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INCOME INEQUALITY AND THE REAL EXCHANGE RATE

Pablo García
Economista Senior
Gerencia de Investigación Económica
Banco Central de Chile

Resumen

En este trabajo investigo el efecto de la distribución del ingreso sobre el tipo de cambio real. Considero una versión del modelo de Salter-Swan, en donde la distribución del ingreso afecta el tipo de cambio real a través de dos canales de equilibrio general: (i) la agregación de demandas individuales derivadas de preferencias no homotéticas y (ii) el efecto Samuelson-Balassa que opera a través del impacto de la distribución del ingreso sobre la productividad agregada del capital humano. El efecto de la distribución del ingreso sobre el tipo de cambio real es en general no-monotónico, en particular en el caso que la elasticidad de demanda por no transables es superior a uno, y la producción de transables es intensiva en capital humano. Empíricamente, encuentro una fuerte asociación entre el tipo de cambio real bilateral y el coeficiente de Gini en un panel de países para el período 1965-1990. Este efecto es negativo para la estimación de efecto fijo, y positivo para el caso de corte transversal. Asocio estos resultados al efecto esperado en el corto y mediano plazo derivado del modelo teórico, y discuto la relación con otras líneas de la literatura, en particular los determinantes de la desigualdad, el efecto de ésta sobre el crecimiento, y la relevancia empírica del efecto Samuelson-Balassa.

Abstract

In this paper I explore the effect of income inequality on the real exchange rate. I consider a version of the Salter-Swan model, where income inequality affects the real exchange rate through two general equilibrium channels: (i) the aggregation of individual demands derived from non-homothetic preferences; (ii) the workings of Samuelson-Balassa through the effect of inequality on the aggregation of human capital. If demand for non traded goods has an expenditure elasticity greater than one, and if tradables production is relatively intensive in human capital, then inequality has a non-monotonic effect on the level of the real exchange rate. Empirically, I find a strong relationship in levels between inequality and the bilateral real exchange rate. This partial correlation is large, significant, and positive in the case of within estimation and negative in the case of between estimation. I relate this finding to the expected short and long run effects of inequality on the real exchange rate, and the role factor endowments play in real exchange rate determination. I discuss the relationship of this fact with other strands of the literature, like the determinants of inequality, the effect of inequality on growth and the relevance of Samuelson-Balassa.

Comments are much welcome. This paper is a modified version of Chapter 2 of the author's PhD dissertation at MIT, and benefits from feedback received at seminars at the Banco Central de Chile, and at the MIT International Economics and Money workshops. I am particularly indebted to Ricardo Caballero, Rudi Dornbusch, Jaume Ventura for their useful suggestions. I thank Pamela Mellado for excellent research assistantship, and José de Gregorio and Jong-Wa Lee for kindly providing their dataset on educational inequality. All errors are mine. E-mail: pgarcia@condor.bcentral.cl

1 Introduction and Motivation

Inequality has been a topic of fluctuating interest in economic research. Apart from a purely normative point of view that characterizes inequality as an issue of interest to policy makers only insofar as social justice matters, inequality and income distribution have been studied in various positive contexts.

One such branch has been the impact of inequality on growth. Two main channels have been discussed in the theoretical literature. First, there is a political economy interpretation that assumes a link between inequality and redistribution. As a mean p-reserving spread will reduce the income of the median voter, more inequality is reflected in more redistribution. Furthermore, if fiscal policy operates through distortionary taxation redistibution increases distortions and hence hinders growth. Secondly, there is a direct link between inequality and growth. If the marginal productivity of human capital is decreasing, and the incompleteness of asset markets prevents agents from trading with each other, income redistribution from rich to poor will raise aggregate productivity. [1]

The theoretical and empirical research agenda on real exchange rate determination calls for the identification of supply and demand factors. Thus, once one considers an open economy that produces tradable and non tradable goods it is natural to ask whether income inequality has an effect on their relative price, the real exchange rate. Insofar as income inequality affects the supply of accumulated factors, as is predicted by the theories behind the link between inequality and growth, it will relate to the real exchange rate if factor intesities are different between sectors. This would be a version of the Samuelson-Balassa effect.

It has also been recognized in the literature that factor price equalization results if preferences are homothetic and the number of traded goods is at least equal to the number of factors. A stronger version of factor price equalization exists in the theory of real exchange rate determination: in a world of two factors of production and two goods, domestic demand will not affect relative prices as long as one good and one factor is traded.

However, if no factor of production can be traded, then demand will enter into relative price determination. Thus, this introduces another channel through which inequality can affect the real exchange rate. The discussion above highlights the conditions under which inequality plays a role in the determination of real exchange rates. First, if domestic asset markets are not complete then inequality in factor endowments relates to the average productivity of these factors through the inequality-growth linkage. Secondly, if international mobility of factors is imperfect then aggregate sectoral demands not only determine the pattern of production but also relative prices. A further general equilibrium channel is present, in that income inequality itself is endogenously determined by relative prices. Below I construct a simple Salter-Swan model of real exchange rate determination where income inequality is endogenously determined and has an impact both from the productivity side as well as through aggregation of demands. I then characterize the equilibrium real exchange rate. As expected, a very nonlinear relation

[1] See Benabou (1996) for a survey on the link between inequality and growth. In contrast to the established view, Forbes (1998) finds a positive relationship between growth and inequality.

between inequality and relative prices exists in this economy in the abscence of domestic financial markets and no integration with the rest of the world. Given a particular parametrization of the model, the relation between inequality and the real exchange rate is not even monotonic. In the model, allowing for international mobility of one of the factors shuts down the demand side, and thus more inequality will depreciate the real exchange rate through the effect of Samuelson-Balassa. I then proceed to test the predictions of the model using a panel of countries for the period 1965 to 1990. The results are suggestive. First, I find a strong relationship between the Gini coefficient and the level of the real exchange rate in within estimation. However, in cross-sectional estimation the effect is negative. I find that these results are compatible with an interpretation that points toward different effects of inequality in the short and long run. The structure of the paper is as follows. In Section 2 I review some of the related literature, including real exchange determination, the estimation of non-homothetic demand systems, and inequality. In section 3 I construct a version of the Salter-Swan model and I study the implications of inequality on the level of the real exchange rate and the current account. Section 4 presents some empirical evidence on this relationship. Section 5 concludes and indicates directions for further research.

2 Related Literature

2.1 Real exchange rates

The discussion on the determinants of real exchange rates has recently moved away from univariate test of purchasing power parity to looking for medium and long run correlates in the context of multicountry regression analysis. This can be attributed to the broad acceptance of PPP corrected for fundamentals in the long run as well as the availability of new quality data sets allowing for panel estimation. [2]

Traditional models of real exchange rate determination imply a role for both tastes and technology, as well as the conditions under which one might be more relevant than the other, in particular the intersectoral and international mobility of capital. Therefore, finding robust empirical relationships between the real exchange rate and other variables can be helpful for disentangling the relative importance of supply versus demand factors. However, this is a hardy task, as usually in panel regressions the econometrician can only seldom claim success in the quest for causality.

The first piece of evidence on real exchange rate determination comes from the relationship between relative price levels and relative gdp-per capita. Figure 1 shows the well known cross-sectional relationship of income per capita and relative price levels from the Pen World Tables v5.6. The usual way to interpret this finding has been the Balassa-Samuelson effect [3], that combines capital and labor mobility, the law of one price, constant returns to scale and differential productity growth in a framework to understand differences in relative prices of tradeable and non-tradeable goods. [4]

[2] Froot and Rogoff (1995) and Rogoff (1996a) provide a survey on PPP tests.

[3] From Balassa (1963) and Samuelson (1964).

[4] The insight that productivity growth in tradeables has an impact on their relative price has been

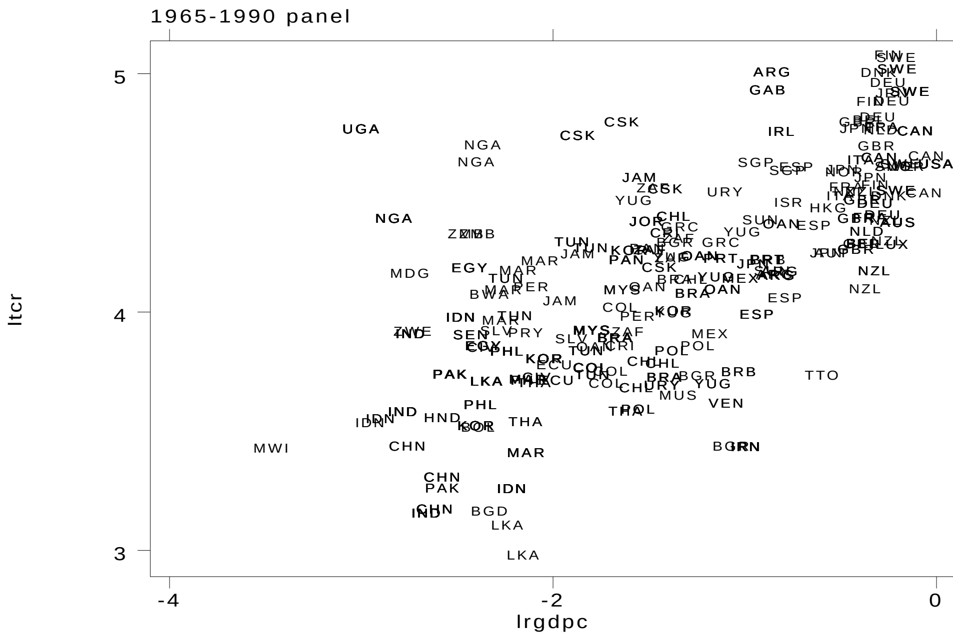

Figure 1: Real Exchange Rates and per-capita GDP

The Balassa Samuelson effect is then an explanation of an observed fact. Therefore, using per capita income in a real exchange rate regression equation is not enough to test whether Balassa Samuelson actually is a relevant channel. Indeed, as Figure 1 shows country-group heterogeneity might be an important consideration; it is not immediately apparent that the correlation between gdp per capita and relative price leves is present within country groups.

Furthermore, direct tests of Balassa Samuelson have not been conclusive. De Gregorio & Wolf (1994) construct a measure of relative TFP in tradables and non tradables, which works in the correct direction. However, the relevant measure of productivity that follows from the Balassa Samuelson effect is not total factor productivity but labor productivity; this is so because sectoral capital accumulation, for purposes of real exchange rate determination, work in the same direction as sectoral TFP growth if capital is sector specific and fixed.[6] Furthermore, they include real per capita income as an additional regressor in their specification, and this comes highly significant. They interpret this

around for a while. Indeed, in a well known quote David Ricardo argued that

> ...the improvements in arts & machinery... will in some measure account for the different value of money in different countries; it will explain why the prices of home commodities, or those of great bulk, though of comparatively small value, are, independently of other causes, higher in countries where manufactures flourish.[5]

[6]This is a feature of traditional Ricardian models of trade, like in Dornbusch, Fischer and Samuelson (1977).

result as capturing non specificed demand effects, like non homothetic preferences. This interpretation is also pointed out by Chinn & Johnston (1996) and Bergrstrand (1991). Obstfeld and Rogoff (1996) argue that the productivity-based explanation is not enough to account for the observed change in sectoral patterns of production and employment across countries.

Ito et al. (1997) assess the validity of Balassa Samuelson for a number of ASEAN countries. They find that, although the evidence points towards these countries moving in the direction indicated by the Balassa Samuelson effect (that is an increase in the share of high value added exports in total exports and GDP), the real exchange rate did not appreciate or only appreciated slightly. Furthermore, they cannot find support for the assumptions behind the Balassa Samuelson effect, namely the law of one price on traded goods, and a pattern of non traded versus traded price movements consistent with the evolution of the real exchange rate.

Therefore, the evidence seems to indicate that there is more than sectoral productivity growth at play in explaining the correlation between price levels and income per capita. Intuitively this should be rather straightforward, as Balassa Samuelson is a purely supply side explanation. However, one important caveat must be considered. Under intersectoral and international capital mobility, the production possibilities frontier of an economy becomes linear and therefore technology is the unique determinant of relative prices. This strong result has been discussed in Rogoff (1996b), Obstfelt (1993), De Gregorio and Wolf (1994). So any other factors, in particular taste shocks, only should have an effect under less than perfect capital mobility. This is an important consideration, as during the last decades there have been large changes in international capital mobility.

Furthermore, and related to the empirical relationship between the real exchange rate and productivity, previous cross sectional analysis of relative price levels, for example Kravis and Heston (1981), Bhagwhati (1983), and also Bergstrand (1991) have focused on the effect of factor endowments. All share the assumption that non tradeable goods tend to be more labor intensive, and therefore capital/labor ratios should affect the real exchange rate.

Other variables that have been used extensively in the literature on real exchange rate determination are government expenditure as a share of GDP, openness and the terms of trade. The empirical evidence is supportive of the inclusion of these variables in real exchange rate regressions. Although I am going to follow the empirical literature below, I am not considering the issue of simultaneity. Hence, the empirical resulst reflect association between the variables, rather than strict causality. I will however attempt to control for the endogeneity of income inequality below.

- Openness

  Dornbusch (1974) and Edwards (1989) argue that trade liberalization should be related to changes in the real exchange rate, as a reflection of the process of sectoral reallocation of factors of production. Indeed, opening up to trade involves a shift of factors of production between exportables and importables sectors, and therefore a real exchange rate depreciation should follow from the shedding of labor in contracting sectors, easing also the absorption of these factors in the expanding sectors.

- Government consumption

  Changes in government consumption, under the assumption that the marginal propensity to consume differs between the government and the private sector, should be reflected in relative prices, in particular the real exchange rate. Furthermore, government consumption as a share of GDP can be though as a proxy for more general distortions in the goods and factor markets. Public policy can have a myriad effects on several key relative prices, like public and minimum wages, as well as relative prices of public utility tariffs.

- The terms of trade

  Shocks to the terms of trade work through two channels. From the supply side, the permanent component of a positive terms of trade shock will induce a shift of factors of production towards exportables. This crowding out will appreciate the real exchange rate by increasing the relative price of non-traded goods. On the other hand, the transitory component of a positive shock to the terms of trade, working as a temporary income effect, might not be smoothed out completely, therefore provoking a temporary change in the real exchange rate.

2.2 Estimation of non homothetic demand systems

It is well recognized that the existence of a representative agent hinges on stringent assumptions. For example, homothetic or quasi-homothetic preferences allow exact linear aggregation. This implies that market demand can be safely represented by the average demands of the agents in the economy.

Also, homotheticity or quasi-homotheticity imply linear Engel curves, which is precisely the condition for exact linear aggregation. However, this might not be an adequate representation, as redistribution of income from one agent to another will leave average demands constant.

However, if the homotheticity or quasi-homotheticity assumption is dropped, almost any pattern of demand can be modelled. It is thus interesting to restrict in some way the range of possibilities. Exact nonlinear aggregation provides a way to have a representative agent that is different from the average agent. Thus, it is possible to include distributional considerations into the analysis. The name given to the conditions under which this is possible is *generalized linearity*, in which representative expenditure depends on average expenditure as well as its distribution, and the vector of prices. A particular case is price independent generalized linearity, which occurs if representative expenditure does not depend on prices. [7]

Lewbell (1989) provides a taxonomy of demand systems in which individual demands are linear in prices, expenditure and a function of expenditure, as well as individual characteristics. In this setting, Engel curves are linear in expenditure and a function of expenditure. Thus, this setting allows to model any nonlinear Engel curve one could

[7] For a discussion on the determinants of market demand, see Deaton and Muellbauer (1980a).

think about. This framework encompasses many demand systems that have been the focus of empirical research, like the Almost Ideal Demand System of Deaton and Muellbauer (1980b) and the quadratic Engel curves of Banks, Blundell and Lewbell (1992), as well of course any system derived from homothetic or quasi-homothetic preferences.

This empirical evidence indicates that expenditure patterns indeed differ according to income. Giles and Hampton (1985) report results from household surveys from several countries. They find income elasticities lower than one for food, and higher than one for goods than might be clasified as non traded, like housing or transport. Hansen, Formby and Smith (1996) show that the income elasticity for housing demand in the US varies with the level of income. Furthermore, household consumption surveys in Chile (Contreras 1997) show a marked difference in consumption patters across income groups. If these effects indeed reflect that the traded and non traded content of the consumption bundle changes with income, then changes in income distribution within a country will affect the real exchange rate.

3 A Salter-Swan economy with heterogenous agents

3.1 Ingredients

The economy is composed of a continuum of skilled and unskilled worker-consumers indexed by $i, i = 0 \dots 2$. Skilled agents are those indexed over the interval $0 \dots 1$, and similarly unskilled agents are denoted by $i = 1 \dots 2$. Skilled agents are endowed with e_i skills, while unskilled agents own one unit of raw labor. Both types of agents have preferences defined over two goods, a tradable good t and a non tradable good n. Production of these two goods uses raw labor and human capital in different intensities. Furthermore, skills *per se* are not tradeable: the amount of human capital a skilled agent supplies to the market is the result of interacting her idiosyncratic skill level with the average skill level of the population. This is an abstract way of representing the educational system in the economy.

For simplicity I will assume that the distribution from which skills are drawn is lognormal:

$$e \sim LN(\mu, \sigma^2)$$

Sectoral consumptions for each agent are denoted by cn_i and ct_i. The tradability of good t is only potential, in the sense that it depends on the openness of the current account. Hence, if the economy is closed none of the goods is internationally traded, and their relative price is determined domestically.

To model the demand system of this economy, I take the case of price independent generalized linearity, in which the indirect utility function v_i for each agent depends on sectoral prices pn and pt as well as total expenditure, denoted by x_i.

$$v_i = \frac{\left(x_i/(pn^{\lambda} pt^{1-\lambda})\right)^{1-\kappa}}{1-\kappa} - (pn/pt)^{\psi}$$

As mentioned above, this specification of preferences embeds as a particular case homothetic utility ($\kappa = 0$ and $\psi = 0$) as well as quasi-homothetic utility ($\kappa = 0$ and $\psi \neq 0$), and it considers non linear Engel curves. Note that simply assuming loglinear demands with constant expenditure elasticities does not satisfy the properties of demand systems, in particular adding-up. The sectoral demands derived from 3.1 are

$$cn_i = \lambda \frac{x_i}{pn} + \psi (pn/pt)^{\psi+\lambda-1} \left[\frac{x_i}{pn^\lambda pt^{1-\lambda}} \right]^\kappa \tag{1}$$

$$ct_i = (1-\lambda) \frac{x_i}{pt} - \psi (pn/pt)^{\psi+\lambda} \left[\frac{x_i}{pn^\lambda pt^{1-\lambda}} \right]^\kappa \tag{2}$$

The productive structure is very simple. To reflect differing factor intensities in both sectors I assume that tradable goods production employs in a CRS technology all the human capital in the economy as well as part of the stock of raw labor. Production of non tradables is linear in raw labor.

$$qn = ln; \quad qt = Aht^\phi lt^{(1-\phi)} \tag{3}$$

As mentioned above, each agent's stock of human capital h_i results from combining, in a constant returns to scale educational system, the agent's skills with the *average* level of skills of the population, given by $e = E_i(e_i)$. Hence,

$$h_i = e_i^\beta e^{1-\beta} \tag{4}$$

Using the fact that skills are lognormally distributed, the aggregate stock of human capital is

$$h = E_i(h_i) = E_i(e_i) \mathrm{e}^{-\frac{\sigma^2}{2}\beta(1-\beta)} \tag{5}$$

Therefore, keeping constant the average level of skills, if $\beta < 1$ more inequality depresses the stock of human capital, by transferring resources from high productivity agents (the poor) to low productivity agents (the rich). This is so because $\beta < 1$ implies declining private returns to skills.

If $\beta = 1$ then the educational system prevents any interaction between agents, and the level of human capital each agent has is simply its level of skills. The opposite case is $\beta = 0$, where all agents end up with the same amount of human capital.

The discussion above related to a situation where the tradability of good t was irrelevant. In the open economy aggregate expenditure can differ from income, and thus there will be a relationship between the current account and the real exchange rate.

I will abstract from intertemporal considerations, and consider that the current account is given exogenously. As inequality affects both the personal distribution of income as well as factor prices, it will matter whether skilled or unskilled agents are the ones incurring this deficit or surplus. This can potentially introduce Kaldorian considerations if only one of the agents saves. Avoiding this additional channel of transmission allows to write the current account identity as

$$x = y + cad$$

Finally, market clearing in non traded goods and factor markets imply

$$\begin{aligned} qn &= cn \\ ht &= h \\ lt + ln &= 1 \end{aligned}$$

This completes the description of the ingredients of the model. Before turning to equilibrium determination, some discussion is in order regarding the possible effects of inequality in this framework. It is clear that inequality will affect the determination of relative prices both from the aggregation of individual demands and through the effect on the aggregate stock of human capital. The way the consumption side has been formulated, the direction of the first effect will hinge on the parametrization of demands, in particular on ψ and κ, and somewhat less so on λ. This relates to the income elasticity of traded and non traded goods demands. If non traded goods consumption increases with total expenditure, given prices, then more inequality will appreciate the real exchange rate. Also, because traded goods production is Cobb-Douglas, inequality is inversely related to total factor productivity in tradables. Thus, more inequality will tend to depreciate the real exchange rate through the workings of Samuelson-Balassa. Furthermore, as factor incomes are endogenously determined, these two effects will interact in the determination of the real exchange rate. This indicates that the effect of inequality on the real exchange rate is ambiguous. However, some benchmark cases help anchor the discussion. Firstly, it is well known in the theoretical literature on real exchange rate determination that allowing for the international mobility of one of the factors of production leads to factor price equalization. Moreover, this pins down the real exchange rate, that becomes dependent on supply factors only. In this situation sectoral consumptions affect only the pattern of production. [8] Secondly, in the literature on inequality and growth that uses a specification like 4 it is the case that if domestic asset markets are complete, then the direct effect of heterogeneity on productivity disappears.[9] This is a reflection of the existence of a representative agent if the idiosyncratic characteristics of individual agents can be "smoothed out" through trade in assets. If this was the case, then inequality plays no role in real exchange rate determination, although the non-homotheticity of preferences still would affect relative prices in the aggregate. Finally,

[8]Hunter, L. and J. Markusen (1988) use this intuition to focus on the effect of income per capita on trade.

[9]Note however that redistribution through distortionary taxation maintains a political economy link between inequality and growth.

the above discussion applies in any closed economy with production and consumption of two goods. In the open economy, the dynamics of the current account are likely to introduce yet another interaction between the real exchange rate and inequality. The relationship between the volatility of the real exchange rate and the volatility of the (exogenously given) current account will depend on inequality.

3.2 Autarky

Although the economy described above is very stylized, it captures several general e-quilibrium considerations that are absent if preferences are homothetic. Mainly, the introduction of heterogeneous agents and non-homothetic preferences allows to clearly distinguish between personal and factor income distribution. This allows to track the effect of demand patterns on resource allocation. Homotheticity and a representative agent make this distinction superfluous. To find the equilibrium real exchange rate in this economy, first note that factor incomes depend on relative prices. Cost minimization and marginal cost pricing imply that the return to human capital s and the wage w paid to raw labor are given by

$$
\begin{aligned}
s =& \left(\frac{pt}{pn}\frac{A}{\Phi}\right)^{1/\phi} pn && (6)\\
w =& pn && (7)
\end{aligned}
$$

where $\Phi = \left(\frac{\phi}{1-\phi}\right)^{1-\phi} + \left(\frac{1-\phi}{\phi}\right)^{\phi}$. Furthermore, agent i income y_i is

$$
y_i = \begin{cases} \left(\frac{pt}{pn}\frac{A}{\Phi}\right)^{1/\phi} pnh_i & \text{for } i = 0\ldots 1 \\ pn & \text{for } i = 1\ldots 2 \end{cases} \tag{8}
$$

As for now by assumption the economy is closed, expenditure equals income. Walras' law allows to consider only one of the goods. Total consumption for non tradables is found by aggregating over skilled and unskilled consumers. The aggregate demand for non traded goods depends thus on relative prices, aggregate endowments and the distribution of skills.

$$
\begin{aligned}
cn = E_i(cn_i) = \lambda & \left[\left(\frac{pt}{pn}\frac{A}{\Phi}\right)^{1/\phi} E_i(e_i)\mathrm{e}^{-\frac{\sigma^2}{2}\beta(1-\beta)} + 1\right] \\
& + \psi\left(\frac{pt}{pn}\right)^{\psi+(1-\lambda)(\kappa-1)} \left[\left(\frac{pt}{pn}\frac{A}{\Phi}\right)^{\kappa/\phi} E_i(e_i)^{\kappa}\mathrm{e}^{-\frac{\sigma^2}{2}\kappa\beta(1-\kappa\beta)} + 1\right] \qquad (9)
\end{aligned}
$$

Similarly, sectoral supplies depend on relative prices and aggregate endowments, as well as the distribution of skills. In particular, supply of non traded goods is

$$qn = 1 - \frac{1-\phi}{\phi}\left(\frac{pt}{pn}\frac{A}{\Phi}\right)^{1/\phi} E_i(e_i)\mathrm{e}^{-\frac{\sigma^2}{2}\beta(1-\beta)} \qquad (10)$$

The equilibrium real exchange rate is the solution to the nonlinear equation $cn = qn$. As there is no closed form solution, I will construct some simulations. For this a sense of the size and sign of the parameters is needed. However, it is easy to note that with a demand system like 1 and 2 the *sign* of ψ is critical in determining whether either good is superior or inferior. Moreover, the *size* of κ reflects the size of the expenditure elasticity. In particular, it can be shown that if $\psi > 0$ then $\kappa > 1$ implies an expenditure elasticity greater than one for non tradables. This will be the benchmark case, as it introduces an opposite channel of inequality to the real exchange rate, that counters Samuelson-Balassa. Otherwise both effects go in the same direction. The parameter λ is less crucial in the sense that it can be more readily associated with the usual expenditure share of Cobb-Douglas demands. It can be related to the other two parameters by assuming that, given expenditure, a higher relative price for non tradeables increases the share of non tradables in total expenditure. This would be in line with the predictions of a CES demand system with a lower than one elasticity of substitution. For this to hold, it must be the case that $\lambda > \psi/(\kappa - 1)$. Regarding the rest of the parameters of the model, ϕ is the share of human capital in tradables, and β the degree of concavity in the human capital production function. Figure 2 presents the results of changes in inequality measured by σ, for $0 < \beta < 1$. Three implications can be derived from this relationship. First, there is a hill-shaped relationship between β and the real exchange rate. This is so because the impact of heterogeneity on the aggregate stock of human capital is maximized for $\beta = 0.5$. In other words, if $\beta = 1$ or $\beta = 0$ aggregate human capital is the same. This reflects the fact that if the educational systems evens out outcomes if $\beta = 0$, and that there is no interaction between agents if $\beta = 1$. For an intermediate range of values of β inequality depresses the stock of human capital. Secondly, increases in inequality have a non-monotonic effect on the real exchange rate. For small values of β, an increase in inequality *depreciates* the real exchange rate. Again, this is related to the fact that if β is close to zero, then the idiosyncratic amount of skills each agent has matters little for her supply of human capital. In other words, the impact of inequality on the aggregation of preferences is small, and thus inequality operates mainly through its effect on aggregate human capital and relative productivities. However, there is a limit to this effect. Indeed, as β increases, the reverse-Samuelson-Balassa effect reaches a maximum, and the aggregation of preferences becomes important. Even if $\beta = 1$ increases in inequality appreciate the real exchange rate. This is so because although the aggregate stock of human capital is not depressed by distributional considerations, the aggregation of preferences plays a role in equilibrium determination.

3.3 The open economy and the current account

Focusing again on equilibrium in the market for non traded goods, the real exchange rate now is a function of aggregate endowments, the distribution of skills and the current account.

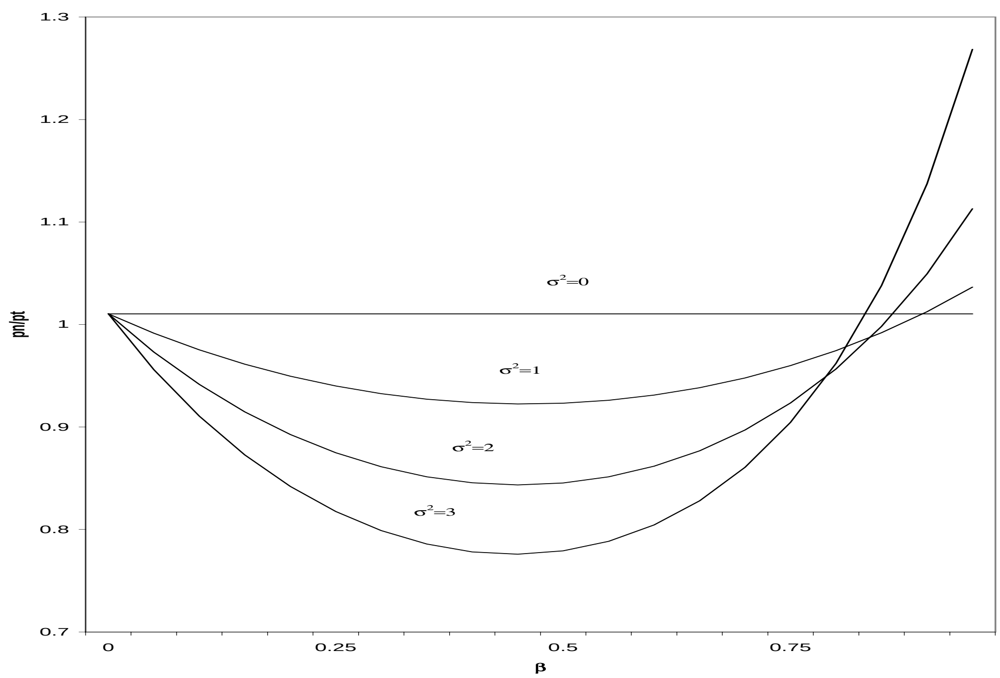

Figure 2: Real Exchange Rates and Inequality

$$1-\frac{1-\phi}{\phi}\left(\frac{pt}{pn}\frac{A}{\Phi}\right)^{1/\phi}E_i(e_i)\mathrm{e}^{-\frac{\sigma^2}{2}\beta(1-\beta)}=\lambda\left[\left(\frac{pt}{pn}\frac{A}{\Phi}\right)^{1/\phi}E_i(e_i)\mathrm{e}^{-\frac{\sigma^2}{2}\beta(1-\beta)}+1\right](1-cad)$$
$$+\psi\left(\frac{pt}{pn}\right)^{\psi+(1-\lambda)(\kappa-1)}\left[\left(\frac{pt}{pn}\frac{A}{\Phi}\right)^{\kappa/\phi}E_i(e_i)^{\kappa}\mathrm{e}^{-\frac{\sigma^2}{2}\kappa\beta(1-\kappa\beta)}+1\right](1-cad)^k \quad (11)$$

Figures 3 and 4 shows the effect of increases in inequality for low and high values of β. First, as there are no distributional effects through the current account, a deficit is associated with an appreciated real exchange rate. Moreover, the impact of inequality mirrors Figure 2. That is, for low values of β inequality mainly operates through Samuelson-Balassa, and therefore an increase in inequality will depreciate the real exchange rate for any given current account deficit. The opposite effect occurs for large values of β. An increase in inequality raises demand for non traded goods, and appreciates the real exchange rate at any given level of the current account. To analyze the role of international factor mobility, first note that the equilibrium relative price does not depend on whether $pt = pt^*$, because in this setup the numeraire is the price of one unit of total expenditure. However, fixing any other price with respect to the numeraire will determine the rest of the relative prices. For example, assuming international mobility of human capital sets $s = s^*$. Using Equations 7 and 8 implies that the real exchange rate is given by $pt/pn = (s^*)^{\phi}\Phi/A$. Therefore, allowing for international capital mobility fixes the real exchange rate as a function of relative factor prices, given from abroad,

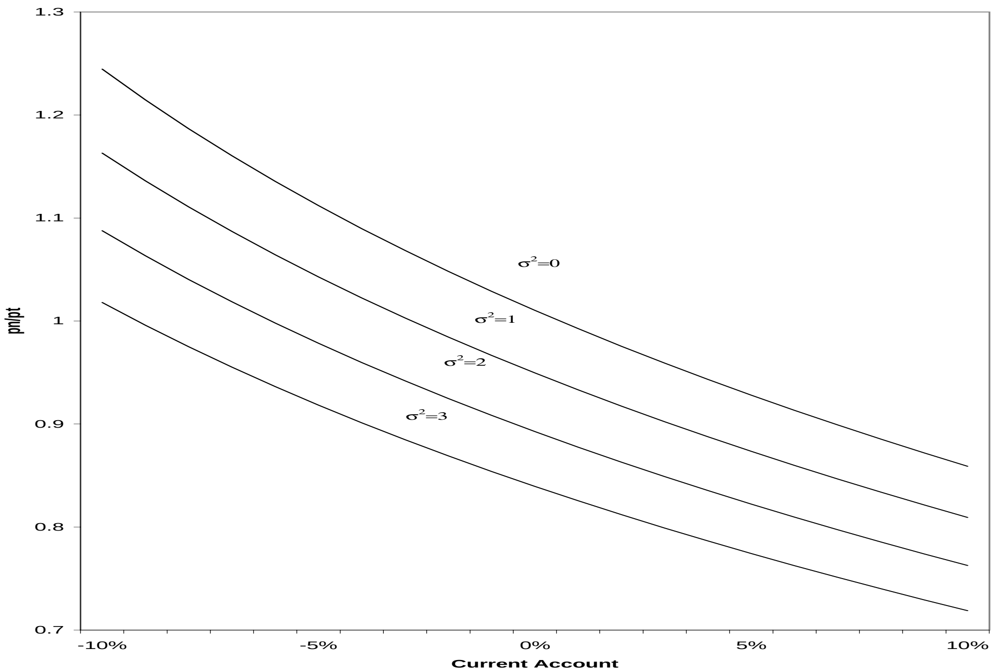

Figure 3: The Current Account and Inequality, low β

and domestic productivity in the tradable goods industry.

4 Empirical evidence on real exchange rates and inequality

4.1 Data and estimation

The following is the usual benchmark regression in the literature, estimated in a (possibly unbalanced) panel of $i = 1...I$ countries with $t = 1...T_i$ periods.

$$lrer_{it} = \theta_1 lgdp_{it} + \theta_2 open_{it} + \theta_3 ltot_{it} + \theta_4 gov_{it} + \nu_i + \epsilon_{it} \tag{12}$$

where all the variables are measured either bilaterally or multilaterally, and where ν_i and μ_t reflect country and time fixed effects.

There are several ways an equation like 12 can be estimated, and a priori both within(fixed-effects) and between (cross-sectional) estimation are useful as they focus on different properties of the data. Moreveover, as I want to check for the effect of inequality on the real exchange rate I expanded the benchmark regression by adding an inequality measure

$$lrer_{it} = \theta_1 lgdp_{it} + \theta_2 ineq_{it} + \theta_3 open_{it} + \theta_4 tot_{it} + \theta_5 gov_{it} + \nu_i + \epsilon_{it} \tag{13}$$

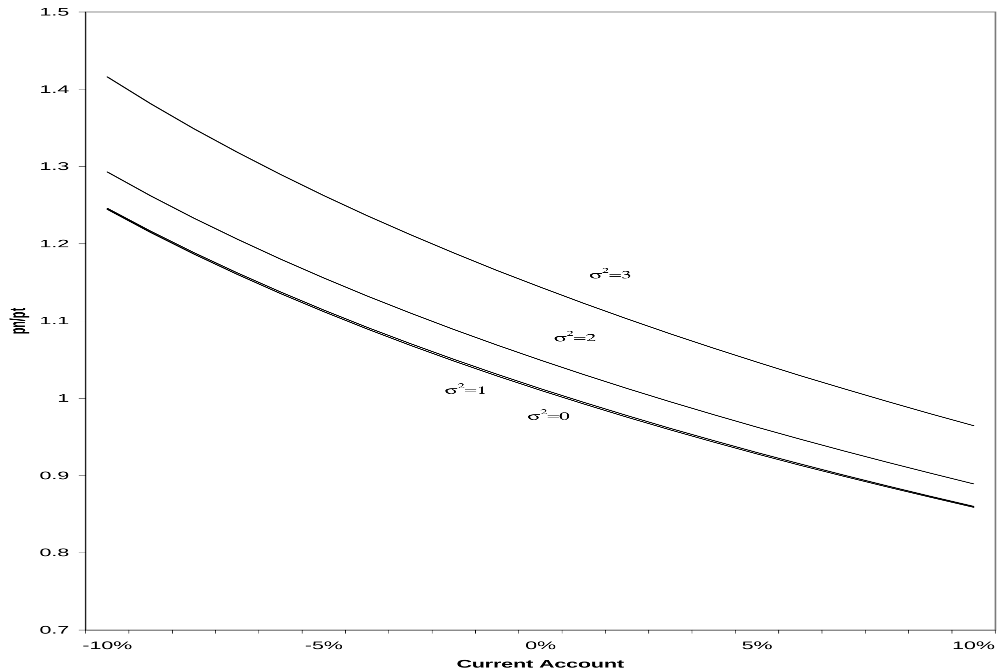

Figure 4: The Current Account and Inequality, high β

This baseline regression was estimated using 5 year bilateral (with respect to the US) averages for 76 countries in the period 1960 to 1990 . I concentrated on 5 year averages because of the sparsity of inequality data for most of the countries. For the same reason I focused on the bilateral measure of the real exchange rate, which was constructed using GDP deflators as the measure of national price levels. I used GDP deflators as price levels instead of CPI because of several reasons. First, from the Penn World Tables one can find GDP deflators for a larger sample of countries, constructed in a more consistent way. On the contrary, CPI data is not available for such a range of countries, and might not be comparable across countries. Furthermore, and more importantly, the Penn-World Tables data allows to make comparisons in *levels*, thus enabling between estimation.

For openness I use a yearly dummy variable constructed from the description of trade regimes in Sachs and Warner (1995). This dummy variable takes the value 1 for countries/periods that are open. Note that as the data is averaged every 5 years, some of the observations actually lie between 0 and 1. Relative GDP per capita is from the Penn World Tables, as is government share in GDP. For the construction of the terms of trade series I used the index of the terms of trade from the World Bank database, completed with IFS information when the World Bank data was either unavailable or sparse.

I used three measures of inequality. First, from Deininguer and Squire(1995) I obtained the Gini coefficients. This data set consists of a large panel on inequality and income distribution within and between countries, from 1960 to 1990. Secondly, from

De Gregorio and Lee (1999) I obtained two other inequality measures, a Gini coefficient on educational attainment and the standard deviation of educational attainment. It is important to distinguish between income inequality and human capital inequality, as the former depends on the latter plus the returns on human capital. Thus, there is the possibility of simultaneity bias if one uses income inequality. Given the slow evolution of educational attainment over time, this simultaneity bias is less likely in the time series dimension, although it might still be present over the cross section.

Table 1 presents the results of estimating equation 13, using the three measures of inequality. Several comments are in order regarding these results. First, they are compatible with previous literature. GDP per capita is positively associated with the real exchange rate, as is the index of the terms of trade. Increasing relative income by 10% percentage points appreciates the real exchange rate by 5% [10] The terms of trade also come out as expected. An improvement in the terms of trade of 10% implies an appreciation of 2.5%

The results are also indicative of a relationship between inequality and the real exchange rate, although the coefficient on the Gini is only significant and positive in fixed effects estimation and the coefficient on the standard deviation of education is highly significant but negative, also in fixed effects estimation.

These results might suffer from three types of problems. First, sensitivity to outliers, second specification problems due to simultaneity bias and third the possibility of ommited variable bias. Moreover, as was shown above theory does not say which is the sign that should be expected.

4.2 Sensitivity

The main issue in sensitivity is the importance of particular data points in driving the results. ALthough there is no systematic procedure to eliminate the problem of outliers, there are some guidelines in the statistical literature. It is aknowledged that the three key issues for identifying model sensitivity to individual observations are residuals, leverage and influence [11]. In general the term 'outlier' might reflect all these three issues. Observations that have a large residual deserve special attention, as well as observations that are far from the center of mass of the rest of the data (high leverage). The partial regression plots showing the partial association between the real exchange rate and the measures of inequality are in Figures 5, 6 and 7. Note that data points with large residuals or large leverage data points might not necessarily affect the size of the coefficient of interest, and likewise points that apparently are not outliers might be unduly affecting the empirical estimates. To check for this last point (influence) I construct dfbetas for the within and between specifications. Dfbetas measure the degree by which the exclusion of individual observations shifts the estimated parameters, scaled by the corresponding standard error. The idea then is to exclude such observations that

[10] As the mean income relative to the US is around 0.3 in the sample, this implies that if the income gap shrinks by 10 percentage points (from 0.3 to 0.4) the real exchange rate appreciates between 10% and 15%

[11] see Belsey, Kuh and Welsch (1980)

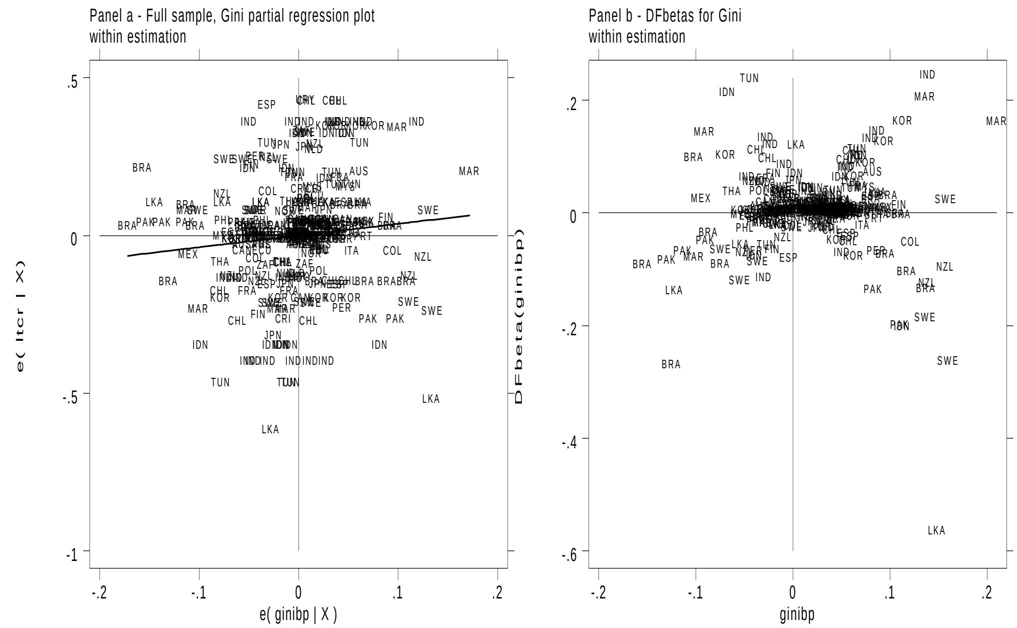

Figure 5: Partial Regression Plots and Influence, Gini

shift the estimates by more than a specified threshold. Belsey, Kuh and Welch suggest $2/\sqrt{samplesize}$ as a proper threshold. Figures 5b and 6b show the estimated dfbetas for the within estimation of the Gini and educational standard deviation coefficient. It is clear that several points can shift the estimators by a large fraction of its standard error.

I run within estimation excluding the data points with dfbetas higher than the threshold for any of the regressors. The empirical results in terms of partial regression plots can be seen in Figures 7 and 8. The most significant feature is the reversal of the sign of the coefficient for educational dispersion.

However, a robust feature in the restricted sample estimation is the fact that the sign of inequality in between estimation is negative, while in within estimation it is positive.

4.3 Specification

Inequality and the real exchange rate are both determined in general equilibrium. Thus, it is possible that the results above are contaminated with simultaneity bias as well as ommited variable bias. There is a large literature on the relationship between income inequality and the level of development, going back to Kuznet's inverted-U hypothesis. The actual testing of the inverted-U hypothesis had traditionally received mixed support in the literature.[12]. However, more recent tests using the new Deininger and Squire data set in inequality have been supportive of the inverted-U hypothesis both within

[12]See Bourguignon and Morrison (1990) and Raj(1998) for surveys on research on inequality

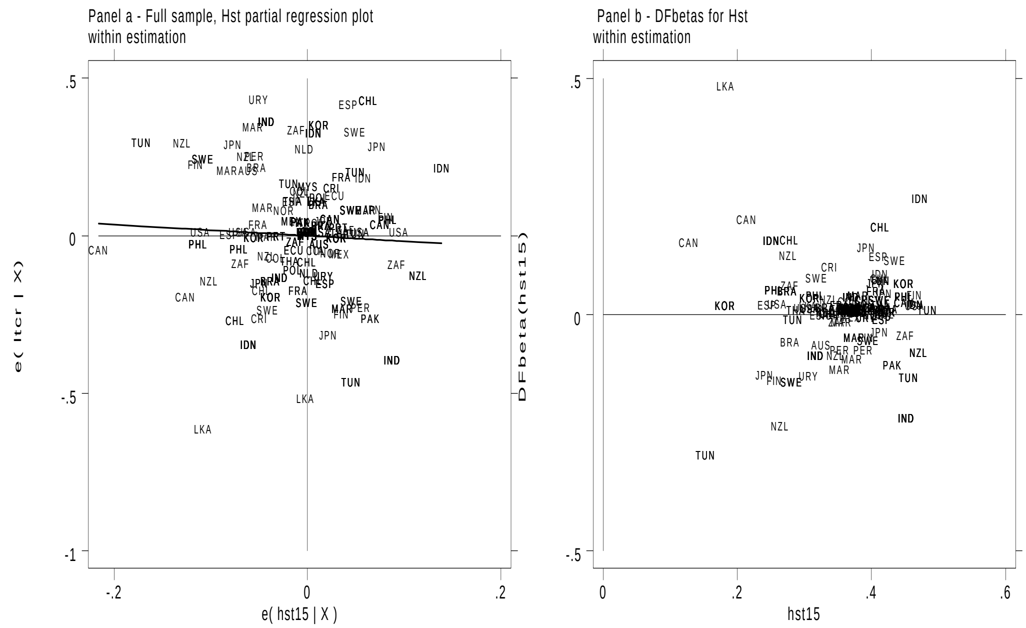

Figure 6: Partial Regression Plots and Influence, HST

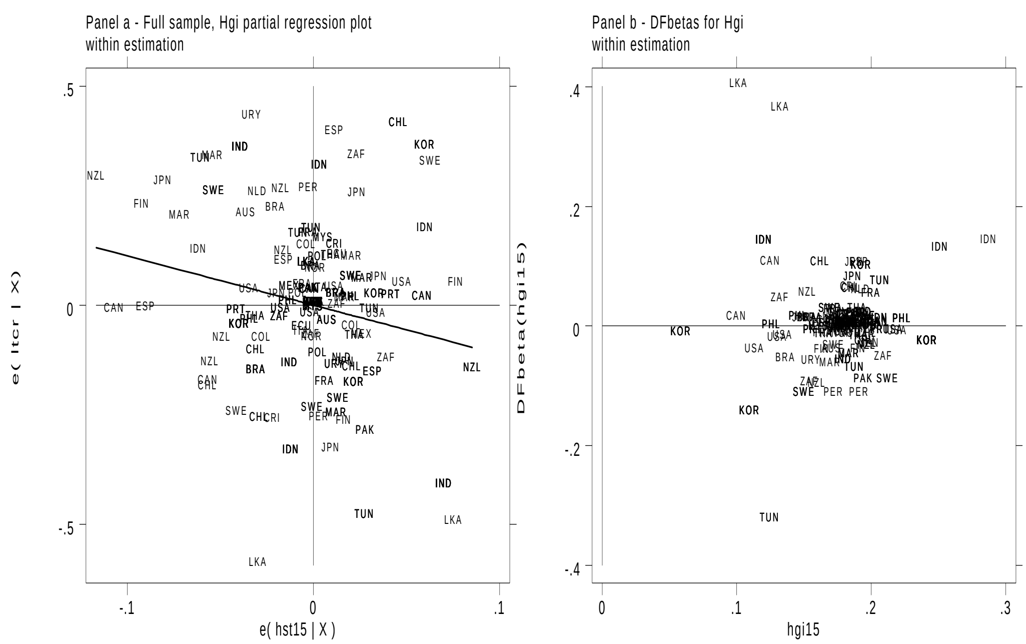

Figure 7: Partial Regression Plots and Influence, HGI

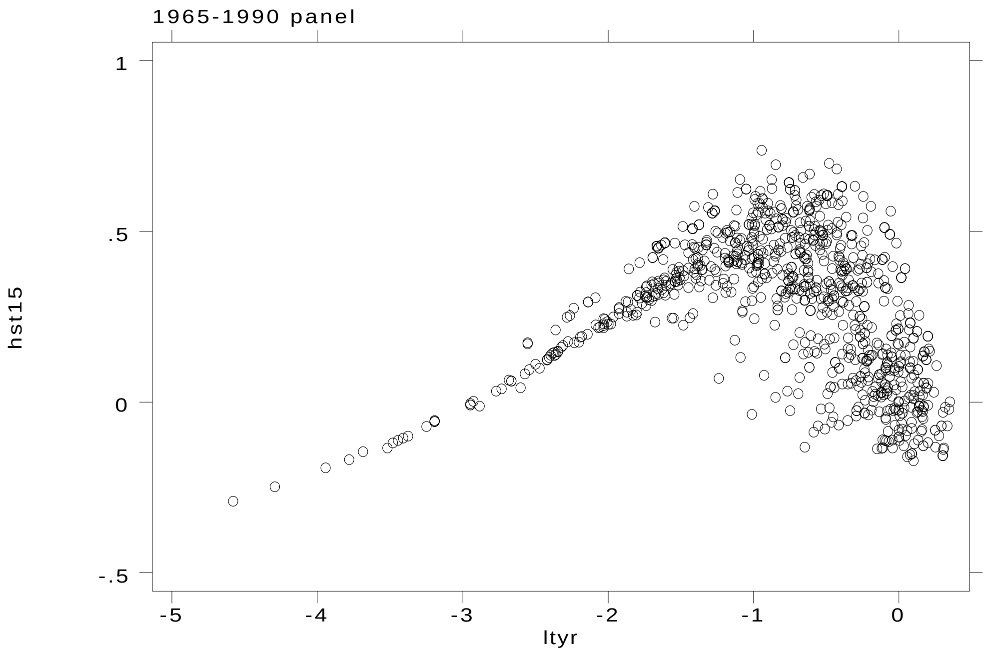

Figure 8: Schooling and Educational Dispersion

and between countries (Jha 1994, Ray 1998, De Gregorio and Lee 1999). Also, the relationship between inequality in educational levels and total years of schooling in the data strongly suggests the inverted U hypothesis. (Figure 9) [13]

As is apparent though for a large fraction of the data the relationship between educational dispersion and total years of schooling is negative. That is, countries with higher educational attainment also display lower dispersion. Therefore, finding a positive effect of inequality, as in the between estimations presented above, could be hiding the effect of factor endowments on the real exchange rate.

To check for these possibilities, I run the restricted sample within and between regressions using lagged values as instruments for the regressors and I include as an additional determinant of the real exchange rate educational attainment, measured as average years of schooling. The results are in Tables 3a and 3b.

First, it is noteworthy that the opposite effects of inequality on the real exchange rate, depending on the estimation procedure, are present also in the sign of the educational attainment variable. Consider the between estimates. The positive coefficient on schooling strongly suggests that in the cross sectional context education tends to appreciate the real exchange rate, even controlling for income per capita. This is precisely

[13]To clarify the intuition of this point, assume a proportion S of the population is educated education. Hence, for any given person chosen randomly from the population the probability of being educated is represented by S, and therefore the variance of this binomial distribution is $P(1-P)$. This immediately leads to the inverted-U between the per capita level of income, that conceivably depends on the fraction of the population that is educated, and the dispersion of education within the population.

what should be expected from the Samuelson-Balassa effect, if tradables production is relatively skill intensive. The size of the coefficient is large: a 10% increase in average years of schooling will appreciate the real exchange rate by 4%.

However, the coefficients of inequality and schooling are reversed for the case of the within estimates. That is, more inequality is associated with an appreciation of the real exchange rate. Equivalently, higher educational attainment leads to a depreciation of the real exchange rate. If preferences are non-homothetic and the demand for non tradable goods has an expenditure elasticity greater than one, then this is what should be expected. A worsening of the income distribution will increase aggregate demand for non tradables.

How to reconcile these two effects? One way to think about it would be that the within estimates reflect the time-series dimension of the relationship between inequality and the real exchange rate, and therefore capture short run dynamics. As the fixed effect captures the wide variation in the cross section that accounts for most of the cross country dispersion in inequality, within a country changes in inequality in the short run interact with the exchange rate via its effect on aggregation of demands.

Indeed, the coefficients of the between estimation only capture the cross sectional variation in the data, and thus have to account for the wide variation in the degree of development in different countries. Hence, these estimates can be related to the longer run, in which Samuelson-Balassa supposedly is the driving force of real exchange rates. Moreover, as the coefficient on schooling is positive this indicates that tradeables production is relatively intensive in skills. Note though that this is a level interpretation of Samuelson Balassa, and does not relate to the usual assumption that differential productivity growth is behind trend appreciation in real exchange rates.

I conclude that the empirical evidence is supportive of factor endowments driving both inequality and the real exchange rate in the long run. In the short run however it appears that inequality has an opposite effect on the real exchange rate, that can be associated with the impact on demand composition. In the next section I will assess the relevance of this result, both quantitatively as well as in relation with the Balassa-Samuelson effect.

5 Assessment and Conclusions

The conclusions of this research can be summarized in three main points.

First, under certain market incompleteness, related to the degree heterogeneity within a country matters for the composition of demand and productivity and whether factor price equalization holds, income inequality has important general equilibrium consequences in the determination of the real exchange rate. The model studied is very general but under some plausible assumptions about the factor intensities and income elasticities the effect of inequality on the real exchange rate is ambiguous. The general equilibrium effect is exacerbated by the fact that inequality itself is endogenously determined.

Secondly, whether the effect is positive or negative hinges on the balance of two forces:

On the one hand, using as a benchmark the negative effect of inequality on productivity of tradable goods, more inequality will tend to depreciate the real exchange rate. This is the Samuelson-Balassa effect. On the other hand, more inequality will tend to appreciate the real exchange rate if the income elasticity of non traded goods demand is greater than one and factor price equalization does not hold.

Thirdly, the empirical evidence seems supportive of these conflicting effects of inequality on the real exchange rate. On the one hand cross country regressions report a negative effect, while fixed effect regression lead to a negative effect. The first channel can be empirically related to the negative relationship present in the cross section between educational dispersion and the average level of schooling of the population. The second effect therefore indicates a short run relationship that, through the composition of demands, leads to more inequality being associated with an appreciation of the real exchange rate.

5.1 Implications for Balassa-Samuelson

The strict version of Balassa-Samuelson is that under perfect capital mobility, *relative* sectoral TFP growth is related to the *changes* in the real exchange rate. The empirical resuls above point instead towards a relation between the *level* of factor endowments and the *level* of the real exchange rate. How can this empirical evidence be related to Balassa-Samuelson? This goes back to the fact that relative TFP growth is the adequate measure of productivity for the determination of the real exchange rate only under factor price equalization. If instead factors of production are relatively immobile between sectors and between countries, a better measure of productivity comes from marginal (or average in the case of Cobb-Douglas technologies) factor productivities. I see the empirical evidence above as a reflection of this case, in the sense that the diferent effects of factor endowments on the real exchange rate can be seen as movements along downward sloping factor demand curves (i.e. a reflection of inelastic factor supplies). If this is the case, then the empirical results allow to infer the relative factor intensities in tradeables and non tradeables. In particular, the positive effect of educational attainment on the real exchange rate imply that tradeables are relatively skill-intensive.

This evidence is also consistent to previous results on the relationship between TFP level and educational attainment[14], hence I interpret the results as a strong backing of supply side determinants of the real exchange rate, versus tastes, in the long run.

5.2 Inequality and growth and directions for future research

The abundant literature on the relationship between inequality and growth has not reached a definite consensus in terms of the size or sign of this effect. Forbes(1998) in fact finds a positive relationship between inequality and growth over the short run, using GMM estimation of growth regressions in the context of an unbalanced panel using the same data set on inequality used here.

[14] i.e. Acemoglu and Zilibotti (1999) and Klenow and Rodriguez-Clare (1997)

I see that evidence as compatible with the one presented here. The Salter-Swan model presented above has a precise channel through which this could be the case. If in the short run output is demand determined, and if more inequality leads to an increase in the demand for non tradeables, then one should expect both an increase in output and a real exchange rate appreciation.

Over the longer run it might be the case that the productivity reducing effects of inequality predominate, because of factor price equalization and international factor mobility. Hence, one should see a reduction in growth as well as a relatively depreciated real exchange rate.

To understand if these are indeed the channels that are at work one needs to specify a model that considers both the dynamics and the level relations between the real exchange rate, productivity, growth and inequality. Indeed, given the debate on the determinants of cross-country growth, it is rather surprising that no attention has been given to the implications for the dual, that is trend appreciation because of Samuelson-Balassa. There is a natural link between the theory and empirics of growth econometrics and the determinants of real exchange rates, that provides a fruitful avenue of research for understanding long run productivity determination and the importance of short run dynamics on growth and the real exchange rate.

A first step in that direction would be to incorporate growth to the Salter-Swan model presented above. This would introduce another dynamic channel of interaction between the real exchange rate, savings, and the current account.

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Table 1 – Full sample estimation – log real exchange rate

	Between			Within		
	gini	hst	hgi	gini	hst	hgi
Lrgdpc	0.338	0.294	0.291	0.178	0.177	0.310
	(0.057)	(0.058)	(0.056)	(0.088)	(0.098)	(0.101)
Inequality	0.156	-0.778	-1.538	0.544	-0.177	0.670
	(0.403)	(0.213)	(0.373)	(0.206)	(0.207)	(0.424)
Open	0.014	-0.077	-0.069	-0.063	-0.084	-0.080
	(0.087)	(0.093)	(0.090)	(0.061)	(0.058)	(0.058)
Ltot				0.267	0.304	0.246
				(0.064)	(0.071)	(0.064)
Cg	1.295	0.616	1.002	-2.542	-2.761	-2.502
	(0.582)	(0.597)	(0.586)	(0.515)	(0.577)	(0.585)
_cons	4.534	4.757	4.737	3.963	4.024	4.118
	(0.103)	(0.119)	(0.112)	(0.203)	(0.194)	(0.192)
n°obs	491	435	435	364	345	345
I	74	59	59	47	43	43
R^2 within				0.153	0.156	0.161
R^2 between	0.423	0.532	0.556			
sd(u_num)				0.785	0.815	0.672
sd(e_num_t)				0.195	0.185	0.185
sd(e_num+u_num)	0.312	0.292	0.285	0.809	0.836	0.696

Table 2: Restricted sample estimation – log real exchange rate

	Between			Within		
	gini	hst	hgi	gini	hst	hgi
Lrgdpc	0.329	0.270	0.279	0.179	0.172	0.304
	(0.056)	(0.055)	(0.054)	(0.090)	(0.100)	(0.104)
Inequality	0.077	-0.893	-1.547	0.549	-0.199	0.617
	(0.392)	(0.204)	(0.356)	(0.214)	(0.212)	(0.436)
Open	0.001	-0.081	-0.080	-0.061	-0.083	-0.077
	(0.086)	(0.089)	(0.089)	(0.062)	(0.060)	(0.059)
Ltot				0.258	0.300	0.240
				(0.066)	(0.073)	(0.066)
Cg	1.711	1.220	1.487	-2.557	-2.795	-2.548
	(0.589)	(0.590)	(0.598)	(0.527)	(0.592)	(0.601)
_cons	4.527	4.752	4.725	3.964	4.014	4.115
	(0.103)	(0.113)	(0.111)	(0.213)	(0.205)	(0.202)
n°obs	470	414	414	344	325	325
I	70	55	55	44	40	40
R^2 within				0.151	0.154	0.158
R^2 between	0.434	0.570	0.568			
sd(u_num)				0.785	0.826	0.679
sd(e_num_t)				0.199	0.189	0.189
sd(e_num+u_num)	0.300	0.271	0.271	0.809	0.848	0.705

Table 3: Robust estimation – log real exchange rate

	Between			Within		
	Gini	hst	hgi	gini	hst	Hgi
Lrgdpc	0.452	0.409	0.416	0.351	0.591	0.547
	(0.047)	(0.051)	(0.050)	(0.053)	(0.055)	(0.058)
Inequality	0.048	-0.329	-0.510	0.076	0.746	1.105
	(0.374)	(0.210)	(0.365)	(0.129)	(0.116)	(0.244)
Open	0.016	-0.009	-0.001	0.034	-0.070	-0.163
	(0.074)	(0.073)	(0.073)	(0.036)	(0.033)	(0.033)
Ltot				0.594	0.086	0.209
				(0.039)	(0.040)	(0.037)
Cg	1.021	0.999	1.162	-1.800	-1.876	-2.649
	(0.453)	(0.423)	(0.436)	(0.361)	(0.324)	(0.337)
_cons	4.673	4.742	4.717	3.754	4.602	4.500
	(0.090)	(0.094)	(0.091)	(0.120)	(0.109)	(0.110)
N° obs	43	43	43	345	345	345
F-test	30.92	35.55	35.03	102.93	50.44	53.44

Tabla 4: Restricted sample – Between estimation

	GINI			HST		HGI	
	1	2	3	4	5	6	7
lrgdpc	0.347	0.338	0.364	0.294	0.331	0.291	0.342
	(0.051)	(0.057)	(0.057)	(0.058)	(0.052)	(0.056)	(0.052)
Inequality		0.156	0.275	-0.778	-0.288	-1.538	-0.249
		(0.403)	(0.409)	(0.213)	(0.212)	(0.373)	(0.599)
ltyr	0.238		0.231		0.196		0.203
	(0.061)		(0.062)		(0.068)		(0.107)
open	-0.049	0.014	-0.046	-0.077	-0.055	-0.069	-0.041
	(0.078)	(0.087)	(0.078)	(0.093)	(0.079)	(0.090)	(0.080)
cg	1.311	1.295	1.357	0.616	1.140	1.002	1.236
	(0.519)	(0.582)	(0.526)	(0.597)	(0.520)	(0.586)	(0.523)
_cons	4.690	4.534	4.699	4.757	4.740	4.737	4.702
	(0.094)	(0.103)	(0.095)	(0.119)	(0.100)	(0.112)	(0.100)
n°obs	433	491	433	435	430	435	430
I	59	74	59	59	58	59	58
R^2 between	0.646	0.426	0.649	0.532	0.667	0.556	0.656
sd(e_num+u_num)	0.250	0.312	0.251	0.292	0.246	0.285	0.250

Tabla 5: Restricted sample – Within estimation

	GINI			HST		HGI	
	1	2	3	4	5	6	7
Lrgdpc [-1]	0.465	0.100	0.450	0.027	0.431	0.157	0.411
	(0.086)	(0.096)	(0.087)	(0.100)	(0.099)	(0.107)	(0.097)
Inequality [-1]		0.440	0.168	-0.504	-0.139	0.193	-0.490
		(0.221)	(0.183)	(0.224)	(0.202)	(0.456)	(0.403)
ltyr [-1]	-0.752		-0.745		-0.739		-(0.771)
	(0.084)		(0.084)		(0.086)		(0.085)
open [-1]	-0.037	0.005	-0.031	-0.019	-0.040	-0.012	-0.031
	(0.056)	(0.069)	(0.057)	(0.064)	(0.056)	(0.065)	(0.056)
Ltot	0.446	0.283	0.446	0.359	0.463	0.283	0.466
	(0.058)	(0.068)	(0.058)	(0.071)	(0.063)	(0.066)	(0.061)
cg [-1]	-1.008	-2.820	-1.006	-3.198	-1.062	-3.081	-1.084
	(0.582)	(0.559)	(0.583)	(0.607)	(0.588)	(0.624)	(0.585)
_cons	3.677	3.790	3.649	3.819	3.663	3.893	3.640
	(0.174)	(0.219)	(0.177)	(0.199)	(0.175)	(0.201)	(0.177)
n°obs	286	300	286	286	286	286	286
I	36	39	36	36	36	36	36
R^2 within	0.367	0.150	0.369	0.177	0.368	0.160	0.370
sd(u_num)	1.222	0.817	1.233	0.951	1.253	0.788	1.261
sd(e_num_t)	0.153	0.188	0.153	0.175	0.154	0.177	0.153
sd(e_num+u_num)	1.231	0.838	1.242	0.967	1.263	0.808	1.270

Tabla 6: Robust between estimation

	GINI			HST		HGI	
	1	2	3	4	5	6	7
lrgdpc	0.372	0.444	0.407	0.371	0.349	0.361	0.363
	(0.045)	(0.048)	(0.046)	(0.042)	(0.044)	(0.042)	(0.043)
Inequality		0.477	0.521	-0.577	-0.434	-1.108	-1.095
		(0.355)	(0.327)	(0.155)	(0.181)	(0.279)	(0.494)
ltyr	0.169		0.152		0.110		-0.004
	(0.053)		(0.050)		(0.058)		(0.088)
open	0.020	0.003	0.039	-0.057	-0.033	-0.014	-0.013
	(0.069)	(0.069)	(0.063)	(0.066)	(0.067)	(0.065)	(0.066)
cg	1.205	1.052	1.403	1.006	1.176	1.367	1.350
	(0.458)	(0.458)	(0.422)	(0.420)	(0.445)	(0.422)	(0.431)
_cons	4.661	4.663	4.680	4.798	4.770	4.740	4.738
	(0.082)	(0.083)	(0.076)	(0.084)	(0.086)	(0.081)	(0.083)
n°obs	58	58	58	58	58	58	58
F-test	33.14	29.90	32.98	36.47	28.65	37.46	29.55

Tabla 7: Robust within estimation

	GINI			HST		HGI	
	1	2	3	4	5	6	7
Lrgdpc [-1]	0.496	0.259	0.476	0.392	0.359	0.445	0.336
	(0.074)	(0.032)	(0.075)	(0.027)	(0.080)	(0.049)	(0.076)
Inequality [-1]		0.066	0.171	0.494	-0.634	0.559	-1.638
		(0.075)	(0.160)	(0.060)	(0.162)	(0.209)	(0.318)
ltyr [-1]	-0.810		-0.800		-0.760		-0.899
	(0.072)		(0.073)		(0.069)		(0.067)
open [-1]	-0.081	-0.286	-0.065	-0.249	-0.038	-0.122	0.044
	(0.048)	(0.023)	(0.049)	(0.017)	(0.045)	(0.030)	(0.045)
Ltot	0.606	0.382	0.588	0.387	0.735	0.870	0.751
	(0.050)	(0.023)	(0.051)	(0.019)	(0.051)	(0.030)	(0.048)
cg [-1]	-1.322	-5.202	-1.345	-2.899	-1.538	-1.464	-1.396
	(0.500)	(0.218)	(0.506)	(0.162)	(0.474)	(0.286)	(0.461)
_cons	3.492	4.132	3.480	4.088	3.361	3.521	3.233
	(0.150)	(0.071)	(0.152)	(0.053)	(0.141)	(0.092)	(0.139)
n°obs	286	286	286	286	286	286	286
F-test	53.64	192.08	42.87	287.39	59.49	280.86	68.37

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