooling*	*Changing the proxy for school.*	*Moving delta to the 1° st.*	*Overall GDP*	*Non OPEC countries*	*Adding government*	*Adding more controls*
Countries with a stronger positive relation between openness and government size (fixed-effects regressions, DF beta greater than the median value)								
Two-stage regressions								
Growth of private GDP	**-.671*** (.189)**	**-.738*** (.251)**	**-.716*** (.224)**	**-.715*** (.214)**	**-.665*** (.252)**	**-.746*** (.248)**	**-.721*** (.238)**	**-.615*** (.246)**
F-test ex. Inst.	23.0	29.0	24.6	30.5	19.1	29.3	14.3	11.3
P-value J stat.	.61	.33	.09	.53	.30	.51	.33	.60
OLS regressions								
Growth of private GDP	**-.466*** (.171)**	**-.457** (.191)**	**-.490*** (.178)**	**-.490*** (.178)**	**-.412** (.170)**	**-.488** (.195)**	**-.426** (.191)**	**-.446** (.196)**
# obs.	45	44	44	44	44	42	44	40
All other countries (fixed-effects regressions, DF beta lower than the median value)								
Two-stage regressions								
Growth of private GDP	**-.099 (.102)**	**-.110 (.113)**	**-.150 (.113)**	**-.110 (.107)**	**-.113 (.116)**	**-.110 (.111)**	**-.127 (103)**	**-.162 (.131)**
F-test ex. Inst.	12.9	14.9	16.7	11.2	18.6	14.4	17.7	11.3
P-value J stat.	.88	.73	.28	.89	.71	.86	.87	.98
OLS regressions								
Growth of private GDP	**-.038 (.075)**	**-.038 (.075)**	**-.038 (.075)**	**-.038 (.075)**	**-.050 (.080)**	**-.026 (.076)**	**-.050 (.082)**	**-.069 (.093)**
# obs.	44	44	44	44	44	42	44	36
Countries with a stronger positive relation between openness and government size (time-series regressions, t-statistic > 1)								
Two-stage regressions								
Growth of private GDP	**-.647*** (.212)**	**-.637*** (.212)**	**-.670*** (.190)**	**-.694*** (.213)**	**-.544*** (.222)**	**-.636*** (.207)**	**-.502** (.224)**	**-.584** (.270)**
F-test ex. Inst.	34.2	25.3	41.0	22.6	24.2	25.5	15.8	7.2
P-value J stat.	.16	.32	.41	.31	.25	.37	.50	.81
OLS regressions								
Growth of private GDP	**-.494*** (.169)**	**-.437*** (.157)**	**-.474*** (.158)**	**-.494*** (.169)**	**-.362** (.144)**	**-.436*** (.155)**	**-.334** (.162)**	**-.384* (.200)**
# obs.	33	33	33	33	33	32	33	29
All other countries (time-series regressions, t-statistic < 1)								
Two-stage regressions								
Growth of private GDP	**-.145 (.094)**	**-.133 (.108)**	**-.160 (.106)**	**-.139 (.101)**	**-.159 (.112)**	**-.141 (.108)**	**-.162* (.095)**	**-.172 (.134)**
F-test ex. Inst.	12.9	17.1	18.09	13.5	23.3	16.4	20.0	13.8
P-value J stat.	.76	.82	.40	.90	.92	.89	.95	.38
OLS regressions								
Growth of private GDP	**-.043 (.071)**	**-.035 (.074)**	**-.053 (.078)**	**-.042 (.073)**	**-.060 (.080)**	**-.024 (.076)**	**-.062 (.080)**	**-.077 (.095)**
# obs.	56	55	55	55	55	52	55	47

See notes to Table 6.