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ON GLOBALIZATION AND THE GROWTH OF GOVERNMENTS

Paolo Epifani and Gino Gancia

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Paolo Epifani, Università Bocconi
Gino Gancia, CREI, Universitat Pompeu Fabra and CEPR

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Centre for Economic Policy Research
90–98 Goswell Rd, London EC1V 7RR, UK
Tel: (44 20) 7878 2900, Fax: (44 20) 7878 2999
Email: cepr@cepr.org, Website: www.cepr.org

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ABSTRACT

On Globalization and the Growth of Governments*

This paper investigates the relationship between trade openness and the size of governments, both theoretically and empirically. We argue 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. Our main theoretical prediction is that the relative strength of the two explanations depends on a key parameter, namely, the elasticity of substitution between domestic and foreign goods. Moreover, while the first mechanism is inefficient from the standpoint of world welfare, the second is instead optimal. In the empirical part of the paper, we provide new evidence on the positive association between openness and government size and we explore its determinants. Consistently with the terms of trade externality channel, we show that the correlation is contingent on a low elasticity of substitution between domestic and foreign goods. Our findings raise warnings that globalization may have led to inefficiently large governments.

JEL Classification: F1 and H1
Keywords: elasticity of substitution between imports and exports, government size, openness and terms of trade externality

Paolo Epifani
Università Bocconi
Via Sarfatti, 25
20136 Milano
ITALY
Email: paolo.epifani@unibocconi.it

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Gino A. Gancia
Department of Economics
Universitat Pompeu Fabra
Ramon Trias Fargas, 25-27
Barcelona, 08005
Email: gino.gancia@upf.edu

For further Discussion Papers by this author see:
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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 shifts part of the cost of taxation abroad. Since governments behaving non-cooperatively do not internalize the cost of taxation that trade imposes onto foreigners, they react to market integration by increasing public spending.[3]

[1] Other studies investigating specifically 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 important, 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

Our main purpose is to compare and test these two mechanisms. To this end, 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 productivity 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. This happens irrespective of countries being large or small, provided that they produce goods that are not perfect substitutes.[4] In particular, the domestic cost of taxation is lower the higher the trade share and the lower the elasticity of substitution between import and export. The intuition for this result is that tax revenue is spent on domestically produced public goods while a fraction of private income is spent on foreign products. It follows that a shift in the composition of local expenditure from the private to public raises the relative demand for domestic labor, the more so the higher the share of imports in private consumption. Yet, for this change in local demand to affect domestic prices and wages, the elasticity of substitution between goods produced in different countries has to be less then infinite, or else prices and wages would be entirely determined on world markets. This induced terms of trade improvement is what makes taxation and public spending less costly in open countries producing differentiated goods.[5]

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

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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 they been compared to other possible explanations. The purpose of this paper is precisely to fill this gap.

[4] 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.

[5] It is important to note that this mechanism, while related to the optimal tariff argument, is conceptually different from it. In setting an optimal tariff, the government tries to increase the terms of trade *up to the level* that maximizes domestic revenues, just like a monopolist. In the case we study, instead, the government set taxes to finance public consumption and the induced terms of trade improvement *always* reduces the cost of public spending, irrespective of the level of domestic and foreign prices.

economy changes in relative prices across sectors provide insurance against productivity shocks, as prices rise when output falls. International competition with producers of close 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 one, 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: on the one hand, they introduce an externality that leads to higher taxation, on the other, they tend to stabilize income in international markets, thus lowering the demand for public insurance in sectors exposed to foreign competition.

The two explanations differ fundamentally in their welfare properties. While the expansion of the public sector for insurance motives can be the optimal reaction to higher risk, the terms of trade externality leads to excessively large governments, as policy makers do not fully internalize the cost of taxation. In the latter case, when all governments raise spending 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 just offset each other.[6] Taking this effect into account, we show that the net impact of an increase in trade on world welfare may even become negative, because the gains from trade may fail to compensate the inefficiency arising from excessive public spending.

The opposite welfare implications of the two mechanisms make it particularly important to assess which one is more relevant empirically. This is a task we address in the second part of the paper, where we bring the model to the data. To set the stage, we show 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 some new empirical 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 in our sample there is no evidence of a positive association between openness and government transfers for social security and welfare and that exposure to external shocks in the form of terms of trade volatility seems unable to explain the variation in government size.

[6] Strictly speaking, this is true in a symmetric equilibrium. When countries are asymmetric, different domestic policies will dampen each other, but the terms of trade will generally move.

Next, we look for evidence on the role played by the elasticity of substitution between import and export in explaining how openness affects the size of government. Identifying this elasticity is a hard task and we therefore rely on two alternative strategies. The first builds on Acemoglu and Ventura (2002), and allows to recover direct estimates of the average elasticity of substitution across groups of countries and overtime. We start by replicating Acemoglu and Ventura with updated data to show that countries growing faster than average experience a deterioration of their terms of trade, implying that the average elasticity of substitution between import and export is not too high. We also show that, consistent with our mechanism, government expenditure crowds out private production, which in turn leads to a terms of trade improvement, and that public expenditure has no direct effect on the terms of trade. More importantly, we perform two tests suggesting the relationship between openness and government size to be contingent on the presence of terms of trade externalities. In particular, we show that (1) estimates of the elasticity of substitution between import and export have fallen at the same time that the correlation between openness and government size has grown stronger, and (2) estimates of this elasticity are much smaller for the sub-sample of countries with a relatively stronger correlation between openness and government size.

Our second strategy is novel and allows to build, for individual countries, an intuitive proxy for the elasticity of substitution between import and export. The idea is to exploit Rauch (1999)'s detailed classification of traded commodities to compute, for each country, the share of differentiated products in total export. We then use this ratio as an inverse proxy for the elasticity of substitution and show that it drives the cross-country correlation between openness and government size. We thus conclude that our evidence is consistently in favor of the view based on the terms of trade externality, thereby suggesting that the increase in trade openness may have led to inefficiently large governments.

The paper is organized as follows. Section 2 illustrates the model, Section 3 brings it to the data, and 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

set policies 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.[7]

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.[8] Full specialization follows from the Armington assumption that goods are differentiated by the country of origin.[9] 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 consumption of the variety produced by country i in sector j and $\sigma > 1$ is the elasticity of substitution between varieties produced in different countries.[10] Equa-

[7] We purposefully distinguish between the two functions of the government, as a provider of insurance and public goods, to preserve the highest transparency in studying the determinants of each component of public expenditure. In reality, of course, such a distinction would be more blurred.

[8] 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.

[9] 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.

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

tion (3) is a generalization, introduced by Benassy (1998), of 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 each (identical) country produces the same amount y, so that consumption of a variety in any given country is y/N. Then, the sub-utility Y_j become $N^{\nu}y$, 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 can be important for welfare analysis.[11]

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.[12] An important advantage of this approach is that it offers a very natural measure of trade openness with a simple empirical counterpart. In particular, note that the utility function (2) implies that 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

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

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sufficient.

[11] None of our main results requires $\nu \neq (\sigma-1)^{-1}$.

[12] 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. 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 (2006), the number of product varieties imported by the US over the last three decades has increased by a factor of four.

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,[13] 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.[14] Moreover, we assume that workers must choose the sector of employment 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 insure the idiosyncratic productivity shock. However, in the following we rule out private insurance markets, or else there would be no role for public insurance, but 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 that seeks to maximize utility of its citizens. We assume that

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

[14] 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.

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.[15] 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.[16] 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.

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

[15] 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.

[16] The 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. Distortionary taxation would reinforce the result, as open countries will not fully internalize the distortion they impose on the world economy.

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:

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

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.[17] Note that $\Omega_n = \Omega_\tau = 1$ 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 shocks (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.

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

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

of C (12), the objective function of the government becomes:

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

which leads to the first order condition:[18]

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

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:

$$g = \frac{1-\eta}{1-\eta\tau/\sigma}. \tag{15}$$

Not surprisingly, it is easy to see that g is higher the stronger the preference for the public good, $(1-\eta)$.[19] More interestingly, so long as σ is finite, the size of the public sector grows with openness.[20] 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 externality. 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. 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.[21]

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

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

[20] The openness measure we refer to here is the volume of trade over private spending. However, it can be shown that (15) also implies a positive relationship between government size and the trade share in total GDP.

[21] Per capita government spending is instead independent of country size, L. This is a special implication of Cobb-Douglas preferences, as discussed in Alesina and Wacziarg (1998). If instead labor supply L where

2.3.1 Robustness

Although our model is special in many respects, the result that open countries do not fully internalize the cost of domestic taxation is a fairly general one. In fact, it does not depend on many of the simplifying assumptions we used. First, as shown in the Appendix, equation (15) can be generalized by removing the symmetry imposed across countries. This is important because, in reality, countries have different preferences for private versus public goods, different degrees of trade openness, and export goods with widely different characteristics. Introducing asymmetries in all the key parameters will allow us to fully exploit the cross-country variation in the data when testing equation (15) in section 3.

Second, the result is robust to alternative descriptions of the globalization process. Although introducing trade barriers of a different nature may require modifying some aspects of our model, it is unlikely to affect the main result. The reason is that, irrespective of the nature of trade barriers, the value of a terms of trade improvement is necessarily proportional to the volume of trade. Thus, the rise in domestic prices following an increase in taxation is more beneficial for countries relatively more open to trade.

Third, the 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 sovereignty. More important, our result is independent from the optimal tariff argument: as shown in the Appendix, equation (15) holds unaffected even when the government is optimally setting an export tax. It follows as a corollary that our analysis remains valid if firms have market power, not just countries.

Fourth, the Armington assumption according to which varieties are differentiated by the country of origin simplifies the analysis enormously, by making the pattern of specialization exogenous. Yet, it is not strictly required for the result to hold: the only crucial assumption is that countries be able to affect their terms of trade. This possibility is captured in a parsimonious way by the parameter σ in our model. Whether the case of a finite σ (for some or all countries) is realistic or not is an empirical question that we address later in the paper. We also want to stress that the terms of trade externality is a

endogenous, the terms of trade externality of our model could help explain why governments of more open European countries are more willing to restrict working hours compared to the US. We are grateful to Philippe Martin for suggesting this observation.

general feature of most trade models, and not a specific property of our approach.[22]

Finally, we would like to emphasize that policy makers need not be aware of the terms of trade externality to take advantage of it. Policy makers should just recognize that tax revenue is spent entirely on domestically produced goods while a fraction of private spending, proportional to openness, is spent on foreign goods, so that a rise in public spending is a way to increase demand for domestic labor. This argument is commonly heard in policy debates. Moreover, governments need not understand the role played by σ: in case of a high σ, they will just realize that increases in public spending to sustain domestic demand are not effective and will thus refrain from them.[23]

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. 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, the variance of wages in nontraded industries is zero.

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

[22] Some economists are skeptical about the practical relevance of terms of trade externalities. However, a growing number of papers provides evidence suggesting that terms of trade considerations play an important role in many contexts: they create seizable growth externality across countries (e.g., Acemoglu Ventura, 2002, Vilarrubia, 2006), lead to incomplete pass-through of exchange rate shocks (see Goldberg and Knetter, 1997, for a survey) and of tariffs (e.g., Feenstra, 2004, pp. 235-240), and affect the structure of protection across goods and countries (Broda, Limao and Weinstein, 2006).

[23] On the contrary, in case of a low σ, a government that does not expand public spending when the others do it experiences a fall in real wages and thus has strong incentives to use policies aimed at sustaining domestic demand.

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 (before transfers), $w_j = p_j y_j / L_j$, and its variance can be found as:

$$\begin{aligned} w_j &= Q_j (\pi_j)^{\frac{\sigma-1}{\sigma}} N^{\nu-\frac{\nu+1}{\sigma}} \left(\frac{Y_j}{L_j}\right)^{\frac{1}{\sigma}}, \quad j \leq \tau \\ VAR(w_{j\leq\tau}) &= \left(1-\frac{1}{\sigma}\right)^2 VAR(\pi), \end{aligned} \tag{16}$$

where we have used the fact that, by the law of large numbers, $VAR(Y_j) = VAR(Q_j) = 0$. 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 captures well 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.[24]

To study the effect of trade on the size of government through the demand for public insurance, we define public spending on insurance T as the total transfer needed to stabilize wages as a share of private 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 private production:

$$T = \int_0^\tau \frac{|w_j - w|}{2w} dj. \tag{17}$$

Using (16) and $\int_\tau^1 w_j dj = \frac{\tau}{1-\tau} \int_0^\tau w_j dj$ yields:

$$T = \frac{\tau}{2} \cdot \frac{(\overline{\pi}/\underline{\pi})^{\frac{\sigma-1}{\sigma}} - 1}{(\overline{\pi}/\underline{\pi})^{\frac{\sigma-1}{\sigma}} + 1}. \tag{18}$$

Total transfers grow with trade openness, τ, the elasticity σ and the variance of productivity π.[25] As $\sigma \to 1$ the need for insurance disappears and $T \to 0$. 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.

[24] 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).

[25] It follows immediately that transfers over total GDP (as opposed to private GDP) are also a positive function of the trade share in total GDP.

2.4.1 Robustness

The case of idiosyncratic productivity shocks is both plausible and simple, and this is why we focused on it. Yet, we would like to know what happens with shocks of different types. We now argue that introducing aggregate (rather than idiosyncratic) uncertainty and demand (rather than supply) shocks is unlikely to change the main conclusion of this section: that the need for insurance falls as the elasticity of substitution between domestic and foreign goods declines. To show this, we briefly discuss how changing the type of shock affects the relationship between trade and risk.

First, assume that π is an aggregate, country-specific, productivity shock. That is, all sectors in country i receive the same realization π_i. In autarky, a country would have no mean to insure against such risk.[26] For an open economy, terms of trade movements do provide some insurance, as it is shown in (16). Rather than amplifying risk, in this case trade dampens wage fluctuations; however, just as we saw before, terms of trade changes provide better insurance when σ is low.

Consider now preference (demand) shocks across varieties produced in different countries. These are external shocks, like shifts in world demand in favor (or against) the variety produced by a given sector in a country. Shocks of this sort can be introduced directly into preferences for differentiated varieties:

$$Y_j = N^{\nu+1}\left[\frac{1}{N}\sum_{i\in N}\left(\pi_{j,i}\right)\left(y_{j,i}\right)^{\frac{\sigma-1}{\sigma}}\right]^{\frac{\sigma}{\sigma-1}} \tag{19}$$

Note that nontraded sectors are, by construction, insulated from these shocks. On the contrary, deriving demand from (19) it can be shown that

$$VAR(w_{j\leq\tau}) = VAR\left(\pi\right).$$

With global shifts in the demand curve, the elasticity of substitution across varieties plays no role in determining a country's exposure to risk. If these shocks are uncorrelated across sectors, workers can be fully insured through transfers. If instead all sectors in a country are hit by the same demand shocks, then full insurance cannot be achieved.

Comparing all these cases, we conclude that, regardless of the source of uncertainty, the demand for insurance is (weakly) increasing in the elasticity of substitution between domestic and foreign goods.[27] Moreover, in a general situation where shocks of all kinds are present, trade increases risk provided that σ is sufficiently high.

[26] Though it could reduce workers exposure to risk by expanding the "safe" public sector.
[27] Cole and Obstfeld (1991) also support this view.

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 onto 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 $Y_w = N^{\nu+1}(1-g)$ 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 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). 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 is beneficial at first, but may become welfare-reducing beyond a critical level. That is, there may be an optimal level of international integration. This case is illustrated in Figure 1, where the level of utility is plotted against the trade share τ for two different values of the gains from trade.[28]

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

Proposition 1 *Openness can increase 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 weakens, while the terms of trade externality becomes stronger. As $\sigma \to \infty$ the terms of trade externality vanishes, while the demand for insurance becomes stronger.*

[28] Figure 1 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 1 shows two cases: $\nu \log (N\Omega_\tau/\Omega_n) = 0.3$ (solid line) and $\nu \log (N\Omega_\tau/\Omega_n) = 0.2$ (broken line). Of course, if gains from trade are strong enough, they will dominate over the entire range.

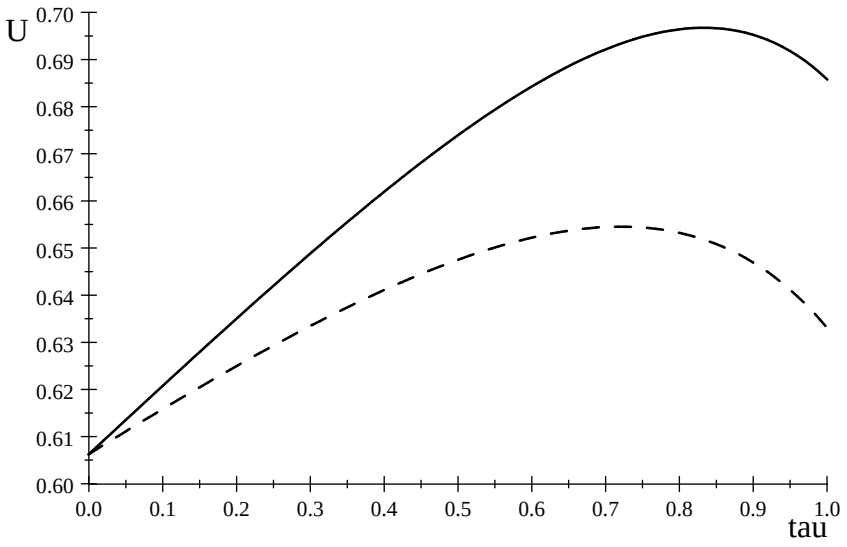

Figure 1: Trade Openness and Welfare

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 cannot explain variation in government size, that openness does not increase transfers for social security 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: a New Look at the Evidence

We start by exploring the robustness of the relationship between openness and government size. To this purpose, we use three different measures of government size. Our preferred measure is general government consumption expenditure (abbreviated as government consumption) as a share of GDP. This variable is a fairly good proxy for general government production, g, in our theoretical model.[29] Moreover, it is available from the Penn World

[29] 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

Tables (release 6.1, PWT henceforth) at current and constant prices[30] for a panel of about 150 countries over half a century (1950-2000). The availability of this variable allows us to go beyond cross-sectional regressions and to update and extend the evidence in Rodrik (1998) and Alesina and Wacziarg (1998), among others.[31] Second, we use data on central government expenditure, drawn from the World Bank website. This measure includes transfers and investment by the central government, but excludes expenditure by lower levels of government, and is available from 1972 to 1999 for up to 114 countries. Third, we use data on central government transfers for social security and welfare (drawn from the World Bank website and covering roughly the same period and countries as the previous measure) to test for the existence of a positive correlation between openness and public transfers. Finally, we follow the previous literature and our model in using the share of imports plus exports over GDP as a proxy for trade openness (from the PWT).

Table 1 reports Fixed-Effects within estimates using government consumption as the dependent variable. All variables except shares are in logs and 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, per capita income and population. Time dummies are included to avoid spurious results due to the correlation of our variables of interest with time effects.[32] Per capita income controls for Wagner's law, according to which the level of development may affect the availability of tax bases and public spending.[33] Finally, we follow Alesina and Wacziarg (1988) in controlling for population to take into account that larger countries trade less and may also have smaller governments due to scale economies in the provision of public goods.[34]

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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.

[30] 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).

[31] Many empirical studies have investigated more generally the determinants of the size of the public sector. A review of this literature goes beyond the scope of this paper. For the interested reader, we refer to the important contributions of Persson and Tabellini (1999 and 2003) and Alesina and Glaeser (2004).

[32] 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.

[33] Income could also be correlated with the demand for public goods, $1-\eta$. Yet, we generally find a robust negative association between government size and per capita income. See also Ram (1987) on this point.

[34] Consistent with Alesina and Wacziarg (1998), we find that the cross-sectional covariance between openness and government size is slightly reduced when controlling for population. In panel regressions,

In column (1), government consumption and openness are measured at current prices. The coefficient of openness is positive and significant 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. Together with the fact that openness increased on average by 42.5 percentage points, the growth of trade volumes alone can explain a 2.5 percentage points increase in government size, equal to one fifth of the total increase.[35] 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. Columns (3)-(6) report the results of 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 is larger in the second sub-period, suggesting that the positive correlation between openness and government size has strengthened overtime. In columns (7) and (8), we perform a more severe test: we add country-specific linear trends to our baseline specification. Remarkably, the coefficient of openness remains significant using both current and constant prices. Finally, when dropping all controls in column (9), the openness coefficient rises to about .1, with a t-statistic of 10.

Table 2 reports further robustness checks on the Fixed-Effects estimates. In columns (1) and (2), we estimate our baseline regression by Instrumental Variables (IV). In the former, the openness ratio is instrumented using its lagged period average. In the latter, all right hand variables (except the dummies) are treated as endogenous and instrumented using their lagged period averages.[36] Note that the IV estimates of the openness coefficient are substantially higher than in the baseline regression and are very precisely estimated. This suggests that the OLS estimates might be downward biased, possibly due to attenuation bias.[37] In column (3), we control for the political regime by adding the widely used *polity2* variable (drawn from the Polity IV dataset).[38] Interestingly, the results are unaf-

however, controlling for population turns out to have a negligible impact on the coefficient of the openness ratio. Moreover, although the coefficient of population is generally negative in cross-country regressions (as in Alesina and Wacziarg, 1988), in panel regressions its sign depends on the proxy for government size: for instance, it is positive when using government consumption and negative when using central government expenditure. The change in sign might be due to the fact that these two types of government expenditures are subject to different returns to scale and demand elasticities.

[35] With less prudential estimates of the openness coefficient reported later, the impact of trade volumes on the growth of governments can be even larger.

[36] The lagged values of the variables treated as endogenous are all strong instruments for their current values.

[37] Another possible source of downward bias of OLS estimates is that a rise in government size may reduce the relative size of the traded sector (and hence the openness ratio), thereby inducing a negative reverse effect.

[38] This variable takes values in the range -10 (high autocracy) to 10 (high democracy) according to the degree of openness of political institutions.

fected. In column (4), 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. As suggested by Rodrik (1998), the interaction term is meant to capture the fact that more open economies may be more exposed to external shocks and hence demand more public insurance. However, the coefficients of both controls are insignificant in our sample, whereas the size and significance of the coefficient of (lagged) openness are unaffected.

The openness ratio may also proxy for aspects of financial globalization that are unrelated to our theoretical framework. Therefore, in column (5) we control for financial restrictions by adding three time-varying dummy variables (drawn from the IMF) taking value of one in the presence of capital account restrictions, current account restrictions and exchange rate restrictions, respectively. Interestingly, the coefficient of the proxy for capital account restrictions is positive and significant, which is consistent with the idea that financial globalization promotes tax competition and thus smaller governments. The other proxies are however insignificant and, more important for our purposes, the openness coefficient is unaffected. In column (6), we control for foreign direct investment using the FDI share of GDP (net inflows, from the World Development Indicators). This proxy is insignificant and leaves the other results unchanged. In column (7), we control for the black market premium, whose coefficient turns out positive and significant, and find that its inclusion increases the size and significance of the trade openness coefficient. Finally, in column (8) we include all the proxies for financial openness in the same specification. The sample size shrinks substantially in this case, yet the coefficient of trade openness is still significant at the 2 percent level.

In Table 3, we rerun some of the above regressions using other measures of government size. In columns (1)-(3), the dependent variable is central government expenditure as a percentage of GDP. We run the baseline specification in column (1), use Instrumental Variables in column (2), and add the terms of trade variability and its interaction with lagged openness in column (3). The coefficient of openness is again positive and strongly significant. Note, however, that the sample is much smaller in this case and therefore, for sake of comparison, in column (4) we rerun regression (3) holding the sample constant and using government consumption as the dependent variable. The results suggest that in this sub-sample central government expenditure is even more closely correlated to openness than government consumption.

In columns (5)-(7), 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. These results are not driven by the change in sample size: using government consumption as the dependent variable for the same sample (column 8), the openness coefficient turns out even larger than in Table 2 (column 4) and very precisely estimated. Finally, even in this table, terms of trade variability does not seem to affect any kind of government expenditure.

In Table 4, we perform a final exercise by running 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. As shown in panel a), the size and significance of the coefficient of openness increase almost monotonically overtime, thereby confirming that the correlation between openness and government size has become stronger. In panel b), we keep the sample size constant throughout the different periods and find essentially the same results. In panel c), we instrument the openness ratio using the trade share predicted by geographical determinants proposed by Frankel and Romer (1999). We also report the F-test of excluded instruments. Since the Frankel and Romer variable is constructed using bilateral trade data for the mid-eighties, we find it to be a strong instrument in the 1980s only. In this decade, we also find that the coefficient of the openness ratio is positive and very precisely estimated. Remarkably, it is also larger than in the OLS regressions, again suggesting that OLS estimates may be biased downwards. Finally, in panel d) we add the five proxies for financial globalization discussed earlier (whose p-value is reported in square brackets) and find that the coefficient of the openness ratio is generally large and precisely estimated.[39]

3.2 Estimating the Terms of Trade Externality

We now look for evidence on the mechanisms linking the size of government to openness in the model of Section 2. A crucial feature of the theory is that a 1 percent fall in private output induces a $1/\sigma$ percent increase in the terms of trade (see equation 4). This pecuniary externality is what makes an expansion of the public sector less costly in open countries. At the same time, a low σ weakens the link between globalization and

[39] 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 ethnolinguistic 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.

governments through the demand for insurance, due to the compensatory role of price adjustments. Therefore, estimating σ is key to understanding which mechanism, if any, is driving the correlation between openness and government size. In this section, we show that the data are consistent with the notion that fast growing countries experience a terms of trade deterioration, and hence that σ is not too high for the average country. Then, in the next two sections we provide an answer to the critical question of whether the positive correlation between openness and government size is contingent on σ being high (consistently with the insurance hypothesis) or low (consistently with the externality view).

To start with, we use equation (4) to estimate a cross-country average of the elasticity of substitution between domestic and foreign goods. 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 terms of trade over the period of analysis, dy_i is the average growth rate of private output[40], X_i' is a set of controls and $\gamma = -1/\sigma$ captures the terms of trade externality.

Estimating σ from (24) poses a standard identification problem, as 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, or otherwise demand shocks would tend to generate a positive correlation between output growth and changes in the terms of trade, biasing γ towards zero and σ towards infinite. 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 distance from its steady-state: under the reasonable assumption that the growth rate due to convergence is exogenous to the terms of trade, it can be used to estimate σ. We therefore instrument dy_i in (24) 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

[40] Of course, in a cross-sectional context the growth of *world* output (i.e., the growth of Y_j in equation 4) is a constant and is therefore absorbed by the intercept coefficient. See Acemoglu and Ventura (2002).

(25) 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 this purpose, in some specifications of equation (25) we add the level and growth rate of the public sector (whose expected sign is negative) among the covariates Z_i'.

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, sourced from the PWT. Output of the private sector is measured as real GDP net of government consumption, from the same source. Table 5 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 two bottom lines of the 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, the bottom panel reports the OLS estimates of the terms of trade effect.

In column (1), we start with a baseline specification where we control for steady state relative income with the initial level of the log of average years of schooling and the log of life expectancy (the former is drawn from the Barro-Lee dataset, the latter from the World Bank website). The value of the F-statistic is very high, suggesting that our instruments are strong, and that the p-value of the J-statistic suggests against their endogeneity. Moving to the second stage, we find that the terms of trade externality is strong and significant at the one percent level. The point estimate suggests that a 1 percent increase in the growth rate of private output brings about a 0.32 percent fall in the terms of trade, implying 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 direct effect on the terms of trade. We find no evidence of such an effect. In column (3), we use secondary education instead of years of schooling 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 change in schooling 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, the 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 externality is significant at the one percent level and of 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.[41] Note that, 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. Moreover, 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.[42]

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 (hence, as a further control for the steady state relative income), and the latter as an included instrument, because the black market premium may act as a trade restriction, thereby affecting the terms of trade directly. As expected, we find that the coefficient of the change in the black market premium is positive and highly significant, although small. We also add, as an included instrument, a dummy for diversified exporters (from the World Bank website), whose coefficient is positive and significant at the 11 percent level. More important, the level and growth rate of government consumption still exert a strong negative impact on the growth rate of private GDP, while γ is close to 0.3 and significant at the 2 percent level.

Finally, the bottom panel of Table 5 reports the OLS estimates of the terms of trade effect. As mentioned earlier, OLS estimates mixing demand and supply changes should be biased toward finding a γ closer to zero (and therefore a higher σ). They can therefore provide a lower bound for the terms of trade effect. As expected, we find that OLS coefficients are smaller than IV coefficients. Interestingly, however, and contrary to Acemoglu and Ventura (2002), they are significant and have the same sign as the IV estimates, suggesting that the latter are not an artifact of the instrumenting strategy.

Overall, the results in Table 5 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

[41] Incidentally, adding more covariates in the first stage regressions brings the convergence parameter closer to the typical value of about 2 percent a year.

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

line with the value previously reported by Acemoglu and Ventura (2002) using a different dataset. Moreover, our estimates are similar to those found by Broda and Weinstein (2006) for the US economy through a very different approach: working with disaggregated data for the period 1972-2001, they report a median value for the elasticity of substitution between US varieties in the interval 2.7 - 3.6.

3.3 The Terms of Trade Externality Overtime and Across Groups

The evidence reported so far suggests the existence of strong terms of trade externalities, yet it does not discriminate between the two mechanisms linking government size to openness. Here, we follow a simple strategy to tell them apart. Proposition 1 asserts that, according to the terms of trade motive, the link between government size and openness is stronger the lower is σ, whereas the converse is true according to the insurance mechanism. Thus, if we can show that the relationship between openness and government size is contingent on the elasticity of substitution being low, we can therefore conclude that the evidence is only consistent with the terms of trade externality as the driving force. Ideally, we would need an estimate of σ for each country and time period, which is however impossible to have with our estimation strategy, as it requires both the cross-sectional and temporal variation to identify σ. 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 had fallen overtime. We can easily test this hypothesis by re-estimating σ using more recent data. The results are reported in Table 6, where we use the same estimation procedure and specifications as in Table 5, but use data for the sub-period 1980-2000 only.[43] 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.[44] In particular, the coefficients imply a value of σ between 1.3 and 1.4, dropping to almost one half of the value found for the entire period 1960-2000.[45] OLS estimates are also larger than those relative to the whole period and are always significant at the 5 or 10 percent level.

Second, we can estimate the elasticity of substitution separately for those countries

[43] To save space, the table displays only the coefficients of selected variables in the first stage regressions.

[44] Note, also, that our instruments pass both tests, as the F-statistic is always high and the J-statistic is always insignificant. Moreover, note that the level and growth rate of government consumption have a negative and highly significant impact on the growth rate of private GDP.

[45] Broda and Weinstein (2006) also find a fall of the elasticity of substitution between US varieties over time.

that exhibit a stronger correlation 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 terms of trade externality view. 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 contributed relatively more to estimating a positive coefficient of openness, 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.[46] Finally, we use the median value of the DF beta to split the sample.

Before running our crucial test, we pause to discuss the characteristics of the two groups of countries (the complete list is reported in the Appendix). Table 7 displays some descriptive statistics, showing that countries in the two groups are similar in many dimensions. Comparing sample means, countries with a relatively stronger correlation between openness and government size are larger (this group includes all the G-8 countries plus China), slightly richer and better endowed with human capital.[47] This may suggest that countries in the first group could 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). It is also reassuring that the average index of data quality (drawn from the PWT documentation) is very similar in the two groups of countries.

In Table 8 we estimate the elasticity of substitution for the two groups of countries using the same specifications as in Tables 5 and 6. To save space, the table only displays estimates of the terms of trade externality ($\gamma = -1/\sigma$) and first stage statistics. The unreported coefficients are however very similar to those previously found. The results are striking. The terms of trade externality 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 γ 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

[46] When running the baseline Fixed-Effects regression for the countries in the first group, we find that the coefficient of the openness ratio is equal to .222 (with a standard error of .016), almost four times larger than in the whole sample (see Table 1, column 1). For these countries, the average increase in the trade share between 1950 and 2000 implies a rise in the average government share of 9.5 percentage points.

[47] However, due to the large heterogeneity, none of these differences is statistically significant.

with a weaker association between openness and government size the terms of trade effect is much smaller (IV estimates of γ range from 0.10 to 0.16) and is never significantly different from zero. OLS estimates are even smaller and always insignificant.[48]

Finally, the two bottom panels of Table 8 check the robustness of our results by using a different approach to split the 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 externality 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 externality 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.

3.4 Openness, Product Differentiation and Government Size

Finally, we complement our previous analysis by appealing to an alternative strategy to build an intuitive proxy of σ for individual countries. In particular, we exploit the fact that the elasticity of substitution is lower among differentiated goods. This suggests that countries exporting differentiated products face, on average, a less elastic demand than countries specialized in homogeneous commodities. Moving from this observation, we combine data on the structure of exports with Rauch (1999)'s classification of traded commodities into differentiated and homogenous products. We then compute, for each country, the share of differentiated products in total exports and use it as an inverse proxy for σ. The main advantage of this approach is that it allows to directly test how the correlation between openness and government size depends on σ by simply introducing an interaction term. To compute this proxy, we use trade data at the 4-digit SITC (rev.2) level of disaggregation (from the UN-Comtrade dataset), so as to match Rauch's classification. Following other studies, we define a commodity as differentiated if it is neither sold on an organized exchange, nor reference priced. We use data for the year 2000 to maximize sample size (125 observations overall). With this new variable at hand, we reexamine the

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

relationship between government size and openness in a cross section of countries.

The main results are summarized in Table 9. Unless otherwise stated, variables are period averages for the years 1995-2000, with the openness ratio lagged one period. In column (1), we regress government consumption on the openness ratio and the export share of differentiated products, and find that the openness coefficient is unaffected by the inclusion of the new control, which turns out insignificant. In column (2), we perform our crucial test by adding the interaction term between openness and the share of differentiated products in total exports. Strikingly, the coefficient of the interaction term is positive, large and significant beyond the one percent level, whereas the coefficient of openness drops to zero. This suggests that openness is positively associated to larger governments only for countries exporting differentiated goods. In column (3), we add our baseline controls, income and population, and find that the results are unaffected. In column (4), we control for the interaction between openness and income to see whether our results are spuriously driven by the fact that the export share of differentiated products may be correlated with per capita income. They are not: the size and significance of the interaction with the export share of differentiated products increase even further, whereas the interaction with income is insignificant.

In columns (5) and (6), we control for terms of trade variability using two different measures: in the former we use the standard deviation of terms of trade (over the entire period 1960-2000), in the latter the standard deviation of the log changes of terms of trade (over the same period). We also interact these terms with the openness ratio. The result is that the coefficient of the interaction with the export share of differentiated products remains always large and highly significant, openness is always insignificant and none of the proxies involving terms of trade variability is ever significant. In column (7), following Rodrik (1998), we include the normalized Herfindahl index of export concentration and its interaction with openness.[49] Interestingly, the new control increases the size and significance of the interaction with the export share of differentiated products. The coefficient of the new term turns out positive and significant at the 10 percent level. However, column (8) reveals this result to be fragile, as the coefficient looses significance when dropping the two terms involving our inverse proxy for σ. To complete the picture, in column (9) we include all controls in the same regression and find that, strikingly, the interaction term between openness and the export share of differentiated products becomes even stronger, whereas all other controls turn out insignificant.[50]

[49] This term may capture the fact that highly concentrated exports may increase the exposure to risk. We use data for the year 2000 from the UNCTAD-Handbook of Statistics to compute it.

[50] We have also performed other checks, not reported due to space constraints. In particular, the size and significance of the interaction term between openness and the export share of differentiated products

4 Conclusion

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.

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.

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5 Appendix

5.1 Country Groups

The countries with a relatively stronger association between openness and government size are: 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 Openness and the Size of Government with Asymmetric Countries

We show how to modify the model to allow for cross-country differences in all the parameters. For simplicity, we limit to partial equilibrium in that we do not solve for world quantities. This is without loss of generality since any (small) country takes world production as given. First, we allow the range of traded goods to vary across countries, so that in different countries different sectors may produce for world markets. For trade to be feasible, we assume that for any good that is traded in a country there is a positive mass of countries where products from the same sector are traded as well.[51] This means that varieties produced in a given sector can be nontraded everywhere, traded by a subset of countries only, or traded by all countries. We denote the mass of countries where industry j is traded as N_j and the total mass of traded sectors in country i as τ_i.

Second, we assume that σ varies across goods but that a country only trades goods with the same σ. This is intended as a shortcut for a more general model where σ varies across exports and the σ we consider represents an appropriate country-average. The important feature we want to capture here is that countries may differ in their ability to affect the terms of trade due to the product characteristics of their export. Our assumption delivers this in the most parsimonious way. Finally, we allow the preference for private consumption, η_i, to vary across countries.

Let us consider country i and, for simplicity, abstract from uncertainty ($\epsilon = 0$). Consumption of goods produced in sector j can be found as follows. If good j is nontraded,

[51] We also maintain the assumption that a country is always small in international markets.

then consumption is equal to domestic production:

$$Y_{i,j} = L_{i,j}. \tag{26}$$

If good j is traded, domestic consumption equals disposable income divided by the price index in sector j:

$$Y_{i,j} = \frac{w_i}{Q_j} L_i (1 - g_i) = \left[(L_{i,j})^{-1} (N_j)^{\nu\sigma - \nu - 1} Y_{w,j} \right]^{1/\sigma} L_i (1 - g_i). \tag{27}$$

Next, we need to solve for $L_{i,j}$. In nontraded sectors, domestic expenditure equals the value of domestic production, $(1 - g_i) w_i L_i = w_i L_{i,j}$, so that $L_{i,j} = (1 - g_i) L_i$. Labor market clearing requires:

$$\int_0^1 L_{i,j} dj = (1 - \tau_i)(1 - g_i) L_i + \tau_i L_{i,\tau} = (1 - g_i) L_i,$$

where $L_{i,\tau}$ is employment in the average traded sector. Solving:

$$L_{i,\tau} = (1 - g_i) L_i.$$

Labor allocation across traded sectors will vary in an asymmetric equilibrium. Equalizing wages in any two traded sectors j and z we have:

$$L_{i,j} = L_{i,z} \left(\frac{N_j}{N_z} \right)^{\sigma\nu - (\nu+1)} \frac{Y_{w,j}}{Y_{w,z}} \left(\frac{Q_j}{Q_z} \right)^{\sigma}.$$

Integrating over the set Γ of traded sectors in country i, we find:

$$L_{i,j} = \kappa_{i,j} L_{i,\tau},$$

where $\kappa_{i,j} \equiv \frac{(N_j)^{\sigma\nu-(\nu+1)} Y_{w,j} (Q_j)^{\sigma}}{\int_\Gamma (N_z)^{\sigma\nu-(\nu+1)} Y_{w,z} (Q_z)^{\sigma} dz}$ is a constant. Finally, with the expressions for $L_{i,j}$ at hand, we can substitute (26) and (27) into utility:

$$C_i = \left[\exp \int_0^1 \log Y_{i,j} dj \right]^{\eta_i} G_i^{1-\eta_i} = K_i \left[(1 - g_i)^{1 - \frac{\tau_i}{\sigma_i}} \right]^{\eta_i} g_i^{1-\eta_i},$$

where K_i collects all terms that are taken as given by country i. Maximizing C_i with respect to g_i gives:

$$g_i = \frac{1 - \eta_i}{1 - \eta_i \tau_i / \sigma_i},$$

which is a simple generalization of equation (15) in the text.

5.3 Taxation and Optimal Trade Policy

We now show that our results hold even when the government can set an optimal trade tax. We introduce 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 ($\epsilon = 0$). 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:

$$p_\tau (1-t) = w = p_n, \tag{28}$$

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 (28) yields labor allocation in each sector: $L_\tau = (1-t) L_n$. As expected, the export tax shifts labor out of exporting industries and allows the government to choose employment levels in traded and nontraded sectors. With full employment, these are:

$$L_\tau = \frac{(1-t)(1-g)}{1-t\tau} L, \tag{29}$$

$$L_n = \frac{1-g}{1-t\tau} L. \tag{30}$$

Substituting (29) for $(1-g)L$ into (11) and similarly (30) 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:

$$\underset{\{g,\, t\}}{Max}\ U = \left(\frac{1-g}{1-t\tau}\right)^{(1-\tau)\eta} \left\{ \left[\frac{(1-t)(1-g)}{1-t\tau}\right]^{\frac{\sigma-1}{\sigma}} N^{\nu-(\nu+1)/\sigma} \left(\frac{Y_w}{L}\right)^{\frac{1}{\sigma}} \right\}^{\tau\eta} (gL)^{1-\eta}. \tag{31}$$

Then, the first order condition for t requires $t = \sigma^{-1}$, confirming the well-known result that the optimal export tax is the inverse of the foreign demand elasticity. More importantly, it is easy to verify from (31) that the first order condition for g is still given by (15).[52]

[52] See also Boadway, Maital and Prachowny (1973) on the independence between optimal tariffs and domestic taxation.

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

Dependent variable: Government Consumption (% of GDP)

	(1) *Baseline*	(2) *Constant prices*	(3) *1950-1975, curr. pr.*	(4) *1950-1975, const. pr.*	(5) *1975-2000, curr. pr.*	(6) *1975-2000, const. pr.*	(7) *Adding trends (curr . pr.)*	(8) *Adding trends (cons . pr.)*	(9) *Dropping all controls*
Openness	**.060*** **	**.041*** **	**.045*** **	**.029*** **	**.058*** **	**.093*** **	**.024** **	**.048*** **	**.097*** **
	(.012)	**(.008)**	**(.014)**	**(.010)**	**(.017)**	**(.015)**	**(.012)**	**(.009)**	**(.011)**
Log of GDP	-3.92***	-4.03***	-6.46***	-8.16***	-.435	-.715	-2.17*	-2.97**	
	(.736)	(.866)	(1.03)	(1.21)	(1.46)	(1.77)	(1.21)	(1.30)	
Log of population	6.66***	6.07***	8.79***	6.74***	2.39	2.81	4.49	1.89	
	(1.40)	(1.69)	(1.93)	(2.33)	(3.21)	(3.93)	(4.38)	(4.74)	
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
# obs.	1171	1171	602	602	691	691	1171	1171	1181
# groups	168	168	122	122	168	168	168	168	168
R-squared	.28	.11	.48	.22	.07	.13	.69	.69	.07

Fixed-Effects within 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 current prices (odd columns) and constant prices (even columns). Regressions in columns (7) and (8) also include country-specific linear trends, whose coefficients are not reported in the table. Data source: PWT 6.1.

Table 2. Trade, Polity, Financial Openness and Government Consumption (Fixed-Effects)

Dependent variable: Government Consumption (% of GDP)

	(1) *IV*	(2) *IV*	(3) *Adding Polity*	(4) *Adding ToT variability*	(5) *Adding financial restrictions*	(6) *Adding FDI flows*	(7) *Adding BMP*	(8) *Adding fin. restr.+ FDI + BMP*
Openness	**.080*** **	**.075*** **	**.060*** **	**.048*** **	**.048*** **	**.052*** **	**.078*** **	**.048** **
	(.021)	**(.008)**	**(.013)**	**(.015)**	**(.015)**	**(.018)**	**(.015)**	**(.020)**
Log of GDP	-3.64***	-2.86***	-3.39***	-3.44***	-1.61	-.085	-2.17**	1.64
	(.856)	(.974)	(.761)	(.940)	(1.03)	(1.29)	(.930)	(1.31)
Log of population	7.06***	7.89***	7.56***	6.71***	6.32***	3.40	9.59***	3.86
	(1.40)	(1.61)	(1.36)	(1.76)	(2.14)	(2.83)	(1.72)	(2.97)
Polity			-.007					
			(.049)					
ToT variability				-.476				
				(1.09)				
ToT var.×openn.				-.003				
				(.014)				
Capital acc. restr.					2.06**			2.71***
					(.844)			(.990)
Current acc. restr.					.812			-.036
					(.780)			(.917)
Exchange rate restr.					.820			.759
					(.717)			(.808)
FDI						.111		-.011
						(.083)		(.108)
Black market pr.							.002***	.002***
							(000)	(.000)
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
# obs.	1005	1003	1006	896	754	718	792	566
# groups	148	148	148	146	134	154	137	126
R-squared	.25	.25	.27	.23	.19	.10	.30	.19

All variables are computed as five-year averages from 1950-54 to 1990-94 and as six-year averages from 1995 to 2000. Openness and government consumption are measured at current prices. In column (1), the openness ratio is instrumented using its lagged five-year average. In column (2), all RHS variables are instrumented using their lagged five-year averages. *Polity* equals polity2, the combined polity score drawn from the Polity IV dataset. In column (4), the openness ratio is 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. Capital account, current account and exchange rate restrictions are dummy variables equal to one in the presence, respectively, of capital account, current account or exchange rate restrictions. FDI is equal to the net foreign direct investment inflows as a share of GDP. Data sources: PWT 6.1, Polity IV, WDI and IMF.

Table 3. Openness and Other Measures of Government Size (Fixed-Effects)

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

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Central Government Expenditure			*Gov. cons.*	*Social Security and Welfare*			*Gov. cons.*
	Baseline	*IV*	*Adding ToT variability*	*(same sample)*	*Baseline*	*IV*	*Adding ToT variability*	*(same sample)*
Openness	**.049****	**.163*****	**.109*****	**.058*****	**-.013****	**-.015**	**.002**	**.078*****
	(.021)	**(.023)**	**(.025)**	**(.023)**	**(.006)**	**(.015)**	**(.008)**	**(.024)**
Log of GDP	-5.55***	-4.84**	-7.73***	-3.24*	-1.24**	-.513	-1.57***	-5.37***
	(1.54)	(2.18)	(1.80)	(1.70)	(.516)	(.776)	(.600)	(1.90)
Log of population	-16.77***	-16.7***	-18.86***	8.68***	-7.37***	-7.34***	-7.69***	5.46*
	(2.91)	(3.27)	(3.10)	(2.94)	(.946)	(1.06)	(1.00)	(3.19)
ToT variability			-2.13*	-.605			-.077	-1.14
			(1.24)	(1.18)			(.383)	(1.22)
ToT var.×openn.			.011	.011			.003	.014
			(.015)	(.014)			(.004)	(.014)
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
# obs.	475	455	399	399	397	380	337	337
# groups	114	105	103	103	107	100	98	98
R-squared	.30	.24	.35	.17	.36	.37	.39	.21

All variables are computed as period averages for 1970-74, 1975-79, 1980-84, 1985-89, 1990-1994 and 1995-2000. Openness and government size are measured at current prices. In columns (2) and (6), all RHS variables are instrumented using their lagged five-year averages. In columns (4) and (8), the sample is the same as in columns (3) and (7), respectively, and the dependent variable is government consumption. In column (3)-(4) and (7)-(8), the openness ratio is lagged one period. Data on Central Government Expenditure and on Expenditure for Social Security and Welfare span from 1972 to 1999. Data sources: PWT 6.1 and World Bank website.

Table 4. Openness and Government Consumption in Different Time Periods

Dependent variable: Government Consumption (% of GDP)

a) Baseline				**1955-59**	**1960-64**	**1965-69**
Openness $_{-1}$				-.022	.015	-.005
				(.037)	(.030)	(.032)
# observations				65	73	110
R-squared				.01	.01	.02
	1970-74	**1975-79**	**1980-84**	**1985-89**	**1990-95**	**1995-00**
Openness $_{-1}$	.027	.089**	.109**	.108***	.127***	.115***
	(.040)	(.045)	(.054)	(.038)	(.038)	(.031)
# observations	110	113	119	121	126	145
R-squared	.07	.14	.35	.44	.42	.36
b) Holding the sample const.		**1975-79**	**1980-84**	**1985-89**	**1990-95**	**1995-00**
Openness $_{-1}$		.095**	.129***	.091**	.119***	.112***
		(.046)	(.047)	(.039)	(.039)	(.039)
# observations		110	110	110	110	110
R-squared		.14	.26	.33	.39	.34
c) Instrumental Variables	**1970-74**	**1975-79**	**1980-84**	**1985-89**	**1990-95**	**1995-00**
Openness $_{-1}$	1.07	.537	.429***	.344***	.271*	.267*
	(2.44)	(.485)	(.158)	(.140)	(.148)	(.153)
F-test excluded instruments	.26	3.91	12.62	9.59	8.85	4.10
# observations	109	112	115	117	117	122
R-squared	.00	.00	.03	.10	.29	.15
d) Adding financial variables	**1970-74**	**1975-79**	**1980-84**	**1985-89**	**1990-95**	**1995-00**
Openness $_{-1}$	.047	.130**	.178***	.148***	.136**	.089**
	(.058)	(.056)	(.059)	(.050)	(.057)	(.043)
P-value financial variables	[.95]	[.06]	[.59]	[.00]	[.26]	[.00]
# observations	71	87	91	93	90	99
R-squared	.09	.24	.29	.43	.39	.46

All variables are period averages, with the openness ratio lagged one period. All regressions include the log of real per capita GDP and the log of population, whose coefficients are not reported in the table, and exclude outlier countries with an openness ratio greater than 200%. Panel a) reports cross-sectional OLS estimates (with robust standard errors in parentheses) for each period from 1955-1959 to 1995-2000. Panel b) reports the same estimates for the sample of countries with available data in the period 1965-69. In panel c), the openness ratio is instrumented using the Frankel and Romer (1999) instrument. In panel d), the following broad proxies for financial openness (whose *p-value* is reported in square parentheses) are added to the baseline specification: three dummy variables equal to one in the presence, respectively, of current account restrictions, exchange rate restrictions or capital account restrictions, the black market premium and the FDI share of GDP. Data sources: PWT 6.1, WDI, IMF and Frankel and Romer (1999).

Table 5. IV and OLS 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 and OLS estimates (with robust standard errors in parenthesis) of the growth rate of terms of trade. The growth rate of terms of trade is measured as the annual growth rate of export prices minus the growth rate of import prices. Private GDP is measured as real GDP net of government consumption, except in column (5), where overall GDP is used instead. 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 6. IV and OLS 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***	-.009***	-.010***	-.009***	-.012***	-.008***	-.016***	-.015***
	(.003)	(.003)	(.003)	(.003)	(.004)	(.003)	(.004)	(.005)
Log of gov. share, 1980							-.014***	-.013***
							(.005)	(.005)
Growth of gov. share of GDP							**-.356*** **	**-.336*** **
							(.103)	**(.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*** **	**-.731*** **	**-.787*** **	**-.767*** **	**-.721*** **	**-.698*** **	**-.738*** **	**-.763*** **
	(.243)	**(.275)**	**(.287)**	**(.267)**	**(.249)**	**(.269)**	**(.241)**	**(.270)**
Growth of years of schooling		.004			.002	.007	.005	.003
		(.008)			(.008)	(.008)	(.008)	(.008)
Growth of sec. schooling			.000					
			(.008)					
Growth of gov. share of GDP							-.136	-.134
							(.101)	(.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** **	**-.195* **	**-.186* **	**-.221** **	**-.196** **	**-.186* **	**-.205** **	**-.220** **
	(.108)	**(.107)**	**(.109)**	**(.108)**	**(.092)**	**(.113)**	**(.101)**	**(.105)**
# obs.	93	93	93	93	93	89	93	89

See notes to Table 5.

Table 7. Descriptive Statistics across Groups

	Mean	Standard deviation	Minimum	Maximum	# Observations
Countries with a stronger positive relation between openness and government size					
Population	46844	147092	67	1232220	74
Real per capita GDP	8275	8327	464	30717	74
Av. years of schooling	6.7	3.1	.8	12.2	51
Gov. share of GDP	21.4	12.7	6.3	57.2	74
Openness	75.6	41.9	19.0	209	74
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
Index of data quality	2.21	.95	1	4	74
All other countries					
Population	28797	115238	41	971743	74
Real per capita GDP	7746	7758	304	38739	74
Av. years of schooling	6.1	2.7	.8	11.9	52
Gov. share of GDP	21.0	11.4	4.3	58.5	74
Openness	92.2	51.6	26.3	319.4	74
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
Index of data quality	2.07	.76	1	4	74

The upper (lower) panel reports statistics for the group of countries that contributed more (less) to the positive coefficient of the openness ratio estimated in column 1 of Table 1 (i.e., countries with an average DF beta greater (lower) than the median value). Most statistics reported in the table are period averages for 1995-2000. 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 8. IV and OLS 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 5.

Table 9. Openness, Product Differentiation and Government Size (1995-2000)

Dependent variable: Government Consumption (% of GDP)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Openness $_{-1}$	**.150*** (.033)**	**.000 (.048)**	**.026 (.048)**	**.291 (.236)**	**.087 (.072)**	**.138 (.101)**	**-.122 (.091)**	**.121* (.065)**	**.125 (.366)**
Share of differentiated products in total exports	-.047 (.034)	-.241*** (.066)	-.125** (.062)	-.153*** (.058)	-.125** (.062)	-.121** (.059)	-.181*** (.060)		-.179*** (.055)
Openness $_{-1}$ ***× share of differentiated products in total exports***		**.279*** (.092)**	**.229*** (.079)**	**.275*** (.069)**	**.236*** (.081)**	**.226*** (.072)**	**.324*** (.083)**		**.326*** (.068)**
Log of GDP			-4.49*** (.742)	-2.43 (1.59)	-4.53*** (.758)	-4.44*** (.747)	-4.45*** (.802)	-4.37*** (.888)	-3.38 (2.05)
Log of population			-.491 (.791)	-.590 (.803)	-.500 (.774)	-.574 (.784)	-.361 (.730)	-.657 (.787)	-.482 (.729)
Openness $_{-1}$ *× income*				-.034 (.027)					-.016 (.035)
Standard deviation of terms of trade (1960-00)					.010 (.011)				
Openness$_{-1}$ *× standard deviation of terms of trade (1960-00)*					-.160 (.153)				
Standard deviation of the log change of terms of trade (1960-00)						.104 (.144)			8.26 (13.3)
Openness$_{-1}$ *× standard dev. of log change of terms of trade (1960-00)*						-.240 (.216)			-.202 (.200)
Export concentration index							-187 (.130)	-.061 (.141)	-.146 (.157)
Openness$_{-1}$ *× export concentration index*							.325* (.169)	.081 (.180)	.266 (.220)
# obs.	125	125	125	125	125	125	125	125	125
R-squared	.22	.28	.41	.42	.42	.43	.44	.37	.45

Cross-section OLS estimates with robust standard errors in parentheses. The share of differentiated products in total exports is computed as the share of 4-digit SITC (rev. 2) goods classified as differentiated (according to Rauch, 1999) in each country's total exports in the year 2000. The terms of trade variability is computed over the period 1960-2000. The export concentration index is the normalized Herfindahl index of country export concentration in the year 2000 (from the UNCTAD Hanbook of Statistics). All other variables are period averages for 1995-2000, with the openness ratio lagged one period. All regressions exclude outlier countries with an openness ratio greater than 200%. Data sources: PWT 6.1, UN-Comtrade, UNCTAD and Rauch (1999).