Public Sector Growth: The Role of Globalization*

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Abstract

This paper analyzes the effect of capital market integration and trade liberalization on nominal relative government size, keeping the real government share constant. It is shown that opening capital markets may lead to an increase in the relative wage rate pushing the costs in the labor intensive public sector relatively more than in the private sector. Trade liberalization may also increase relative nominal government size through raising average productivity in the private sector and inducing a Balassa-Samuelson effect.

Keywords: Capital market integration, trade liberalization, Balassa-Samuelson effect, public sector growth

JEL Classification: F11, F12, F15 , F21, H41, H50

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1 Introduction

In a seminal paper Baumol (1967) argues that productivity increase in the progressive sector induces wages to rise in all sectors if labor is mobile between sectors. This leads to a higher cost and price increase in the sector with lower productivity experience. It implies that the expenditure share for the stagnant sector rises if real output shares are constant (i.e., if demand is sufficiently price inelastic or income elastic). This has been commonly called Baumol's costs disease. While this term has been mainly used in the growth literature, the analogous mechanism in the trade framework is called the Balassa-Samuelson effect according to which higher productivity in the tradable sector leads to higher prices in the less progressive, labor intensive and non-tradable sector (Balassa, 1964; Samuelson, 1964). The public sector is typically characterized as labor intensive, exhibits low productivity growth and produces mainly non-tradable goods. Therefore, Baumol's cost disease and the Balassa-Samuelson effect provide us with an explanation for the steady growth of the public sector.

This paper analyzes the impact of globalization - more precisely integration of capital markets and trade liberalization - on the relative costs of the public sector in a general equilibrium framework. We follow Baumol (1967) and hold real public sector share constant while analyzing the effect on the expenditure shares. This allows us to isolate the purely economic effects of integration on public sector growth from changes through the political channel. It is shown that capital market and goods market integration may lead to rising public budget shares. In particular, the paper identifies a channel which is related to the Balassa-Samuelson and Baumol effect, however driven by a decrease in transportation costs. Accounting for heterogeneous firms in line with Melitz (2003) trade liberalization affects average productivity positively which in turn raises the costs of the public sector. Furthermore, it is shown that capital inflow raises the relative wage rate and the relative costs in the labor intensive public sector.

The intention of the paper is to tie in with the "openness and government size" literature. There is however one major difference, which is, we assume that the public sector does not actively react with its share to globalization. There will be no welfare maximizing government. This was the standard approach in the theoretical literature dealing with the effect of globalization on government size. In this literature, optimal public good provision is derived and compared for closed an open economies. Hence, the government is assumed to react actively with its share to globalization. Optimal public good provision may be different in open and closed economies as market integration brings additional costs or additional benefits. The standard tax competition argument is that optimal public good provision is lower as capital markets are integrated since large taxes on capital implies an outflow of capital and therefore higher costs of public good provision compared to closed capital markets. However, taking into account insights from new geography models, like Baldwin and Krugman (2004) the reverse may be deduced. Tax competition may lead to larger governments. A different argument is provided in the seminal paper Rodrik (1998), where he argues that external risk is higher in open countries. This leads to an increase in demand for public insurance which will be provided by the government. Active governments may also react to trade integration with larger governments since a fraction of its costs can be exported to the foreign countries. Trade liberalization may bring gains from trade in the form of a terms of trade effect and/or love of variety effect (see Epifani and Gancia (2008) and Hanslin (2008)) whereof governments can benefit.

Although the relationship between openness and government size has been widely discussed in the literature, as far as we have found, the price level of governments (relative to the price level of GDP) has not yet been related to measures of openness at least theoretically.[1] However, data for OECD countries shows an interesting correlation between the relative price level of governments to the price level of GDP and some measures of openness (figures 1-3). In figure 1 the correlation between the price level of government (relative to the price level of GDP) and FDI flows is plotted. One observation corresponds to any year between 1981 and 2004. The figure indicates that larger financial openness is associated with higher relative prices

[1] Empirical analysis such as Clague (1986) and Kravis and Lipsey (1983) who tried to explain national price levels have controlled for trade openness.

in governments. The same picture is found for trade openness and relative prices. Higher exports and imports relative to GDP is positively correlated with relative price level (figure 2). Interestingly not only openness measures such as flows but also trade liberalization in the sense of a reduction of import tariffs is positively correlated with the relative price levels as it is shown in figure 3. The sample of figure 3 consists only of 15 OECD countries.

Figure 1: Correlation between relative price levels and financial openness

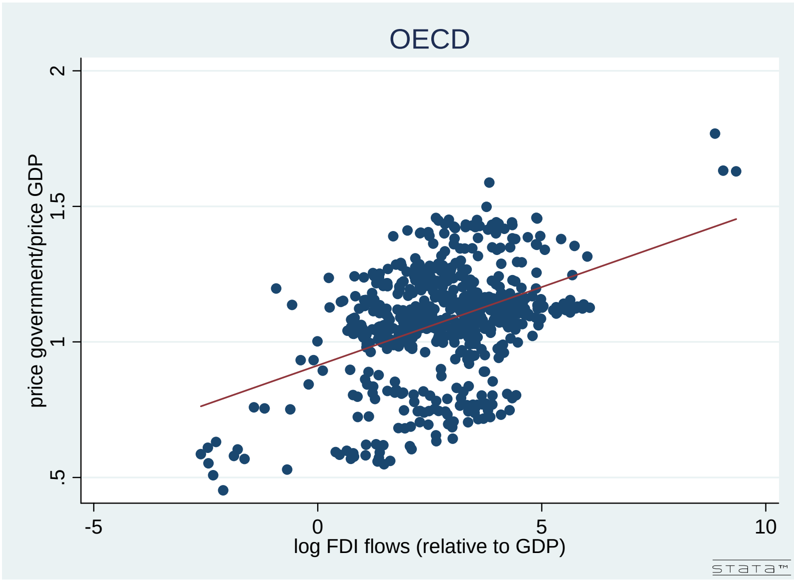


Figure 2: Correlation between relative price levels and openness in trade

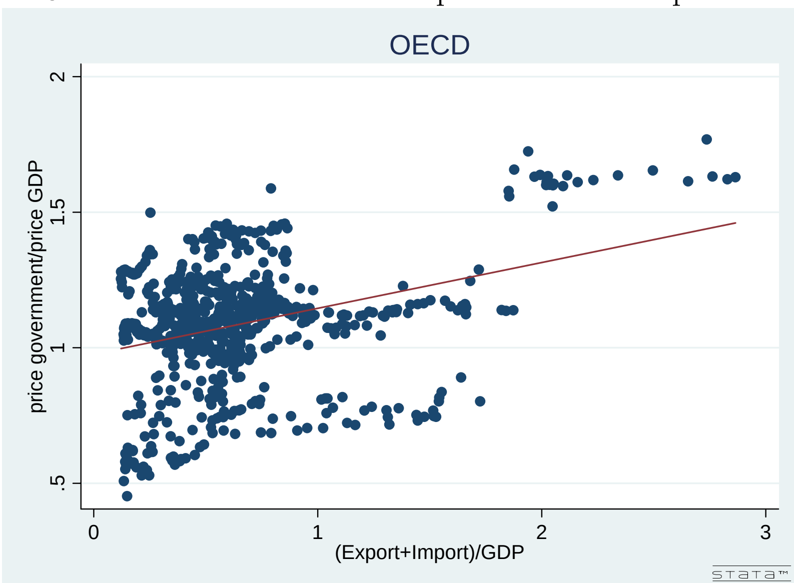
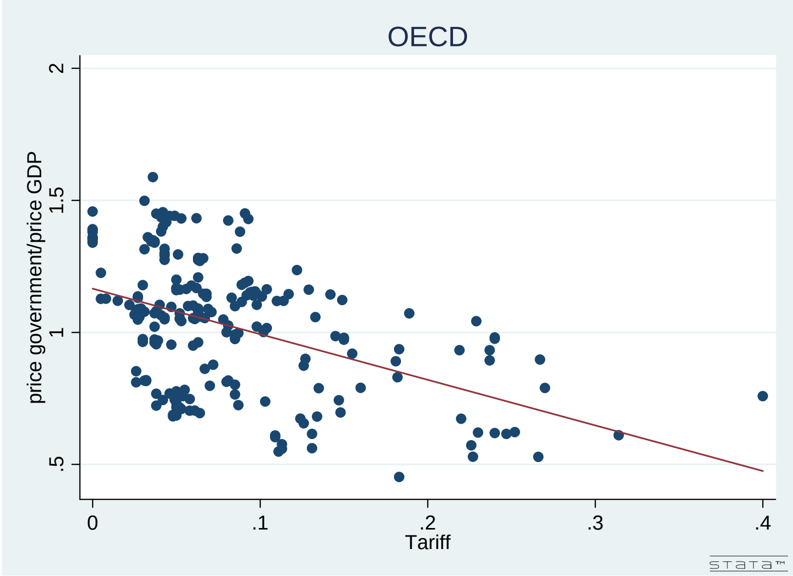


Figure 3: Correlation between relative price levels and average import tariffs



The paper begins with a standard Heckscher-Ohlin small open economy framework and perfect competition to analyze the effect of capital market integration. Capital inflow depresses the interest rate and raises the relative wage rate which leads to higher relative public expenditure. Contrary, if opening capital markets leads to capital outflow, public spending decreases. That relative capital (to labor) endowment leads to higher relative prices in service and/or non-market sectors has been discussed in the literature, see for example Bhagwati (1984) and Gemmell (1987). However, relating relative prices to capital mobility has, to our knowledge, not yet been covered, although capital flows have taken on a dimension which is far from negligible. We argue that it is not relative endowment but relative employment of capital which is decisive for the relative factor prices which makes capital flows an important determinant for relative price levels of the non-tradable and labor intensive public sector.

Further interesting insights are obtained in a Melitz (2003) framework. Trade liberalization leads to higher average productivity which lowers unit costs in the private sector and increases the relative costs of the public sector. Furthermore, the rise in average productivity increases relative wage rate which induces an additional public cost push. This productivity change in the private sector which is endogenously driven by trade liberalization induces a Baumol's cost disease combined with a Balassa-Samuelson effect.

The two theoretical channels are analyzed empirically for a large country sample and separately for the OECD countries. Two measures for the relative costs of the public sector are used, both derived from from PWT 6.2. One is the ratio of current to constant price relative public expenditures and the other is the price level of governments relative to the price level of GDP. We investigate whether net capital inflow and trade liberalization have a positive effect on the two aforementioned measures.

Section 2 develops the theoretical framework and highlights the new results on public sector expenditure shares in response to capital market and trade liberalization. Section 3 presents the empirical analysis of the two hypothesis derived from the theoretical model. Section 4 concludes.

2 The Model

We consider an economy with two sectors, a private and a public, and two production factors, capital and labor. Both production factors can move freely between the sectors within country. Labor and initially also capital are assumed to be immobile across countries. However, capital market integration will be discussed. The public sector produces one non-tradable public good. The private goods are assumed to be tradable.

2.1 Preferences

Utility of the representative household depends on the private and public sector output. Preferences over private and public sector output are given by a Leontief function such as

$$\min\{X, \frac{1}{g}G\}\ , \qquad g > 0$$

where G stands for public sector output and X denotes output in the private sector. Optimal consumption results in a constant real government share to private output given by the constant g

$$g = \frac{G}{X} \ .$$

The assumption underlying the specification is that public and private goods are complements and that the price elasticity of demand is equal to zero. Independent of the price level, the household wants to consume a constant amount of the private and public good. This is of course an extreme assumption. There is however a strong consensus that demand for public goods is price inelastic. Early estimates of the price elasticity of demand for public goods were found to lie between -0.4 and -0.5 (see Bergstrom and Goodman, 1973 and Borcherding, 1985). Hence, assuming an elasticity between zero and one would be realistic but makes the analysis more complicated. To avoid undue complexity we will therefore stick to the assumption of complete inelastic demands. It is important to mention here that the obtained results do not require the strong assumption of no price elasticity.

2.2 The public sector

The public good G is produced according to linear-homogeneous strictly concave production function:

$$G = F_G(K_G, L_G)$$

where K_G and L_G are the inputs of capital and labor.

It is assumed that the public sector takes factor prices as given. There is no direct price for the public good since it is not 'sold'. The implicit price is given by its costs which are payed by a lump-sum tax T which is levied on the representative consumer. Cost minimization of the public sector leads to minimal unit cost

$$c_G(r, w) = a_G(\omega)w + b_G(\omega)r$$

where $a_G(\omega)$ and $b_G(\omega)$ are the cost minimal labor and capital coefficients, respectively, and $\omega \equiv w/r$ is the factor price of labor relative to the factor price of capital. Capital intensity in the public sector is given by $k_G \equiv \frac{K_G}{L_G} = \frac{b_G(\omega)}{a_G(\omega)}$.[2]

[2]See Section A.1 in Appendix for the derivation.

The two central measures for size of the public sector are (1) provision of public good relative to the output of the private sector (X):

$$g = \frac{G}{X}$$

and (2) the costs of public good provision relative to the value of the domestic private sector output:

$$g_n = \frac{c_G G}{pX} = \frac{c_G}{p} g \ .$$

The distinctive between the nominal and real ratio of the public and the private sector provides the possibility to analyze the effects of globalization on the relative costs of the public sector. Thus our main focus will be on the ratio between the nominal and real government share $\frac{g_n}{g}$ for which we take the approach to keep real relative government activity unchanged (g) while analyzing the effects of globalization on g_n. This is the case with Leontief utility function. Under Cobb-Douglas preferences expenditures shares and hence g_n would stay constant while g is endogenous. As our interest lies in analyzing changes in the ratio between the nominal and real government share, it does not matter whether we are going to assume Leontief or Cobb-Douglas utility or even if we assume preferences with inelastic demands for some degree. The qualititative effect on $\frac{g_n}{g}$ does not depend on the preferences assumptions.[3]

2.3 Private sector

In the private sector, we will distinguish between two different frameworks. To start with and in order to structure ideas we will assume that there is perfect competition in the private sector. There we can identify two channels how globalization can affect the share of the public sector in nominal terms. Capital market integration is one obvious channel. A second channel must work through productivity for which there is a prominent example such as Melitz (2003). Therefore, we will continue the discussion with a private sector which is characterized by monopolistic competition with heterogeneous firms.

[3]Some simulations for the effect of trade liberalization on $\frac{g_n}{g}$ are given in Appendix A.3.

2.3.1 Perfect Competition

The private sector produces the homogeneous good X under perfect competition according to a linear-homogeneous strictly concave production function

$$X = AF(K_X, L_X)$$

where A is productivity, K_X and L_X represent capital and labor input for private production. Since the homogeneous good is freely tradable, its price is determined at the world market. The world market price p^* is chosen as the numéraire.

Cost minimization leads to the minimal unit costs:

$$c_X(r, w, A) = a_X(\omega, A)w + b_X(\omega, A)r \tag{1}$$

where $a_X(\omega, A)$ and $b_X(\omega, A)$ with $\frac{\partial a_X}{\partial A} < 0$ and $\frac{\partial b_X}{\partial A} < 0$ are the cost minimal labor and capital coefficients, respectively.[4]

Throughout the paper it is assumed that the public sector produces more labor intensive than the private sector, that is $k_X > k_G$.

Equilibrium conditions

The resource constraints read:

$$a_X(\omega, A)X + a_G(\omega)G = \bar{L} \tag{2}$$

$$b_X(\omega, A)X + b_G(\omega)G = K \tag{3}$$

where $\bar{L}$ is labor endowment available for production of the public and private goods. If capital markets are closed, there is $K = \bar{K}$ capital endowment available. If capital markets are integrated, the world market interest rate is given and K is determined endogenously.

The zero profit condition in the private sector reads

[4] See Section A.1 in Appendix for the derivation.

$$c_X(r, w, A) = 1(= p^{RoW}) \tag{4}$$

According to equation 4 an increase in productivity A for a given interest rate raises the wage rate w.

Solving (2) and (3) for G and X and using $b_G(\omega)/a_G(\omega) = k_G(\omega)$ and $b_X(\omega)/a_X(\omega) = k_X(\omega)$ we obtain the Rybczynski lines[5]

$$X = \frac{1}{a_X(\omega, A)} \frac{K - k_G(\omega)\bar{L}}{k_X(\omega) - k_G(\omega)} \tag{5}$$

$$G = \frac{1}{a_G(\omega)} \frac{k_X(\omega)\bar{L} - K}{k_X(\omega) - k_G(\omega)} \tag{6}$$

Note that $k_G(\omega) < \frac{K}{L} < k_X(\omega)$. Combining the two equations yields real government size relative to the private sector

$$g \equiv \frac{G}{X} = \frac{a_X(\omega, A)}{a_G(\omega)} \frac{k_X(\omega) - k}{k - k_G(\omega)} \equiv \Gamma(\omega, k, A) \tag{7}$$

Lemma 1. *The function $\Gamma(\omega, k, A)$ depends positively on ω and negatively on k and A (ceteris paribus).*

Proof. Using the fact that $k_X(\omega) = b_X(\omega, A)/a_X(\omega, A)$ and $k_G(\omega) = b_G(\omega)/a_G(\omega)$ we can rewrite expression (7)

$$\Gamma(\omega, k, A) = \frac{b_X(\omega, A) - a_X(\omega, A)k}{a_G(\omega)k - b_G(\omega)}$$

It follows

$$\frac{\partial \Gamma}{\partial \omega} = \frac{\left(\frac{\partial b_X}{\partial \omega} - \frac{\partial a_X}{\partial \omega}k\right)(a_G k - b_G) - (b_X - a_X k)\left(\frac{\partial a_G}{\partial \omega}k - \frac{\partial b_G}{\partial \omega}\right)}{(a_G k - b_G)^2}$$

Hence, $\frac{\partial \Gamma}{\partial \omega} > 0$ is equivalent to

$$\left(\frac{\partial b_X}{\partial \omega} - \frac{\partial a_X}{\partial \omega}k\right)(a_G k - b_G) > (b_X - a_X k)\left(\frac{\partial a_G}{\partial \omega}k - \frac{\partial b_G}{\partial \omega}\right)$$

[5]See Section A.2 in Appendix for the derivation of the Rybczinski lines. The Rybczynski theorem indicates that if prices kept constant and endowment of some factor rises, not all output can expand (Rybczynski, 1955).

which holds since $\frac{\partial b_i}{\partial \omega} > 0$, $\frac{\partial a_i}{\partial \omega} < 0$, $a_G k - b_G > 0$ and $b_X - a_X k > 0$ (because of $k_X > k > k_G$). The left hand side of the inequality is positive while the right hand side is negative.

Moreover,

$$\frac{\partial \Gamma}{\partial k} = \frac{a_X a_G \left(\frac{b_G}{a_G} - \frac{b_X}{a_X} \right)}{(a_G k - b_G)^2} < 0$$

since $\frac{b_G}{a_G} = k_G < k_X = \frac{b_X}{a_X}$.

$$\frac{\partial \Gamma}{\partial A} = \frac{\frac{\partial a_X}{\partial A}(k_X - k)}{a_G(k - k_G)} < 0$$

since $k_X > k > k_G$ and $\frac{\partial a_X}{\partial A} < 0$ □

For an exogenous relative real government size and exogenous relative capital endowment (closed capital markets), the relative wage rate is endogenously determined as a function of government size capital-richness and productivity:

$$\omega = \omega(g, k, A) \tag{8}$$

Proposition 1. *The relative wage rate ω depends positively on g, k and A.*

Proof.

$$\frac{\partial \omega}{\partial g} > 0$$

follows directly from Lemma 1 since ω is the inverse of Γ.

Further, because of Lemma 1, for given g, the following holds

$$\frac{\partial \omega}{\partial A} > 0 \quad \text{and} \quad \frac{\partial \omega}{\partial k} > 0$$

□

The intuition is straightforward: a larger government (higher g) implies a higher relative demand for labor which raises the relative wage rate. Higher relative capital endowment k implies an increase of the factor price getting relatively scarce in the economy. An increase of the productivity raises output of the private sector for given capital and labor demand. However, if we keep relative real government size constant, production of G must increase which raises relative demand for labor and hence, the relative wage rate.

The analysis so far provides very interesting insights for the costs of the public sector. These costs may react on changes in the economic environment even if relative real government size remains constant. As a measure for nominal relative government size (the relative expenditures of the public sector) we define

$$g_n \equiv \frac{c_G(r,w)G}{pX} = \frac{c_G(r,w)}{c_X(r,w,A)}g$$

The relative costs in relation to the relative real government size is a function of the relative wage rate:

$$\frac{g_n}{g} = \frac{c_G(1,\omega)}{c_X(1,\omega,A)} \equiv \kappa(\omega, A) \tag{9}$$

Proposition 2. *$\kappa(A,g,k)$ is a positive function of A, g and k.*

Proof.

$$\frac{d\kappa}{d\omega} = \frac{\frac{\partial c_G(1,\omega)}{\partial\omega}c_X(1,\omega) - \frac{\partial c_X(1,\omega)}{\partial\omega}c_G(1,\omega)}{(c_X(1,\omega))^2}$$

It follows that (making use of Shepard's Lemma ($\frac{\partial c_i}{\partial w} = a_i$))

$$\begin{aligned}\frac{d\kappa}{d\omega} > 0 &\Leftrightarrow \frac{\partial c_G(r,w)}{\partial w}c_X(1,\omega) > \frac{\partial c_X(r,w)}{\partial w}c_G(1,\omega)\\ &\Leftrightarrow a_G(wa_X + rb_X) > a_X(wa_G + rb_G)\\ &\Leftrightarrow a_Gb_X > a_Xb_G \Leftrightarrow k_X > k_G\end{aligned}$$

$$\begin{aligned}\frac{\partial\kappa}{\partial A} &= \frac{\frac{\partial c_G(1,\omega)}{\partial\omega}\frac{\partial\omega}{\partial A}c_X(1,\omega) - \frac{\partial c_X(1,\omega)}{\partial\omega}\frac{\partial\omega}{\partial A}c_G(1,\omega) - \frac{\partial c_X}{\partial A}c_G}{(c_X(1,\omega))^2}\\ &= \frac{\frac{\partial\omega}{\partial A}(a_Gc_X - a_Xc_G) - \frac{\partial c_X}{\partial A}c_G}{(c_X(1,\omega))^2}\end{aligned}$$

Because of Proposition 1, $a_Gc_X - a_Xc_G = k_X - k_G > 0$ and $\frac{\partial\psi_X}{\partial A} < 0$ we have $\frac{\partial\kappa}{\partial A} > 0$

Further, because of Proposition 1

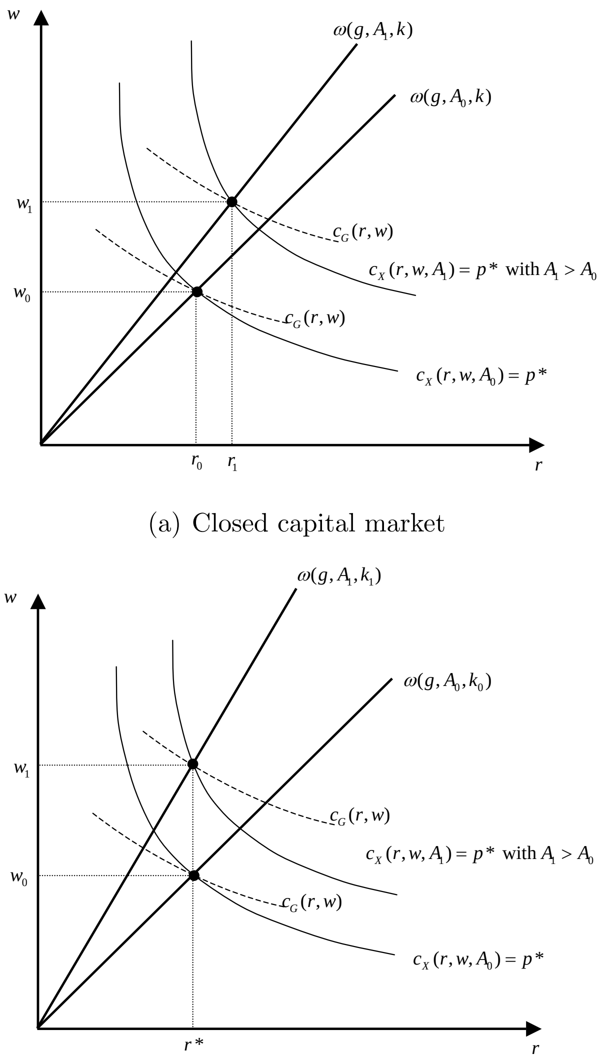
$$\frac{d\kappa}{dg} = \frac{\partial\kappa}{\partial\omega}\frac{\partial\omega}{\partial g} > 0$$

□

The intuition behind this is as follows. Government expansion raises relative demand for labor which implies an increase in the relative wage rate for given factor endowments. Real government expansion implies an even larger nominal expansion since the relative costs in the public sector increase additionally. An increase of the relative capital endowment implies a higher relative equilibrium wage rate and hence higher relative costs in the public sector (for this argument see also Gemmell, 1987). A higher productivity has a direct and indirect effect on the relative growth of government expenditures. In the private sector per unit costs are reduced and hence relative costs of the public sector increase. Further, a productivity increase in the capital intensive sector raises the relative wage rate which results in a relative larger cost increase in the labor intensive public sector. Hence, when price elasticity of demand is sufficiently price inelastic, there is a Balassa-Samuelson effect even if both factors are internationally immobile. Authors such as Obstfeld and Rogoff (1996), Kravis and Lipsey (1983) and Bhagwati (1984) concluded that some degree of capital mobility is required to explain differences in the relative wage rate. The effect of an increase in productivity is illustrated in the factor price diagram below (figure 4) for a closed and integrated capital market.

Capital market integration

In a small open economy with fully integrated capital markets, the interest rate is given by the world market. In this case ω is determined by the zero profit condition (4) and $r = r^{RoW}$. Hence, ω is independent of the government size. Nevertheless, transition from closed to open capital markets brings interesting insights for the relative government size. Assume, for instance, that the autarky interest rate is relatively high ($r > r^{RoW}$), that is, ω is low. Opening capital markets induces inflow of capital until the domestic interest rate equals the rate on the world market, $r = r^{RoW}$. As the analysis above has shown, an increase in relative capital endowment increases the relative wage rate and hence, the relative costs of public good production. The reverse results if the autarky interest rate is relative low before opening capital markets. Globalization in terms of capital market integration may



(a) Closed capital market

(b) Integrated capital market

Figure 4: The effect of an increase in productivity

raise or decrease the relative size of the government, depending on the initial capital richness of the country. Capital rich countries with low interest rates will experience a capital outflow and a reduction in the relative wage rate and relative government expenditures decrease.

2.3.2 Heterogeneous firms

In this section it is shown that trade liberalization can be responsible for a Balassa-Samuelson effect and a Baumol's cost disease in the public sector by rising average productivity in the private sector. In order to illustrate this channel we assume that the private sector is characterized with heterogeneous firms according to Melitz (2003). We will start to characterize the closed economy before we discuss the costly trade equilibrium.

Closed economy

The private sector of the economy consists of differentiated intermediate goods that are sold under monopolistic competition and a second sector that produces a homogeneous final output Y under perfect competition. The production function of the final output producer that uses the intermediate goods as the only inputs is given by

$$Y = \left[M^{-\frac{1}{\sigma}} \int_{v \in V} x(v)^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}} \ , \ \sigma > 1$$

where the measure of set V represents the mass of available intermediate goods M and σ the constant elasticity between the varieties. As in Blanchard and Giavazzi (2003) and Egger and Kreickemeier (2009) we exclude the external scale effect - the effect of trade liberalization on the available mass of intermediate goods - in order to focus on the the effect of trade liberalization on the productivity distribution of firms. The price index corresponding to the final good Y is given by

$$P = \left[M^{-1} \int_{v \in V} p(v)^{1-\sigma} \right]^{\frac{1}{1-\sigma}}$$

Profit maximization of the final goods producers leads to the following demand function for each intermediate variety

$$x(v) = Dp(v)^{-\sigma} \tag{10}$$

with $D \equiv \frac{YP^{\sigma}}{M} = \frac{IP^{\sigma-1}}{M}$. I denotes private consumption expenditure which is total expenditure minus taxes used for public good production.

At the intermediate goods level, there is a continuum of firms each producing a different variety. It is assumed that fixed and variable costs of the intermediate goods producer require both factors of production with identical factor intensity. Variable costs varies across firms and depend on firm specific productivity $A \in (0, \infty)$. All firms face the same fixed overhead costs which are assumed to decrease with average productivity (denoted by $\tilde{A}$) due to national spillovers between firms.[6] The cost functionreads

$$C_X = c_X(r, w, \tilde{A})f + c_X(r, w, A)x$$

where $f > 0$ denotes the units of capital and labor required for overhead fixed investment, c_X is given by equation (1) and x is output of a firm.[7] Because of the fixed production costs, in equilibrium, each firm produces a different variety. A monopolistic firm with productivity A charges a profit-maximizing price equal to a mark-up $(1 + \mu)$ times marginal costs:

$$p(A) = c_X(r, w, A)(1 + \mu).$$

where $\mu = \frac{1}{\sigma - 1} > 0$.

A firms revenue is thus given by

$$rev(A) = D\left[(c_X(r, w, A))(1 + \mu)\right]^{1-\sigma} \tag{11}$$

Revenue in the private sector depends negatively on the government size as government spending affects available income for private goods negatively. Available income for private goods, the price index P, productivity and the mark-up affect demand for each variety positively and increase revenue. It is obvious that relative revenue of two firms with productivity A' and A'' does only depend on their relative productivity: $\frac{rev(A')}{rev(A'')} = \left(\frac{A'}{A''}\right)^{\sigma-1}$.

The contribution margin is given by $px - c_X x = rev(A)\frac{\mu}{1+\mu}$ which implies for a firms profit

$$\pi(A) = \frac{\mu}{1 + \mu} rev(A) - f c_X(r, w, \tilde{A}).$$

Following Melitz (2003) we define an "average" firm with productivity $\tilde{A}$. This productivity average is very useful because aggregate variables are the same as

[6]We may also assume that a fixed investment of $f > 0$ units of total domestic output Y is needed each period. Then the cost function takes the form $C_X = Pf + c_X(r, w, A)x$. This will lead to similar results.

[7]The corresponding production function is $x = A(F(K, L) - \frac{f}{\tilde{A}})$.

if there were M identical firms with productivity $\tilde{A}$. For final output we have $Y = Mx(\tilde{A})$ which implies that output of the average firm equals the average output per firm. The price index simplifies to $P = p(\tilde{A})$, total revenue and profits are represented by $R = PY = Mr(\tilde{A})$ and $\Pi = M\pi(\tilde{A})$. According to Melitz (2003) we can write the average productivity as

$$\tilde{A} \equiv \left(\frac{1}{1 - G(A^*)} \int_{A^*}^{\infty} A^{\sigma-1} g(A) dA \right)^{\frac{1}{\sigma-1}} ,$$

where $G(A)$ is the productivity distribution and $g(A)$ the respective density function. We make use of the standard assumption that ex ante firm productivity is Pareto-distributed, i.e. $G(A) = 1 - \left(\frac{b}{A}\right)^s$.[8] $b > 0$ is the minimum value of productivity and hence $A \geq b$ and s determines the skewness of the Pareto distribution. It is assumed that $s > \sigma - 1$ in order to ensure that the average productivity has a finite positive value. In this case average productivity is given by:

$$\tilde{A} = \left(\frac{s}{s - \sigma + 1} \right)^{\frac{1}{\sigma-1}} A^* \, . \tag{12}$$

Zero cut-off profit and free entry condition

Before a firm can produce, it must pay a fixed entry cost which is thereafter sunk. For simplicity we assume that the factor intensity of costs of entry and production are the same. Again it is assumed that these sunk entry costs decrease in average productivity due to spillovers.[9] Hence, a firms total costs of entry can be written as

$$f_e c_X(r, w, \tilde{A})$$

where f_e denotes the units of capital and labor required for entry investment. After paying this investment the firm draws a productivity level A from a common distribution $g(A)$. Each firm has one draw of an A-level which is fixed after entry. A firm starts to produce if $\pi(A) \geq 0$. Since profits are increasing in A, the cutoff pro-

[8]The respective density function is $g(A) = s\frac{b^s}{A^{s+1}}$.

[9]With the alternative specification that requires f_e units of total domestic output for entry we would write for the costs of entry $f_e P$ with $P = c_X(r, w, \tilde{A})(1 + \mu)$.

ductivity for successful entry is determined by the zero-profit condition $\pi(A^*) = 0$ which is equivalent to

$$rev(A^*) = \frac{1+\mu}{\mu} f c_X(r, w, \tilde{A}) \tag{13}$$

Each firm which draws a productivity $A \geq A^*$ will produce, firms which draw a productivity below A^* exit immediately. Making use of $rev(\tilde{A}) = \left(\frac{\tilde{A}}{A^*}\right)^{\sigma-1} rev(A^*)$ and $\bar{\pi} = rev(\tilde{A})\frac{\mu}{1+\mu} - f c_X(r, w, \tilde{A})$ the zero cut-off productivity can be written as $\pi(\tilde{A}) = \left(\left(\frac{\tilde{A}(A^*)}{A^*}\right)^{\sigma-1} - 1\right) f c_X(r, w, \tilde{A})$ with $\tilde{A}(A^*)$ according to (12) and hence the zero profit condition is given by

$$\bar{\pi} = f c_X(r, w, 1) \left(A^*\right)^{-1} \left(\frac{s}{s-\sigma+1}\right)^{\frac{-1}{\sigma-1}} \frac{\sigma-1}{s-\sigma+1} \; . \tag{14}$$

The zero cutoff profit condition is a downward sloping curve in the (A, π) space, since the fixed costs are decreasing in average productivity.

There is an infinite number of periods and if the firm starts to produce it faces an exogenous probability of death δ each period. As there is an unbounded pool of potential entrants, in equilibrium the expected value of entry - which is equal to the probability of a successful draw times the expected profitability of producing until death - must equal the sunk cost of entry:

$$\begin{aligned} \text{expected value of entry } &= (1 - G(A^*))\frac{\bar{\pi}}{\delta} \\ &= f_e c_X(r, w, \tilde{A}) = \text{sunk entry cost} \end{aligned} \tag{15}$$

where average profit is equal to a firm with weighted average productivity: $\bar{\pi} = \pi(\tilde{A})$. Reformulating the free entry condition results in $\pi(\tilde{A}) = \delta f_e c_X(r, w, \tilde{A}) \left[1 - G(A^*)\right]^{-1}$ and replacing $\tilde{A}$

$$\bar{\pi} = \delta f_e c_X(r, w, 1) \left(\frac{s}{s-\sigma+1}\right)^{\frac{-1}{\sigma-1}} \left(A^*\right)^{-1} \left(\frac{A^*}{b}\right)^{s} \; .$$

The free entry curve is downward sloping in the (A, π) space if $s < 1$. For $s = 1$ average profit is independent of the productivity and for $s > 1$ it is upward sloping.

Because we have to assume that $s > \sigma - 1$ and estimates for σ are around 3 or even larger,[10] the upward sloping free entry curve is the most realistic one. The zero cut-off profit and the free entry condition together determine implicitly the cut-off productivity A^* which is independent of the factor prices since the unit fixed costs of entry and production cancel out

$$\delta f_e = f(1 - G(A^*)) \left(\left(\frac{\tilde{A}}{A^*} \right)^{\sigma-1} - 1 \right) . \tag{16}$$

This yields for the cut-off productivity $A^* = b \left(\frac{f}{\delta f_e} \frac{\sigma-1}{s-\sigma+1} \right)^{\frac{1}{s}}$. The assumption that fixed costs decrease with average productivity does not affect equilibrium cut-off productivity.

The resource constraints will complete the characterization of the closed economy equilibrium. It is assumed that both factors of production are immobile between countries. Labor and capital market clearing requires that the resources used for total production (variable (L_v and K_v) and fixed (L_f and K_f) input) and entry (L_e and K_e) plus resource employed by the public sector (L_G and K_G) must be equal to the available resource stock in the country.

$$L_v + L_f + L_e + L_G = \bar{L} \tag{17}$$
$$K_v + K_f + K_e + K_G = \bar{K} . \tag{18}$$

Total profits will cover the total costs for entry while total revenue minus profits cover total costs of production

$$\Pi = M\bar{\pi} = wL_e + rK_e$$
$$R - \Pi = w(L_v + L_f) + r(K_v + K_f).$$

Total revenue $R = Mrev(\tilde{A}) = Mp(\tilde{A})x(\tilde{A})$ equals total costs (inclusive entry and fixed costs of production). Hence, $Mp(\tilde{A})x(\tilde{A}) = wL_X + rK_X$ with $L_X = L_v + L_f + L_e$ and $K_X = K_v + K_f + K_e$. The price and the total unit costs in the private sector

[10] See for example Bernard et al. (2003)

are given by

$$p(\tilde{A}) = \frac{wL_X + rK_X}{Mx(\tilde{A})} \quad \Leftrightarrow \quad c_X(r, w, \tilde{A}) = \frac{wL_X + rK_X}{(1+\mu)Mx(\tilde{A})} \; .$$

Using the fact that $c_X(r, w, \tilde{A}) = a_X(\omega, \tilde{A})w + b_X(\omega, \tilde{A})r$, this can be rewritten as

$$(1+\mu)Mx(\tilde{A})a_X(\omega, \tilde{A})w + (1+\mu)Mx(\tilde{A})b_X(\omega, \tilde{A})r = wL_X + rK_X$$

which implies for total private input of labor $L_X = (1+\mu)Mx(\tilde{A})a_X(\omega, \tilde{A})$ and for total input of capital in private production $(1+\mu)Mx(\tilde{A})b_X(\omega, \tilde{A})$. Hence, the resource constraints can be written as

$$a_X(\omega, \tilde{A})(1+\mu)Y + a_G(\omega)G \quad = \bar{L} \tag{19}$$

$$b_X(\omega, \tilde{A})(1+\mu)Y + b_G(\omega)G \quad = \bar{K} \; . \tag{20}$$

Solving the resource constraints for G and Y we obtain the Rybczinski lines $Y = \frac{1}{a_X(\omega,\tilde{A})(1+\mu)} \frac{K - k_G(\omega)\bar{L}}{k_X(\omega) - k_G(\omega)}$ and $G = \frac{1}{a_G(\omega)} \frac{k_X(\omega)\bar{L} - K}{k_X(\omega) - k_G(\omega)}$. The ratio between public good provision and private sector output

$$\hat{g} \equiv \frac{G}{Y} = \frac{a_X(\omega, \tilde{A})(1+\mu)}{a_G(\omega)} \frac{k_X(\omega) - k}{k - k_G(\omega)} \tag{21}$$

which implies that the relative factor price is implicitly determined by real government size, average productivity and hence cut-off productivity, relative capital endowment and the mark-up: $\omega(\hat{g}, A^*, k, \mu)$. The nominal government share is determined by $\hat{g}_n = \frac{c_G G}{PY}$. This implies for the ratio between relative costs (expenditures) of the public sector and real government share

$$\frac{\hat{g}_n}{\hat{g}} = \frac{c_G(1, \omega)}{c_X(1, \omega, \tilde{A})} \frac{1}{1+\mu} \tag{22}$$

We are back to equation (9) with one difference which is that the mark-up plays also an important role in determining the relative costs in the public sector. κ depends negatively on the mark-up μ. More competition, that is a lower μ, will result in lower prices in the private sector and higher relative costs in the public sector.

Open economy

We will know consider trade between identical countries described in the previous subsection. It is assumed that the final good is traded frictionless, while trade in intermediates is costly. An intermediate firm faces variable trade costs of the iceberg form where $\tau > 1$ units have to be shipped in order for 1 unit to arrive. This implies for the price in the export market that $p_{ex} = \tau p$. In addition, there are fixed per period beachhead costs f_{ex} to enter the foreign market. It is assumed that this fixed costs require domestic resources with the same factor intensity as the other type of fixed costs and they also decrease in average productivity.[11] We have to specify which average productivity is important for the spillovers. Generally the domestic average productivity differs from average productivity of competing firms in the domestic market. If we assume that the fixed costs of exporting and domestic fixed costs are identical $f_{ex} = f$, average productivity in the domestic market and the one of competing firms in the domestic market is identical.

Because of symmetry, demand for a variety on the domestic and foreign markets is given by $y_d = p^{-\sigma} D$ and $y_{ex} = \tau^{-\sigma} y_d$, respectively. Hence, an exporting firm's revenue from one export market is proportional to the domestic revenue:[12] $rev_{ex}(A) = \tau^{1-\sigma} rev_d(A)$ where $rev_d(A)$ coincides with the revenue in the closed economy. High transportation costs, i.e. more units are lost during transport, reduces relative revenue in the export market. Not every firm will serve the export market but if the firm exports, it exports to all N markets. Hence total revenue is given by

$$rev(A) = \begin{cases} rev_d(A) & \text{if firm does not export} \\ rev_d(A)\left[1 + \tau^{1-\sigma} N\right] & \text{if firm exports} \end{cases}$$

An exporting firm obtains profits from one export market of $\pi_{ex} = \frac{\mu}{1+\mu} rev_{ex}(A) - f_{ex} c_X(r, w, \tilde{A})$. If $\pi_{ex}(A) \geq 0$, the firm exports to all N markets. A firm's profit can

[11] For a similar assumption concerning equal factor intensity in production and fixed costs see Bernard et al. (2007).

[12] $\tau y_{ex} = \tau(\tau p)^{-\sigma} D$ units have to be shipped in order for y_{ex} units to arrive. Thus, revenue from one export market is given by $rev_{ex} = p_{ex} y_{ex}$.

be written as

$$\pi(A) = \pi_d(A) + \max\{0, N\pi_{ex}(A)\}$$

where $\pi_d(A)$ corresponds to the profit in the closed economy.

In the open economy there are two cutoff productivities, one for successful entry (A^*) and one for exporting firms (denoted by A^*_{ex}). A firm with productivity A^* will make zero profit in the domestic market, a firm with productivity A^*_{ex} will make zero profit in the export market and positive profit in the domestic market. The cutoff productivity for exporting is found by $\pi_{ex}(A^*_{ex}) = 0$

$$rev_{ex}(A^*_{ex}) = \frac{1+\mu}{\mu} f_{ex} c_X(r, w, \tilde{A}) \tag{23}$$

Together with $rev_{ex}(\tilde{A}_{ex}) = \left(\frac{\tilde{A}_{ex}}{A^*_{ex}}\right)^{\sigma-1} rev_{ex}(A^*)$, the zero profit condition for exporting can be reformulated as

$$\begin{aligned} \pi_{ex}(\tilde{A}_{ex}) &= r_{ex}(\tilde{A}_{ex}) \frac{\mu}{1+\mu} - f_{ex} c_X(r, w, \tilde{A}) \\ &= \left(\left(\frac{\tilde{A}_{ex}}{A^*_{ex}} \right)^{\sigma-1} - 1 \right) f_{ex} c_X(r, w, \tilde{A}) \end{aligned} \tag{24}$$

Equations (11) and (13) can be solved for $A^* = \left(\frac{f}{\tilde{A}\mu D}(c_X(r, w, \tilde{A})\tilde{A}(1+\mu))^{\sigma}\right)^{\frac{1}{\sigma-1}}$ and similarly using (23) and $rev_{ex}(A) = \tau^{1-\sigma} rev_d(A)$ we obtain for cut-off productivity of exporting $A^*_{ex} = \tau \left(\frac{f_{ex}}{\tilde{A}\mu D}(c_X(r, w, \tilde{A})\tilde{A}(1+\mu))^{\sigma}\right)^{\frac{1}{\sigma-1}}$. If we compare the two cut-off productivities, we see that A^*_{ex} is proportional to A^*:

$$A^*_{ex} = \tau \left(\frac{f_{ex}}{f}\right)^{\frac{1}{\sigma-1}} A^* \tag{25}$$

It is assumed that exporting firms are more productive than non-exporting firms, that is, productivity of the marginal exporter is larger than cut-off productivity for the domestic market: $A^*_{ex} > A^*$. This requires that $\tau \left(\frac{f_{ex}}{f}\right)^{\frac{1}{\sigma-1}} > 1$. As we assume that $f_{ex} = f$, since $\tau > 1$, this will produce a selection of the more productive firms into the export market.

In equilibrium the expected value of entry must equal the sunk cost of entry:

$$\frac{1}{\delta}\left[(1-G(A^*))\bar{\pi}_d + (1-G(A^*_{ex}))N\bar{\pi}_{ex}\right] = f_e c_X(r,w,\tilde{A}) \tag{26}$$

with $\bar{\pi}_d = \pi_d(\tilde{A})$ and $\bar{\pi}_{ex} = \pi_{ex}(\tilde{A}_{ex})$ are the expected profit for the domestic market and for one export market respectively.

The free entry condition together with the zero cut-off productivity condition can be written as

$$f_e = \frac{1}{\delta}\left[(1-G(A^*))f\left(\left(\frac{\tilde{A}}{A^*}\right)^{\sigma-1} - 1\right) + (1-G(A^*_{ex}))Nf_{ex}\left(\left(\frac{\tilde{A}_{ex}}{A^*_{ex}}\right)^{\sigma-1} - 1\right)\right] \tag{27}$$

where

$$\tilde{A}(A^*) = \left(\frac{1}{1-G(A^*)}\int_{A^*}^{\infty} A^{\sigma-1}g(A)dA\right)^{\frac{1}{\sigma-1}}$$
$$\tilde{A}_{ex}(A^*_{ex}) = \left(\frac{1}{1-G(A^*_{ex})}\int_{A^*_{ex}}^{\infty} A^{\sigma-1}g(A)dA\right)^{\frac{1}{\sigma-1}} .$$

$\tilde{A}(A^*)$ is average productivity of all domestic firms producing either only for the domestic market or for both the domestic and foreign market. $\tilde{A}_{ex}(A^*_{ex})$ is average productivity only of the exporting firms. Equation (27) together with (25) determine implicitly the cut off productivity A^*. Solving for the cut-off productivity under the assumption that $f_{ex} = f$ and that productivity is Pareto distributed[13] we obtain

$$A^* = b\left(\frac{f}{\delta f_e}\frac{\sigma-1}{s-\sigma+1}\left[1+N\tau^{-s}\right]\right)^{\frac{1}{s}} . \tag{28}$$

The private sector price index in the open economy (again with excluded love of variety) can be written as

$$P = \left[M_t^{-1}\left(Mp(\tilde{A}) + N\rho_{ex}M\left(\tau p(\tilde{A}_{ex})\right)^{1-\sigma}\right)\right]^{\frac{1}{1-\sigma}}$$

[13]We use $\frac{\tilde{A}}{A^*} = \frac{\tilde{A}_{ex}}{A^*_{ex}} = \left(\frac{s}{s-\sigma+1}\right)^{\frac{1}{\sigma-1}}$, eq. (25) and $1-G(A) = A^{-s}$

where $\rho_{ex} = \frac{1-G(A^*_{ex})}{1-G(A^*)}$ is the ex ante probability of exporting conditional on successful entry and $M_t = (1+\rho_{ex}N)M$ denotes the mass of available varieties. It is equivalent to $P = p(\tilde{A})$ under the assumption that $f_{ex} = f$.[14] In this case Aggregate output is determined by $Y = M_t x(\tilde{A})$, aggregate profits $\Pi = M_t \pi(\tilde{A})$ and revenues $R = M_t rev(\tilde{A})$. Furthermore, average profit and revenue of the domestic producer is affected by the highly productive exporting firms implying[15]

$$\bar{\pi} = \pi_d(\tilde{A}) + \rho_{ex} N \pi_{ex}(\tilde{A_{ex}})(1 + \rho_{ex}N)\pi(\tilde{A})$$

In the open economy, additional resources are required for exporting. Hence, total employment of capital in the private sector is given by $L_X = L_v + L_f + L_{ex} + L_e$ and $K_X = K_v + K_f + K_{ex} + K_e$ respectively. If M_e denotes the mass of entrants, $\rho_{in} M_e$ are successful entrants. Hence, in steady state the mass of firms which are successful must equal the mass of firms which exit the market: $\rho_{in} M_e = \delta M$. This implies that $M_e = \frac{\delta M}{\rho_{in}}$ where $\rho_{in} = 1 - G(A^*)$. Therefore the number of workers and capital needed to enter the market is given by $L_e = M_e f_e a_X(\omega, \tilde{A}) = \frac{\delta M}{\rho_{in}} f_e a_X(\omega, \tilde{A})$ and $K_e = \frac{\delta M}{\rho_{in}} f_e b_X(\omega, \tilde{A})$. For fixed costs of exporting and domestic production an amount of labor (capital) according to $L_{ex} = M\rho_{ex} N f_{ex} a_X(\omega, \tilde{A})$ ($K_{ex} = M\rho_{ex} N f_{ex} b_X(\omega, \tilde{A})$) and $L_f = M f a_X(\omega, \tilde{A})$ ($K_f = M f b_X(\omega, \tilde{A})$) is required.

Total revenue in the private sector has to be equal to total costs in the private sector:

$$R = w(L_v + L_f + L_{ex} + L_e) + r(K_v + K_f + K_{ex} + K_e).$$

Demand for labor and capital in the private sector are given by $L_X = (1+\mu)Y a_X(\omega, \tilde{A})$ and $K_X = (1+\mu)Y b_X(\omega, \tilde{A})$ with $Y = M_t x(\tilde{A})$. The mark-up captures the amount of capital and labor used for the three type of fixed costs. This implies that

[14] The assumption of equal fixed costs in exporting and production implies that average productivity in the domestic market is equal to average productivity of competing firms in the domestic market. Define $\tilde{A}_t \equiv \left[M_t^{-1}\left(M\tilde{A}^{\sigma-1} + NM_{ex}(\tau^{-1}\tilde{A}_{ex})^{\sigma-1}\right)\right]^{\frac{1}{\sigma-1}}$ as the average productivity of firms competing in the domestic market. Using the fact that $\tilde{A} = \left(\frac{s}{s-\sigma+1}\right)^{\frac{1}{\sigma-1}} A^*$ and $A^*_{ex} = \tau\left(\frac{f_{ex}}{f}\right)^{\frac{1}{\sigma-1}} A^*$, we can write $\tilde{A}_t = \left[M_t^{-1}\left(M + NM\rho_{ex}\frac{f_{ex}}{f}\right)\right]^{\frac{1}{\sigma-1}} \tilde{A}$.

[15] Use $\bar{\pi} = \pi_d(\tilde{A}) + \rho_{ex} N \pi_{ex}(\tilde{A_{ex}})(1 + \rho_{ex}N)\pi(\tilde{A})$ and replace $\frac{\tilde{A}}{A^*} = \frac{\tilde{A_{ex}}}{A^*_{ex}} = \left(\frac{s}{s-\sigma+1}\right)^{\frac{1}{\sigma-1}}$ and $rev(A^*) = rev(A^*_{ex}) = \frac{1+\mu}{\mu} f c_X(r, w, \tilde{A})$

$\mu Y = M(f + \rho_{ex} N f_{ex} + \frac{\delta}{\rho_{in}} f_e)$.Using the resource constraints (equations (19) and (20)) of the closed equilibrium we obtain (21) and (22) for the two government share measures. The only two difference is the mass of available goods $M_t = (1 + \rho_{ex} N) M$ and that the cut-off productivity is determined by (28).

Trade liberalization

Lemma 2. *Trade liberalization raises average productivity.*

Proof. This follows directly from (27) and (12). The proof for a general distribution function of A is given in Melitz (2003).

□

Proposition 3. *Trade liberalization raises the relative factor price ω.*

Proof.

$$\frac{\partial \omega}{\partial \tau} = \underbrace{\frac{\partial \omega}{\partial \tilde{A}}}_{>0} \underbrace{\frac{\partial \tilde{A}}{\partial \tau}}_{<0} < 0$$

Use Lemma 2 and proposition 1. □

Proposition 4. *Trade liberalization raises the relative costs in the public sector κ.*

Proof.

$$\frac{\partial \kappa}{\partial \tau} = \underbrace{\frac{\partial \kappa}{\partial \tilde{A}}}_{>0} \underbrace{\frac{\partial \tilde{A}}{\partial \tau}}_{<0} < 0$$

According to Proposition 2 $\kappa(\tilde{A}, \hat{\hat{g}}, k)$ is a positive function of average productivity $\tilde{A}$. Because of Lemma 2 trade liberalization increases average productivity. □

An increase in the average productivity raises the relative wage rate which leads to an increase in the relative public budget share. Moreover, an increase in average productivity leads to higher relative unit costs in the public sector. Figure 5 illustrates the effect of trade liberalization on the production possibility frontier (PPF). Trade liberalization increases average productivity and the PPF rotates outwards. Keeping the real relative government size $\hat{\hat{g}}$ constant, the new equilibrium is determined by the intersection between $\hat{\hat{g}}$ and the new PPF. There the slope is flatter which implies that the price of government relative to the private sector must be higher. For a given average price in the private sector the relative wage has to increase. The effect of trade liberalization in the factor price diagram for a given average price $p(\tilde{A})$ is provided in figure 6. The higher equilibrium ω implies that both the private and public sector produce more capital intensive. Since average productivity in the private sector increases, output increases for given inputs. As the public sector has to expand production, employment of capital and labor in the public sector increase while employment of both input factors in the private sector decrease. This can be best illustrated in the Edgeworth box as in figure 7.

Figure 5: The effect of trade liberalization on output

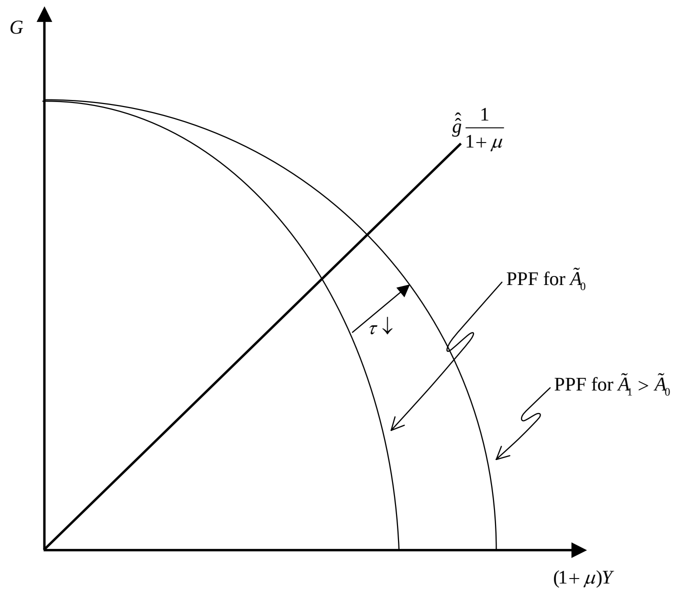


Figure 6: The effect of trade liberalization on factor prices

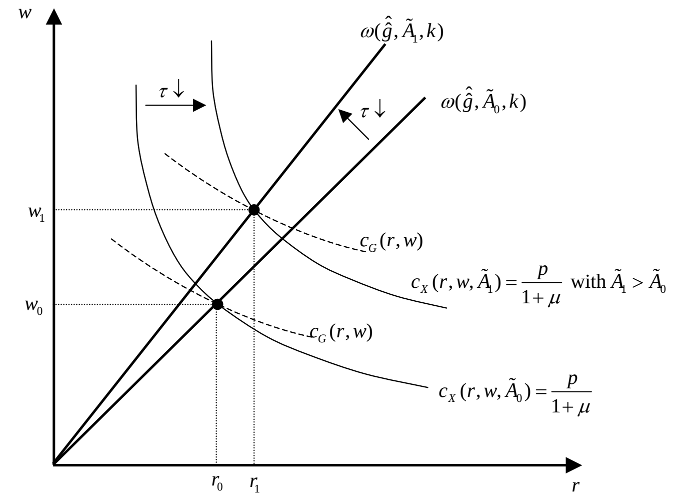
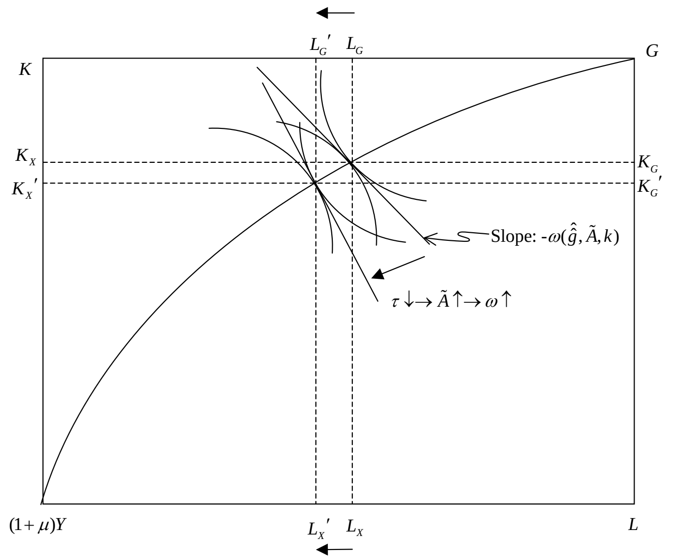


Figure 7: The effect of trade liberalization on factor employment



3 Empirical Evidence

The following two predictions from the theoretical models are going to be investigated empirically.

i. Net capital inflow has a positive effect on the relative nominal government size.

ii. Trade liberalization has a positive effect on the relative nominal government size.

The data are obtained from various sources. For relative nominal government size, $\kappa(\omega)$ in the model, we take two different measures. A first variable will be the relative price levels of government versus the price level of GDP. A second measure is current relative to constant government consumption share. From the theoretical point of view the two measures should be identical

$$\kappa = \frac{c_G}{p_X} = \frac{g_n}{g} .$$

In the data, however, the two measures are not at all positively correlated. We think that empirically the former (the relative price levels) is the more appropriate measure for our purpose. For robustness checks we will provide always the results for both endogenous variables.

For the explanatory variables concerning the capital market we have net foreign direct investment inflows ($FDInetinflow$) derived from the International Financial Statistics (IMF). FDI inflow is a close measure to the model as we think of capital as production capital. Nevertheless, we will also provide results for a more aggregate net financial inflow, the capital account CA (also derived from the IFS). As a measure for trade liberalization we take on the one hand the average applied tariff rates ($tariff$) provided by the World Bank and on the other hand the Trade Freedom index from the Heritage Foundation and Wall Street Journal ($tradefreedom$). The Trade Freedom index is based on trade-weighted average tariff rates and on non-tariff barriers. The two endogenous variables for real government size (gov), population (pop), GDP and openness are derived from Heston et al. (2006) PWT

6.2.The urbanization rate (*urban*) and the dependency ratio (*depend*) are from the World Development Indicators (World Bank). Moreover, it is controlled for the political regime (polity2 from the Polity IV dataset), whether the country was affected by violence or wars (from MEPV) and black market premium (*blackpremium*). The result is an unbalanced panel of yearly data for the time span 1970-2004. All the regressions are executed with country and time fixed effects. The three variables *gov*, *gdp* and *openness* are lagged by one period.[16] As some controls do not vary much over time, some regressions with all controls show a large correlation between the the RHS variables and the country fixed effect. Therefore, in column (1) and (4) in each table it is controlled for a subset of variables for which the correlation between the explanatory variables and the country fixed effect is rather low.[17]

Tables 1 to 4 present the results for capital inflow. When all controls are taken into account the number of observations is reduced noticeable because black market premium is only available until 1999. There is some evidence that net FDI inflow have a positive effect on relative costs of the public sector (hypothesis i). Table 1 presents the results for a sample of 120-163 countries. The relative price level is not significantly affected by net FDI inflow. Significantly positive effects are obtained for the current versus constant government consumption regression. The estimation for net FDI inflow is positively significant at the 1% level and the estimation of net FDI inflow lagged one period is positively significant at the 10% level. Table 2 provides the results for 26-30 OECD countries. Except in column (1) and (6) the estimations for net FDI inflow are singificantly positive.

The estimations for the capital account are provided in tables 3 and 4. The estimations on the relative price levels are (mostly) significantly positive at the 1% level in both the large country sample and the subset of OECD countries. The regressions with current relative to constant government consumption as an endogenous variable look different. In both country samples the estimations for the capital account are negatively significant.

[16]The estimates are quite similar whether the explanatory variables are lagged or contemporaneous.

[17]Fixed effects regression require that the explanatory variables and the country fixed effects are uncorrelated.

The time series for the trade measures are much shorter. The trade freedom measure starts in 1995 and the earliest average tariffs are available for 1981. The results for trade liberalization are mixed (tables 5 to 8). According to table 5 there is no evidence for hypothesis ii in the pooled regression of the large country sample. The OECD sample, however, shows highly significant and positive effects of tradefreedom on the relative price level of governments (column (1)-(3) in table 6). The estimations are slightly negative but insignificant when the endogenous variable is current relative to constant government consumption. Only tradefreedom lagged one period shows a weakly significant negative effect at the 10% level. No evidence for the hypothesis ii are found in the tariff regressions (table 7 and 8) which show mostly nonsignificant estimates. According to the hypothesis trade liberalization has a positive effect on the nominal relative governemnt size. This implies that the estimations for the tariffs should be negative. However, we find in column (3) of table 8 that lagged average tariff rates has a positive significant effect on the 5% level on the relative prices of governments.

The measures for trade liberalization are far from perfect. As import tariffs are an important source for financing government spending in developing countries, it is very likely an endogenous variable. Since the variable $tradefreedom$ captures not only tariffs but also non-tariff barriers it seems to be a slightly better measure.

The empirical results show that the real government share is mostly negatively correlated with the relative price levels. An explanation for the negative correlation found in the data might be the endogeneity of the government share. Higher prices of the public good will lead to a reduction in real consumption share if there is some degree of a price elasticity of demand. As our main purpose is to give some suggestive evidence we are not going to deal with the endogeneity issue here.

Since richer countries have higher national price levels, we would expect that for given population a higher GDP is positively correlated with relative prices of governments. In tables 1 to 4 most of the relative price level regression show this pattern. In columns (4) to (6) in most tables, the estimates are adverse. Also in columns (2) and (3) in tables 5 to 8 there is a tendency that poorer countries have higher relative prices in governments.

4 Conclusion

This paper identifies two globalization channels which can explain an increase in government expenditure shares. We refrain from political decisions on public good provision and keep the real government share constant. Doing so we can isolate the effects of globalization on the costs of public good production relative to the private sector.

We find that capital inflow leads to a higher relative wage rate and to higher relative costs in the labor intensive public sector. There is some empirical evidence which supports this hypothesis. Net FDI inflow has a positive effect on current relative to constant government consumption. Furthermore, the relative price levels between governments and GDP for OECD countries depend positively on net FDI inflows.

Moreover, in the Melitz framework, we identify a channel which is related to the Balassa-Samuelson effect. Trade liberalization increases average productivity in the private sector. For given real government size, the relative wage rate has to increase. This leads to higher relative costs in the public sector. In order to test this prediction we use average tariffs and a the Trade Freedom index as a measure for trade liberalization. The results are mixed with not much evidence for the prediction. The only support for the hypothesis is obtained for OECD. There we find that the trade freedom index has a positive effect on the relative price level of governments to GDP.

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A Appendix

A.1

Assume that the production function $X = AF(K, L)$ is linear-homogeneous. Then, $\frac{\partial F(K,L)}{\partial K} = F_K(K, L)$ and $\frac{\partial F(K,L)}{\partial L} = F_L(K, L)$ are homogeneous of degree zero. Cost minimal factor combination is given by the condition

$$\omega = \frac{F_L(k, 1)}{F_K(k, 1)} = MRTS(k)$$

where $\omega = w/r$ and $k = K/L$. This determines relative factor input $k(\omega)$. Using $L = \frac{X}{A(F(k,1))}$ and $K = \frac{X}{A(F(1,1/k))}$ the unit cost function ($c = r\frac{K}{X} + w\frac{L}{X}$) can be written as

$$c = \frac{1}{A}(F(k, 1))^{-1}w + \frac{1}{A}(F(1, \frac{1}{k}))^{-1}r \ .$$

If we define $a(\omega, A) = \frac{1}{A}(F(k(\omega), 1))^{-1}$ and $b(\omega, A) = \frac{1}{A}(F(1, \frac{1}{k(\omega)}))^{-1}$, we can write $\frac{b(\omega,A)}{a(\omega,A)} = \frac{F(k(\omega),1)}{F(1,1/k(\omega))} = k(\omega)$.

A.2

Solving the capital market clearing condition (3) for G and replacing in (2) results in $a_X(\omega, A)X + a_G(\omega)(K - b_X(\omega, A)X)\frac{1}{b_G(\omega)} = \bar{L}$. With some rearranging we obtain

$$X = \frac{1}{a_X(\omega, A)} \frac{\frac{b_G(\omega)}{a_G(\omega)}\bar{L} - K}{\frac{b_G(\omega)}{a_G(\omega)} - \frac{b_X(\omega,A)}{a_X(\omega,A)}} = \frac{1}{a_X(\omega, A)} \frac{K - k_G(\omega)\bar{L}}{k_X(\omega) - k_G(\omega)}$$

where we used $\frac{b_G(\omega)}{a_G(\omega)} = k_G(\omega)$ and $\frac{b_X(\omega,A)}{a_X(\omega,A)} = k_X(\omega)$. Replacing X in $G = [\bar{L} - a_X(\omega, A)X]\frac{1}{a_G(\omega)}$ and using the fact that the relative input coefficients equal capital intensity we get

$$G = \frac{1}{a_G(\omega)} \left[\bar{L} - \frac{\frac{b_G(\omega)}{a_G(\omega)}\bar{L} - K}{\frac{b_G(\omega)}{a_G(\omega)} - \frac{b_X(\omega,A)}{a_X(\omega,A)}} X \right] = \frac{1}{a_G(\omega)} \frac{k_X(\omega)\bar{L} - K}{k_X(\omega) - k_G(\omega)} \ .$$

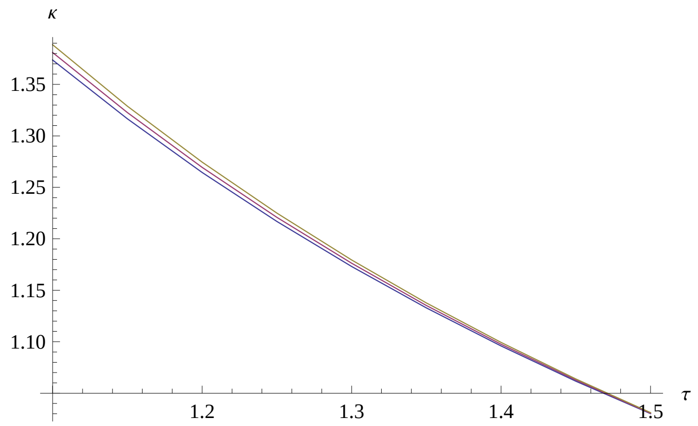
A.3

This subsection provides a simulation of the effect of trade liberalization on $\kappa = \frac{g_n}{g}$ when preferences are given by

$$U = \left(Y^{\beta} + G^{\beta}\right)^{\frac{1}{\beta}}, \quad \beta < 0 \; .$$

The elasticity of substitution is determined by $\sigma = \frac{1}{1-\beta}$. For the numerical analysis we have borrowed the assumptions on parameter values from Bernard et al. (2007). This is $\sigma = 3.8$, $s = 3.4$, $\bar{K} = 1200$, $\bar{L} = 1000$, $\gamma = 0.6$, $\alpha = 0.4$, $f_e = 2$, $b = 0.2$, $f = 0.1$, $N = 30$, $\delta = 0.025$, $P = 1$ (numéraire).

Figure 8: The effect of trade liberalization on relative costs of the public sector



The flattest curve corresponds to $\beta = -10 \Rightarrow \sigma \approx 0.1$, the middle one to $\beta = -1 \Rightarrow \sigma \approx 0.5$ and the lower curve to $\beta = -0.1 \Rightarrow \sigma \approx 0.9$. There is almost no difference in κ across the different elasticities of substitutions.

A.4 Tables

Table 1: Net FDI inflow: fixed effects regression

Dependent variable	price gov./price GDP			current/constant gov. cons.		
	(1)	(2)	(3)	(4)	(5)	(6)
FDInetinflow	-0.018	0.014		0.011***	0.028***	
	(0.012)	(0.033)		(0.004)	(0.008)	
FDInetinflowlag			0.031			0.020*
			(0.038)			(0.011)
gov	-0.010***	-0.010***	-0.010***	-0.001***	0.000	-0.001
	(0.001)	(0.002)	(0.002)	(0.000)	(0.001)	(0.001)
pop	-0.008	0.015	0.012	0.006*	-0.006	-0.006
	(0.010)	(0.014)	(0.015)	(0.004)	(0.006)	(0.007)
gdp	0.462***	0.383***	0.335***	0.035**	0.010	0.027
	(0.066)	(0.104)	(0.096)	(0.016)	(0.031)	(0.031)
openness	0.055***	0.166***	0.147***	-0.030***	-0.090***	-0.093***
	(0.016)	(0.046)	(0.043)	(0.008)	(0.013)	(0.013)
polity2		-0.002	-0.002		0.001**	0.000
		(0.001)	(0.001)		(0.000)	(0.000)
war		0.004	0.004		0.001	0.002
		(0.003)	(0.003)		(0.001)	(0.001)
depend		0.543***	0.516***		-0.144***	-0.160***
		(0.098)	(0.108)		(0.031)	(0.034)
urban		0.001	0.000		-0.004***	-0.003***
		(0.002)	(0.002)		(0.001)	(0.001)
blackpremium		0.001***	0.000***		-0.000	-0.000
		(0.000)	(0.000)		(0.000)	(0.000)
Time dummies	yes	yes	yes	yes	yes	yes
# Obs.	3675	2066	1993	3675	2066	1993
# countries	163	120	123	163	120	123
R^2	0.085	0.095	0.087	0.108	0.134	0.133

Notes: Robust standard errors in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 2: Net FDI inflow: OECD, fixed effects regression

Dependent variable	price gov./price GDP			current/constant gov. cons.		
	(1)	(2)	(3)	(4)	(5)	(6)
FDInetinflow	0.013	0.032*		0.006**	0.016***	
	(0.013)	(0.017)		(0.003)	(0.005)	
FDInetinflowlag			0.086***			0.006
			(0.025)			(0.007)
gov	-0.017***	-0.025***	-0.026***	-0.001**	-0.000	0.000
	(0.002)	(0.003)	(0.004)	(0.001)	(0.001)	(0.001)
pop	0.139	-0.780***	-0.810***	0.070**	0.200***	0.236***
	(0.133)	(0.164)	(0.176)	(0.028)	(0.035)	(0.036)
gdp	-0.253	0.906***	0.931***	-0.108***	-0.305***	-0.340***
	(0.174)	(0.253)	(0.270)	(0.037)	(0.049)	(0.050)
openness	-0.050*	-0.102	-0.124	-0.017	-0.072***	-0.058**
	(0.030)	(0.076)	(0.077)	(0.011)	(0.024)	(0.023)
polity2		0.008***	0.009***		0.000	0.000
		(0.003)	(0.003)		(0.000)	(0.000)
war		0.018**	0.009		0.007***	0.007***
		(0.008)	(0.011)		(0.002)	(0.002)
depend		-0.103	-0.128		0.013	0.017
		(0.143)	(0.144)		(0.029)	(0.030)
urban		0.005***	0.006***		-0.003***	-0.003***
		(0.001)	(0.001)		(0.000)	(0.000)
blackpremium		-0.021*	-0.019*		0.002**	0.002**
		(0.012)	(0.011)		(0.001)	(0.001)
Time dummies	yes	yes	yes	yes	yes	yes
# Obs.	816	577	561	816	577	561
# countries	30	26	26	30	26	26
R^2	0.340	0.389	0.392	0.522	0.511	0.507

Notes: Robust standard errors in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 3: Capital account: fixed effects regression

Dependent variable	price gov./price GDP			current/constant gov. cons.		
	(1)	(2)	(3)	(4)	(5)	(6)
CA	0.646***	0.939***		-0.179***	-0.170**	
	(0.224)	(0.319)		(0.054)	(0.069)	
CAlag			0.951***			-0.154**
			(0.319)			(0.076)
gov	-0.010***	-0.010***	-0.010***	-0.001***	-0.000	-0.001*
	(0.001)	(0.002)	(0.002)	(0.000)	(0.001)	(0.001)
pop	-0.024	-0.004	0.005	0.019***	0.007	0.002
	(0.017)	(0.018)	(0.017)	(0.007)	(0.010)	(0.009)
gdp	0.543***	0.534***	0.436***	0.001	-0.041	-0.009
	(0.071)	(0.111)	(0.104)	(0.019)	(0.036)	(0.035)
openness	0.060***	0.170***	0.150***	-0.033***	-0.088***	-0.093***
	(0.016)	(0.044)	(0.041)	(0.008)	(0.013)	(0.013)
polity2		-0.002	-0.002		0.001*	0.000
		(0.001)	(0.001)		(0.000)	(0.000)
war		0.007**	0.007**		0.001	0.001
		(0.003)	(0.003)		(0.001)	(0.001)
depend		0.513***	0.488***		-0.157***	-0.164***
		(0.102)	(0.111)		(0.032)	(0.034)
urban		0.002	0.001		-0.004***	-0.003***
		(0.002)	(0.002)		(0.001)	(0.001)
blackpremium		0.001***	0.000***		-0.000	-0.000
		(0.000)	(0.000)		(0.000)	(0.000)
Time dummies	yes	yes	yes	yes	yes	yes
# Obs.	3768	2093	2020	3768	2093	2020
# countries	165	121	123	165	121	123
R^2	0.086	0.096	0.088	0.110	0.135	0.135

Notes: Robust standard errors in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 4: Capital account: OECD, fixed effects regression

Dependent variable	price gov./price GDP			current/constant gov. cons.		
	(1)	(2)	(3)	(4)	(5)	(6)
CA	0.394**	0.532***		-0.274***	-0.198***	
	(0.161)	(0.138)		(0.051)	(0.051)	
CAlag			0.517***			-0.177***
			(0.146)			(0.057)
gov	-0.017***	-0.024***	-0.024***	-0.001**	-0.000	0.000
	(0.002)	(0.003)	(0.004)	(0.001)	(0.001)	(0.001)
pop	0.175	-0.790***	-0.804***	0.078***	0.227***	0.250***
	(0.138)	(0.184)	(0.197)	(0.027)	(0.035)	(0.035)
gdp	-0.281	0.957***	0.949***	-0.137***	-0.358***	-0.372***
	(0.182)	(0.284)	(0.296)	(0.036)	(0.050)	(0.050)
openness	-0.058*	-0.119	-0.146*	-0.015	-0.060***	-0.051**
	(0.030)	(0.078)	(0.079)	(0.010)	(0.023)	(0.022)
polity2		0.008***	0.008**		0.000	0.000
		(0.003)	(0.003)		(0.000)	(0.000)
war		0.006	0.006		0.005***	0.006***
		(0.012)	(0.012)		(0.002)	(0.002)
depend		-0.147	-0.183		0.018	0.020
		(0.144)	(0.145)		(0.029)	(0.029)
urban		0.005***	0.005***		-0.003***	-0.003***
		(0.001)	(0.001)		(0.000)	(0.000)
blackpremium		-0.021*	-0.020*		0.002**	0.002**
		(0.012)	(0.012)		(0.001)	(0.001)
Time dummies	yes	yes	yes	yes	yes	yes
# Obs.	813	574	558	813	574	558
# countries	30	26	26	30	26	26
R^2	0.341	0.365	0.367	0.535	0.518	0.515

Notes: Robust standard errors in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 5: Trade liberalization: Trade Freedom, fixed effects regression

Dependent variable	price gov./price GDP			current/constant gov. cons.		
	(1)	(2)	(3)	(4)	(5)	(6)
tradefreedom	-0.243*	-0.230*		-0.017	-0.021	
	(0.147)	(0.131)		(0.016)	(0.017)	
tradefreedomlag			-0.138			0.006
			(0.144)			(0.018)
gov		-0.004**	-0.004**		-0.001	-0.002**
		(0.002)	(0.002)		(0.001)	(0.001)
pop		-0.059	-0.079*		0.052**	0.078***
		(0.037)	(0.042)		(0.026)	(0.030)
gdp		-0.010	0.050		-0.043	-0.080
		(0.148)	(0.153)		(0.060)	(0.067)
openness		-0.299*	-0.164		-0.032*	-0.028
		(0.175)	(0.180)		(0.018)	(0.019)
polity2		-0.000	-0.002		0.001	0.000
		(0.002)	(0.002)		(0.001)	(0.001)
war		-0.000	-0.002		-0.005**	-0.002
		(0.004)	(0.003)		(0.002)	(0.002)
depend		0.111	0.029		0.204**	0.220**
		(0.118)	(0.112)		(0.088)	(0.107)
urban		-0.007*	-0.005		-0.002	-0.002
		(0.004)	(0.005)		(0.002)	(0.002)
Time dummies	yes	yes	yes	yes	yes	yes
# Obs.	1339	1158	1023	1334	1158	1023
# countries	157	142	142	157	142	142
R^2	0.057	0.131	0.065	0.128	0.085	0.092

Notes: Robust standard errors in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 6: Trade liberalization: Trade Freedom, OECD, fixed effects regression

Dependent variable	price gov./price GDP			current/constant gov. cons.		
	(1)	(2)	(3)	(4)	(5)	(6)
tradefreedom	0.221***	0.142***		-0.030	-0.031	
	(0.079)	(0.050)		(0.035)	(0.038)	
tradefreedomlag			0.136**			-0.096*
			(0.056)			(0.052)
gov		-0.007*	-0.006		-0.003	-0.007***
		(0.004)	(0.004)		(0.002)	(0.003)
pop		1.783***	1.583***		-0.279	-0.147
		(0.412)	(0.461)		(0.182)	(0.193)
gdp		-1.391***	-1.189***		0.281*	0.175
		(0.367)	(0.400)		(0.168)	(0.168)
openness		0.002	0.026		-0.002	0.009
		(0.031)	(0.027)		(0.020)	(0.022)
polity2		0.006	0.011		0.007*	0.005
		(0.006)	(0.008)		(0.004)	(0.005)
war		0.014	0.015		-0.010**	-0.010**
		(0.010)	(0.010)		(0.004)	(0.004)
depend		0.076	0.085		0.098	0.137
		(0.210)	(0.228)		(0.107)	(0.126)
urban		0.005***	0.004**		0.000	0.001
		(0.002)	(0.002)		(0.002)	(0.002)
Time dummies	yes	yes	yes	yes	yes	yes
# Obs.	290	245	217	290	245	217
# countries	30	28	28	30	28	28
R^2	0.631	0.453	0.419	0.622	0.496	0.536

Notes: Robust standard errors in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 7: Trade liberalization: Tariff, fixed effects regression

Dependent variable	price gov./price GDP			current/constant gov. cons.		
	(1)	(2)	(3)	(4)	(5)	(6)
tariff	0.083	0.043		0.021	0.034	
	(0.065)	(0.075)		(0.019)	(0.021)	
tarifflag			0.060			0.019
			(0.091)			(0.021)
gov		-0.011***	-0.012***		-0.001	-0.000
		(0.002)	(0.002)		(0.000)	(0.000)
pop		0.091***	0.108**		-0.007	-0.008
		(0.034)	(0.042)		(0.013)	(0.012)
gdp		-0.038	-0.092		0.057	0.067
		(0.164)	(0.194)		(0.046)	(0.045)
openness		-0.165*	-0.109		-0.046***	-0.045***
		(0.099)	(0.130)		(0.012)	(0.013)
polity2		-0.000	-0.003		-0.000	-0.000
		(0.003)	(0.004)		(0.001)	(0.001)
war		-0.003	-0.006		-0.002	-0.003
		(0.004)	(0.004)		(0.001)	(0.002)
depend		0.179	0.184		0.010	0.039
		(0.136)	(0.179)		(0.057)	(0.060)
urban		0.004	0.006		0.000	0.000
		(0.004)	(0.006)		(0.002)	(0.002)
Time dummies	yes	yes	yes	yes	yes	yes
# Obs.	1783	1528	1432	1775	1528	1432
# countries	162	135	135	162	135	135
R^2	0.024	0.080	0.070	0.179	0.216	0.196

Notes: Robust standard errors in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 8: Trade liberalization: Tariff, OECD, fixed effects regression

Dependent variable	price gov./price GDP			current/constant gov. cons.		
	(1)	(2)	(3)	(4)	(5)	(6)
tariff	0.367	0.224		0.010	0.016	
	(0.300)	(0.382)		(0.052)	(0.079)	
tarifflag			0.542**			-0.008
			(0.234)			(0.078)
gov		-0.017**	-0.021**		0.003	0.003
		(0.007)	(0.008)		(0.002)	(0.002)
pop		0.374	0.777**		0.042	0.074
		(0.465)	(0.379)		(0.084)	(0.085)
gdp		-0.268	-0.703*		-0.039	-0.069
		(0.512)	(0.374)		(0.098)	(0.094)
openness		-0.106*	-0.134*		-0.028	-0.012
		(0.061)	(0.075)		(0.024)	(0.022)
polity2		0.008	0.005		0.000	-0.000
		(0.005)	(0.005)		(0.001)	(0.001)
war		-0.020	-0.023		0.004	0.006
		(0.013)	(0.017)		(0.004)	(0.004)
depend		-0.778	-0.252		-0.130	-0.086
		(0.662)	(0.382)		(0.097)	(0.099)
urban		0.010*	0.011**		0.001	0.001
		(0.005)	(0.005)		(0.002)	(0.002)
Time dummies	yes	yes	yes	yes	yes	yes
# Obs.	218	194	181	218	194	181
# countries	15	14	14	15	14	14
R^2	0.372	0.459	0.594	0.580	0.578	0.553

Notes: Robust standard errors in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%