Preliminary and Incomplete
Not for Citation

Inequality, Growth, and Trade Policy

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November 14, 2003

Abstract

1 Introduction

If the world is often skeptical of what economists have to tell them about trade policy, it is at least in part because they suspect that economists live in some cloud-cuckoo-land of perfectly functioning markets and unlimited mobility. While this is broadly unfair, it is true that the standard models of trade do make these kinds of assumptions and perhaps for that reason, their predictions have, at best, an uncomfortable relation with the evidence.

The most celebrated example of this disjunct is perhaps the observation, going back at least to the work of Wasssily Leontief in the 1950s, that most of trade is between rich countries with very similar factor endowments, while the Hecksher-Ohlin model, so much the work-horse of trade policy analysis, emphasizes the opportunities for trade between rich countries and poor countries, since they are the ones with the biggest differences in factor endowments.[1]

Perhaps the politically most sensitive prediction of Hecksher-Ohlin theory is that trade will reduce inequality in the capital scarce country and increase it in the capital abundant country. This follows from the fact that poor countries are labor abundant—trade allows them to take better advantage of their abundant factor, raising the rewards for workers. It is, however, not

[1] See, however, Trefler's (1993) attempt to reconcile the data with the theory.

easy to find evidence that supports this prediction: Based on cross-country panel data, Barro (2000) and Kapstein and Milanovic (2002) conclude that inequality goes up with openness *in poor countries but not in rich ones.* Lundberg and Squire (1999) also using cross-country data, find that inequality goes up on average, while Rama (2001) and Dollar and Kray find no relationship between trade and inequality. Using wage data from Mexico, Hanson and Feenstra (1997) conclude that wage inequality went up in Mexico after it joined the GATT in 1985. Similar patterns have been found by a study of the Argentine liberalization of early 1990s (Galliani and Sanguinetti, 2002) and the Colombia liberalization of the late 1980s (Attanasio et al, 2001). Finally, using tax data from India, Banerjee and Piketty (2003) argue that the post-liberalization period (1992 onwards) was associated with a very rapid increase in the incomes of the very rich (the top 0.1% of the income distribution)—the top 0.01% increased their share of income from 0.6% to 1.6% between 1992-93 and 1998-99—but had relatively uniform impact on the rest of the taxpayers.

There is yet another fact that get less emphasis but is also troubling. The studies for Mexico, Colombia and Argentina mentioned above all note that there is no correlation between changes in tariffs and labor reallocation even though in each case there are substantial distributional changes. This appears to be more the rule than the exception for most developing countries: Papageorgiou et al. (1991) report evidence from 19 liberalization episodes showing no correlation between trade liberalization and transitional shifts in employment. Wacziarg and Wallack (2003) report similar results for 25 liberalization episodes in a range of countries. By contrast, Freeman and Katz (1991), Revenga (1992) and Gaston and Trefler (1994, 1997) do find evidence of labor reallocation in response to tariff changes in the U.S. and Canada and Gourinchas (1999) finds that French labor does move when exchange rates change. It appears that the lack of allocative response to trade policy shocks is particularly striking in developing countries.

Multiple potential explanations have been proposed for each of these facts and it is not our goal here to try to dispute them.[2] But these facts do provide the motivation for trying to rethink what the assumptions of a usable trade model ought to be. Here we propose a variant of the standard Ricardo-

[2] See, for example, Feenstra and Hanson (1996), Davis (1996), Wood (1997) on attempts to explain the distributional facts, or Currie and Harrison (1997) on the lack of factor mobility.

Viner which builds on two key ideas: First that capital is imperfectly mobile across firms, because of the risk of willful default. There is now a very large literature supporting this assumption and suggesting that this is particularly serious problem in developing countries. And second, that one cannot go into a particular business unless one owns a certain amount of what, for want of a better description, we will call sector-specific skills, though we construe them to include both technological know-how as well as more intangible assets like a good name or a set of contacts.

When we combine these two assumptions with the assumption of linear production technology and some convenient assumptions about preferences, we get a model that is still tractable enough to try to address most of the standard questions in trade theory. We argue that this model suggests an explanation of why the standard model fails. It also suggests why it does particularly badly in developing countries, based on the idea that financial markets are particularly ineffective in developing countries. In the last part of the paper, we ask what our model is telling us about the choice of trade policy. We argue that it suggests that for developing countries there are no easy options: Trade will have large and often undesirable distributional consequences in these countries, but to avoid these by imposing tariffs would involve sacrificing more growth than the standard model would predict. Export subsidies do promote short run growth, but at the potential cost of making the rich richer.

2 A Model

2.1 Technology

Consider an economy where there is one non-tradeable final good that is produced using a continuum of tradeable intermediate goods, indexed by $i \in [0, 1]$. The final good y is produced according to the production function $y = A \exp \int_0^1 \log x(i) di$, where $x(i)$ is the amount of the ith intermediate good.

The production of intermediate goods uses only the final good and labor. The production function is of the endogenous growth type: The total output of intermediate good i will be $a\sigma(i)k^{\alpha}l^{1-\alpha}(\overline{k})^{1-\alpha}$ when a firm combines k units of the final good with l units of labor and the average capital stock invested in production in the economy is $\overline{k}$.

The function $\sigma(i)$ represents the productivity of the various sectors; we assume that $\sigma(\cdot)$ is strictly increasing and continuous in the "home" country. Other countries will typically have different orderings.

2.2 Consumption, Savings and Investment

Each sector i has a sub-population of producers of size $N(i)$ who are the only ones in the country capable of producing that good. There is also a sub-population of workers, who have no industry-specific skills but who alone can supply labor. The supply of labor is normalized to be 1.

Everyone in this economy is long-lived, and the skill distribution remains unchanged over time. Both the producers in this economy and the workers consume only the final good. Producers maximize a utility function of the form: $\sum_0^\infty \delta^t \log(c_t)$ where c_t is the amount of the final good they consume in period t. Consumption takes place at the beginning of each period, before investments are made and the income for the period is generated. The rest is saved and invested. Workers consume their entire wages and do not save anything.

Intermediate goods must be used right away to produce the final good; they are not storable past the end of the period in which they are produced.

2.3 Asset Markets

There are three possible destinations for savings in this economy. First, they may be invested in the industry associated with the saver. Second, they may lend the money to another investor in the economy. Third, they can put them in a default asset which yields a (gross) rate of return ρ, but does not use any labor. We may interpret this asset either as capital flight, or as storage. The final good is the sole vehicle for all investment. There are no capital inflows into this economy (though one interpretation of the default asset may be as capital outflows).

We assume that there is no credit involved in the production of the final good: Units of the various intermediate goods can be instantaneously combined to generate the final good. On the other hand, the production of intermediate goods requires credit because there is a delay between the investment and the production, and both labor and capital has to be paid for in advance.

2.4 Production of the Final Good

Cost minimization in the production of the final good yields the first order condition $\frac{x(i)}{x(j)} = \frac{p(j)}{p(i)}$, where $p(i)$ is the price of the ith intermediate. From this, it follows that the unit cost of the final good will be

$$A^{-1} \exp \int_0^1 \log p(i) di.$$

2.5 A Model of the Credit Market

The key substantive assumption in this investigation is that the credit market is imperfect, so that one's initial wealth figures in how much one can invest. We choose a very simple model of such a market, in which loan repayment is imperfectly enforceable. Suppose k dollars invested yields a gross return Rk and that the gross interest rate is $r \leq R$. A borrower who has a wealth of w and invests k will need to borrow $k - w$. He is supposed to repay $(k - w)r$ at the end of the period (there is free entry into lending). But by expending some resources, which we assume to be proportional to the size of the investment, he can avoid repayment altogether. We denote the constant of proportionality by η and assume that it is less than the "backstop" rate of return ρ.

Lenders will only provide finance up to the point where the borrower has the incentive to repay: This requires $Rk - r(k - w) \geq Rk - \eta k$ which gives us:

$$\frac{k}{w} = \frac{r}{r - \eta} \equiv \lambda(r, \eta).$$

This formulation of the credit market imperfection, though crude (in particular, we have ruled out long-term contracts), yields the most tractable model. More complex contracting assumptions could be considered, and have been in the literature (see Kehoe-Levine, 19nn;), but would be unlikely to substantially alter our conclusions. In particular, there is no reason to believe that more complex contracts will eliminate the imperfections altogether, nor diminish the importance of current wealth in limiting investment.

Moreover, by varying the parameter η we can consider all degrees of efficiency of capital markets. One can give η a legal, institutional, or technological interpretation. Based on the now extensive literature showing a strong correlation between financial market development (high η) and other measures of development (income per capita, human capital, etc.) we shall often speak of developed (or rich) economies as those with high η (hence λ large) and less-developed (or poor) ones as having η near 0, so that all investment must be almost entirely self-financed.

2.6 Production of an Intermediate Good

The choice of labor and capital maximizes

$$a\sigma(i)k^{\alpha}l^{1-\alpha}(\overline{k})^{1-\alpha},$$

subject to the constraint that if ω is the market wage:

$$\omega l + k = \lambda(r, c)w.$$

This tells us that $k = \alpha\lambda w$ and $l = (1-\alpha)\lambda w/\omega$.

Total output is therefore

$$a\sigma(i)\alpha^{\alpha}(1-\alpha)^{1-\alpha}(\lambda w)(\frac{\overline{k}}{\omega})^{1-\alpha}.$$

Now, aggregate demand for labor is $(1-\alpha)\lambda\overline{w}/\omega$, where $\overline{w}$ is the average wealth in the economy among those who invest in production, and $\lambda\overline{w} = \overline{k}$, the average amount invested in production. The aggregate demand for labor must be equal to the supply, 1. Consequently, total output of firm i can be written in the form $\sigma(i)\lambda w$ under the normalization $a\alpha^{\alpha} = 1$.

2.7 Individual Decision Making

For an investor who produces intermediate good i, the net income after repaying his loans (which is his starting wealth for the next period) will be

$$w_{t+1}(i) = [p_t(i)\sigma(i)\lambda(r_t) - (\lambda(r_t) - 1)r_t](w_t(i) - c_t(i)),$$

where $p_t(i)$ is the price of the ith intermediate in terms of the final good and $R_t(i)$ is the return on capital in that sector.

If the investor instead lends his wealth on the capital market, his income is

$$w_{t+1} = r_t(w_t(i) - c_t(i)).$$

It is easily checked (see for instance Sargent, 1987) that in either case his optimal savings rule will be the same: $w_t(i) - c_t(i) = \delta w_t(i)$. It will be convenient to denote the gross return to saving at t in sector i by $R_t(i)$, so that $R_t(i) = \max\{r_t, p_t(i)\sigma(i)\lambda(r_t) - (\lambda(r_t) - 1)r_t\}$.

3 Equilibrium and Dynamics in a Closed Economy

3.1 Equilibrium

Several facts result from fairly standard calculations. First, free entry into the in the final goods market implies that the consumption-good price is equal to unit cost: $A^{-1} \exp \int_0^1 \log p(i) di = 1$.

Second, as we have noted, for the intermediate goods, sales revenue is constant across all sectors. As a result, the price for a particular intermediate good will be inversely proportional to the amount produced.

Third, for any good i in which $R_t(i) > r_t$ all the wealth of that sector will be invested in production and the firms will be maximally leveraged. Total production will be $\delta\sigma(i)\lambda(r_t)w_t(i)$. For those goods for which $R_t(i) = r_t$, it must be the case that $p_t(i) = r_t/\sigma(i)$, and total production will be set to generate a price that satisfies this equation.

3.2 Dynamics

Assume that the initial distribution of wealth within each sector is given, identically, by $H_0(w)$. Everybody within a sector enjoys a common growth rate: $w_{t+1}(i) = \delta R_t(i) w_t(i)$. Therefore the distribution of wealth in a sector normalized by mean wealth in that sector does not change over time. All of the "interesting" dynamics are cross-sectoral. Denote the aggregate wealth of sector i at t by $w_t(i)$.

Before proceeding, note that with perfect capital market: Almost all sectors must have the same rate of return in equilibrium, else all capital would flow to those having higher returns, leading to zero output given the Cobb-Douglas technology of final good production. Therefore any cross-sectoral relative distribution of wealth is stationary and all sectors always grow at the same rate.[3]

This is not the case with imperfect credit markets, but the source of relative growth is somewhat surprising. One might, for instance, expect that more productive sectors grow faster. As it turns out, productivity has nothing to do with it:

[3] This would be true even if the aggregate technology were strictly convex, as in the "neoclassical" growth model.

Proposition 1 *In the closed economy, a sector grows faster than another sector only if its average wealth is lower.*

Proof. Since the growth rate $w_{t+1}(i)/w_t(i) = \delta R_t(i)$, it is enough to show that $R_t(i) > R_t(j) \Longrightarrow w_t(i) < w_t(j)$. Note first that for two sectors i and j that are both constrained

$$\begin{aligned} R_t(i) \quad &> \quad R_t(j) > r_t \Longleftrightarrow p_t(i)\sigma(i)\lambda(r_t) > p_t(j)\sigma(j)\lambda(r_t) \\ &\Longleftrightarrow \quad \frac{\sigma(i)}{\sigma(j)} > \frac{p_t(j)}{p_t(i)} = \frac{x_t(i)}{x_t(j)} = \frac{\sigma(i)\lambda(r_t)\delta w_t(i)}{\sigma(j)\lambda(r_t)\delta w_t(j)} \\ &\Longleftrightarrow \quad w_t(i) < w_t(j) \end{aligned}$$

The same conclusion is true if comparing a constrained sector i with an unconstrained sector (i.e., one in which $R_t(j) = r_t$), j. The same conclusion is true if comparing a constrained sector with an unconstrained one (i.e., one in which $R_t(j) = r_t$); then $x_t(j) \leq \sigma(j)\lambda(r_t)\delta w_t(j)$, and $p_t(i)x_t(i) = p_t(j)x_t(j)$ implies $\frac{r_t}{\sigma(i)}x_t(i) = r_t\lambda(r_t)\delta w(i) < p_t(i)x_t(i) = p_t(j)x_t(j) \leq \frac{r_t}{\sigma(j)}\sigma(j)\lambda(r_t)\delta w_t(j)$ $\Longleftrightarrow w_t(i) < w_t(j)$. Only if both sectors earn the interest rate r_t can we not be sure of the relative size of their wealths. ■

The basic intuition for this result comes from the fact that the revenue going to each sector is a constant. The rate of return is therefore maximized by the sector that invests the least (and still earns the same revenue as everyone else), which is the sector which starts with the least money. It follows from this proposition that the sectors that, in equilibrium, lend (and therefore earn the lowest returns), are the ones that have the highest average wealth. Moreover, the sector that starts with the highest average wealth will remain that way. To see this, note that for any sector i that borrows:

$$w_{t+1}(i) = \delta[p_t(i)x(i) - loanrepayment]$$

and for any j that lends

$$w_{t+1}(j) = \delta[p_t(j)x(j) + interestearnings].$$

Since $p_t(i)x(i)$ is a constant across sectors, the lending sectors must end up richer than the borrowing sectors. Moreover, for every lending sector $w_{t+1}(j) = \delta r_t w_t(j)$. Therefore, the sector that starts richer, among those that lend, ends up richer.

Since the sector that starts with the highest average wealth remains that way, we can use this sector, which we designate sector κ, as a benchmark for comparing the growth of all the other sectors. From the point of view of this exercise, the relevant distinction is between constrained and unconstrained sectors: The unconstrained sectors grow at rate δr_t, just like sector κ, and therefore maintain their proportional distance from sector κ. The constrained sectors grow faster and therefore catch up with sector κ. It follows that:

Proposition 2 *Assume $w_0(i) > 0$ for all i. Then the economy converges to a steady-state growth path in which:*
(1) all sectors grow at the same rate; (2) the rate of return in all sectors is equal and equal to the interest rate.

Proof. In appendix ■

This tells us that in a closed economy, there are no extra rewards for owning particular sector-specific factors, in the long run.

3.3 Steady State Growth in the Closed Economy

Focusing on the steady state just described, denote the average sectoral steady state wealth by w_t. Then the output of the final good of the economy will be just

$$A \exp \int_0^1 \log \sigma(i) \delta w_t di = \delta A w_t \exp \int_0^1 \log \sigma(i) di.$$

The steady state interest rate in the closed economy must satisfy $r^c = A \exp \int_0^1 \log \sigma(i)$, and the corresponding growth rate will be $\delta A \exp \int_0^1 \log \sigma(i) di$.

4 Equilibrium and Dynamics in an Open Economy

4.1 Equilibrium

We imagine our economy as embedded in a world economy in which trade among other countries has already adjusted to its steady state. In particular, every other country has completely specialized in the good in which it has a comparative advantage (i.e., at which *its* σ function is maximized). Each economy is small, so that it takes all prices as given. Because of the assumption we made about all the σ functions, namely that they achieve the same value at their maximum, all intermediate goods have the same price in world markets, which we normalize to be 1.

When our economy is open, trade in intermediate goods is frictionless, but there is still no trade in the consumption good, nor does lending occur across borders. The final good will have a price of $1/A$, and the price of intermediates in terms of the final good is $p_t(i) = A$. Therefore, $R_t(i) = A\sigma(i)\lambda(r_t) - (\lambda(r_t) - 1)r_t$.

Because the credit constraints prevent capital from flowing instantaneously to the "best" sector, much of it will remain in relatively inefficient sectors. These sectors will continue to produce, at least for a while. There are two types of equilibria possible. In the first, the interest rate on the default asset is too low to be binding on the equilibrium interest rate. In this case, there will be a cut-off level $\underline{i}$ such that only goods above $\underline{i}$ will be produced in equilibrium and the interest rate clears the capital market: i.e.,

$$\int_{\underline{i}}^{1} \lambda(r_t) w_t(i) = \int_{0}^{1} w_t(i) \text{ and } A\sigma(\underline{i}) = r_t.$$

In this equilibrium the wage rate $\omega = (1-\alpha)\int_0^1 w_t(i)$.

Under the second possibility, we still have a (different) cut-off level $\underline{i}$, but now there is an interest rate at its floor, ρ, given by the default asset: i.e., $A\sigma(\underline{i}) = \rho$. In this steady state the wage rate, $\omega = (1-\alpha)\int_{\underline{i}}^1 \lambda(\rho) w_t(i)$.

5 What happens when a closed economy in steady state is opened?

5.0.1 Wages and interest rates

First, note by way of comparison that with *perfect* capital markets only good 1 would be produced and the interest rate would $A\sigma(1)$. There would be no effects of opening trade on the inter-sectoral distribution of wealth, since all agents receive the same rate of return, whether they produce or simply lend. Everyone who owns wealth will become richer, in exactly the same proportion as their wealth. Workers will initially remain unaffected, but over time, wages will go up in proportion to average wealth.

But as we have already suggested, things are rather different with capital market imperfections. Some very inefficient sectors do close down, and their producers lend their capital to the rest of the economy. But now many sectors, rather than just one, will expand. We now try to characterize this process more precisely.

First, the interest rate goes up if and only if:

$$\int_{\underline{i}}^{1} \lambda(r^c) > 1 \text{ where } \underline{i} \text{ is defined by } A\sigma(\underline{i}) = r^c = A \exp \int_0^1 \log \sigma(i).$$

Here r^c is the closed economy steady-state interest rate. This condition is more likely to be satisfied when the λ function moves to the right, i.e., if it is large. Thus opening trade will tend to raise interest rates in "developed" countries (those with well-developed capital markets) – the increased average productivity if the economy dominates. But in "less developed countries", i.e., countries with poorly functioning credit markets (low η), the interest rate will tend to fall. Lending more to the most productive sectors results in sure default, so the capital has to remain in unproductive sectors.

This gives a comparative static very similar to that in the Hecksher-Ohlin world—interest rates go up in rich countries and fall in poorer ones upon trade liberalization—but for entirely different reasons. Goods that are exported in our world are no more capital-intensive than goods that are imported, so the Hecksher-Ohlin mechanism has no place in our world. Falling interest rates in poor countries after trade liberalization is not a symptom of the benefits of trade for poor countries, but a sign of the costs it imposes on countries with ineffective capital markets.

Wages do not change on impact of trade opening if the new interest rate is greater than ρ. If the interest rate falls to ρ and some capital is invested in the default asset, the total wage bill falls and therefore wages must fall when liberalization hits.

5.0.2 Winners and losers

Putting all this together we see that the effect of liberalization starting in a steady state of the closed economy falls into one of three patterns. First, since in the closed economy steady state everyone was earning a return r^c on their wealth, everyone must be (weakly) better off as a result of liberalization, as long as the interest rate goes up (since wages do not change). In such economies liberalization must reduce poverty. However, assuming that the workers were initially the poorest people in this economy, inequality, as measured by the range, must go up when trade is liberalized, since the rich have become richer and the poor (i.e., the workers) remain where they were. Inequality, as measured by the Gini coefficient, may or may not go up because while some people will get very rich, others who are currently well-off may become poorer and may, as a result, end up closer to the workers. Of course, the workers need not be the poorest people in this economy. Petty entrepreneurs, in developing countries, are often those who do not have the human/social capital to qualify to be workers. In this case, the effect on inequality depends on the kinds of sectors where the poor are concentrated. If these happen to be the less productive sectors, inequality will tend to go up, but in the alternative case, it may actually go down.

The second possibility is that the equilibrium interest rate goes down but does not hit ρ. In this case, the workers will be exactly as well off as before, but a group of entrepreneurs/rentiers will lose because their sector shuts down or because the sectors they used to lend to shut down. The effect on poverty depends on whether these entrepreneurs/rentiers actually become poorer than the workers. On the other side, those among the rich who belong to the industries that have the highest productivity levels must be better off after liberalization. This is because they must earn a return of at least $\sigma(i)A$ on their wealth, which is more than r^c as long as i is close enough to 1. The combined effect is that the impact on inequality is ambiguous, unless we measure it by something like the range, but the people at the top end of the distribution capture a large part of the gains from liberalization. This could explain the pattern that Banerjee and Piketty (2003) report for India in the 1990s.

Finally, interest rates may go down and hit ρ. In this case, the workers will get poorer, and while a fraction of the rich will get much richer, other entrepreneurs may end up worse off.

Given that interest rates are more likely to go up when the capital markets work well, one broad pattern seems to be: *The less developed the financial sector, the more likely it is that some people get hurt.*

The effect on inequality of better capital markets is less clear cut since the specific choice of measures seem to matter. However, the effect on inequality is not necessarily the greatest when η is the smallest. This is because a small η makes it harder to borrow and therefore limits the ability of the most productive sectors to benefit from the liberalization. On the other hand, as we already noted, a very high η, representing perfect credit markets, also limits the impact on inequality, since it squeezes the rents that would have otherwise gone to the owners of specific factors. The effect on inequality may be biggest at intermediate levels of η.

Given that the increase in inequality comes from people in the most productive industries being able to take better advantage of their skills, it is entirely possible that when two countries open for trade with each other inequality goes up in both. This contrasts with the usual intuition, based on the Samuelson-Stolper Theorem, that the reduction in inequality in one of the partners has to be mirrored by an increase in inequality in the other.

Finally, the better the default asset (higher ρ – the easier the capital flight, the larger the government deficit), the more of the cost of transition is borne by workers and rather than rentiers. This is another reason why trade liberalization might be particularly traumatic in the poorer countries.

5.1 The volume of trade

The volume of trade in our world will depend on the quality of capital markets and the length of time the country has been open to trade. To see this, consider the case where $\eta = 0$, so that no one can borrow or lend. When the country is opened to trade, initially the allocation of capital (and therefore labor) across sectors will not change, unless some of the capital goes into the default asset. Therefore there will be no trade. However, there will be substantial reallocation of rents across sectors, since now all the sectors face the same output prices, irrespective of productivity. In other words, there will be changes in the distribution of income without there necessarily being any changes in the pattern of trade. This could explain the fact, reported above, that changes in trade policy are not usually associated with substantial factor reallocations.

Over time, this will change. The more sectors that have the most rents will grow the fastest, and eventually the allocation of resources will be aligned with the pattern of productivity differences. In the process trade will expand: The most productive sectors will export and the rest will become importers.

With better capital markets the adjustment will be faster, since some of the factor reallocation will happen through lending and borrowing rather than the accumulation of internal funds.

An implication of this argument is the following: If we think of countries being similar if they have similar (but not identical) orderings of $\sigma(i)$, then two similar countries with good capital markets may trade more with each other than two dissimilar countries, at least one of which has poor capital markets, controlling for the length of time they have been open to each other.

This is one possible reason why rich countries trade more with each other than with developing countries.

5.2 The long run

The dynamics of each sector is still given by $w_{t+1}(i) = \delta R_t(i) w_t(i)$ for $i \geq \underline{i}$, and for the rest $w_{t+1}(i) = \delta r_t w_t(i)$: The more productive sectors grow faster. This raises the interest rate and the wage rate.

Eventually the economy converges to producing only good 1 and growing at its Harrod-Domar growth rate, $\delta A \sigma(1)$, which is clearly greater than the closed economy steady state growth rate, $\delta A \exp \int_0^1 \log \sigma(i) di$.

6 Trade Policy

6.1 Import Tariffs

Let the import tariff be at the rate τ. Let the revenues be paid out as a proportional negative income tax at rate ξ. Imports will have the price $1+\tau$, while exports will have the price 1, as before.

In general what gets exported depends on the domestic distribution of wealth. Let us assume that $w_t(i)$ is increasing in i. Then there will be an i^c such that $p_t(i) = 1$, $i > i^c$ and $p_t(i) = 1+\tau$, $i \leq i^c$. Goods below i^c would not be exported. There will also be $\underline{i}$ such that goods below $\underline{i}$ will not be produced.

The price of the final good will be $P_t = A^{-1} \exp[\int_0^{i_c} (1+\tau) di] > A^{-1}$. This is the usual idea that tariffs raise the prices paid by consumers.

6.1.1 The impact of a tariff

For any initial vector $\{w_t(i)\}$, the effect of the tariff will be to raise the number of goods that are domestically produced which raises the interest rate initially.

The government's budget constraint implies:

$$\xi_t y_t = \frac{\tau}{1+\tau}[(1+\xi_t) i^c y_t - \int_0^{i^c} p_t(i) z_t(i)],$$

where y_t is the total pre-tax value of domestic production (at domestic prices) and $z_t(i)$ is the amounts produced.

This implies that $\xi_t < i_c \frac{\tau}{1+\tau}(1+\xi_t)$. ξ_t is the subsidy an exporter gets, while $i_c \frac{\tau}{1+\tau}(1+\xi_t)$ is the extra amount he pays. There is a net transfer from exporters to producers of import-competing goods.

The growth rate of the economy as a function of the tariff rate can be written as:

$$\frac{\delta}{\int_0^1 w_t(i)}\left[\int_{\underline{i}}^{i^c} \frac{(1+\xi)A\sigma(i)w_t(i)(1+\tau)}{\exp[\int_0^{i_c}(1+\tau)di]} + \int_{i^c}^{1} \frac{(1+\xi)A\sigma(i)w_t(i)}{\exp[\int_0^{i_c}(1+\tau)di]}\right].$$

The expression in the square brackets goes down when τ goes up. This is the usual trade distortion of effect. For the standard reasons, this is second order for small changes in τ, starting with $\tau = 0$. In addition, however, the distribution of wealth is changed in favor of less productive sectors. This has a first order negative effect on future growth but also a first order effect on the future distribution of income: It may be possible to protect the poor by using tariffs, but only at a significant cost in terms of growth.

The long run growth rate also goes down with higher tariffs. This is of course what we would have expected given that the long run of this model is just like the long run of a standard AK model.

6.2 Export subsidies

Let us start by assuming that when the economy was opened, $w_t(i)$ was increasing in i. Then the sectors that are the most productive will also be the biggest exporters when the economy is opened. Now suppose the government announces a rule that says that it will pay a subsidy to *firms that are in industries where the country is a net exporter.*[4] Suppose that it finances this subsidy through a proportional income tax on other producers (i.e., not on workers). This will help the most productive industries to grow faster, which will raise the growth rate of the economy in the short run. The long run growth is however unaffected.

Since we start by assuming that the exporting sectors are also rich, an export subsidy might increase inequality. However, it also raises interest rates, which go the other way.

[4] If the government simply paid a subsidy for every unit exported, in our model, people will simply export everything they produce and import it back.

Export subsidies work less well if initially the richest sectors were not the most productive ones. Then the subsidy might help some relatively unproductive firms survive or even expand. This could slow down the transition process.

7 Conclusion

The goal here was to build a simple model of international trade that takes factor market imperfections seriously and to see where it takes us. This model clearly resists classification along the "for or against Globalization" dimension, at least under their most naive interpretations. What it does say, rather emphatically, is that from the point of view of poor countries liberal trade policies offer a rather harsh trade-off: In the long run, growth may indeed benefit from liberalizing trade but at the cost of much short-run displacement.