Unequal societies, Unequal Terms of Trade and Trade Policy

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Abstract

We consider a demand based theory along the lines of Murphy et al. (1989) to study the interaction between income inequalities and trade patterns. We analyze the effect of redistributive policies on the production patterns and welfare. We distinguish an intensive and an extensive channels through which an increase of demand - driven by redistribution or trade opening - leads to output growth inside a country and in its partner country. Trade between different countries (in terms of income or inequality) generates a modification of the demand distribution between sectors which impacts the industrialization process, the terms of trade and the welfare distribution within countries. Our framework hopefully provides a basic tool for studying the interactions between changes in tariffs on welfare and inequalities inside and between countries.

We obtain non monotone relationships between the degree of inequality in the home country and the level of income of its trade partner. We can observe a U-shape or an inverted U-shape depending on among other things, the relative size of the two countries. As a result the welfare effect of trading with unequal countries is ambiguous.

(Very preliminary Version)
"It is obvious that our desires do not aim so much at quantity as diversity."¹

Income levels are decisive in determining consumption patterns. As Jackson (1983) notes, consumption behavior at low income levels is characterized by a very limited set of purchased items. In particular, he shows that the richest people in his sample purchase on average at least 50 commodities not in the basket of goods purchased by the poorest people.

Data also point to important differences between trade patterns of countries with similar income per capita levels depending on their degree of inequality. For instance, international exports of luxury goods towards countries such as Brazil and Costa Rica—two countries with similar income per capita, but different degree of inequality—are quite different, meaning that both income per capita and income inequalities have strong influence on trade pattern².

In this paper, we focus on the effects of income inequalities between and within countries on trade patterns and trade policies. For instance we ask ourselves the impact of income inequalities on the political decision concerning trade tariffs. We believe that this subject matter is especially relevant in light of the observed rise of inequalities in emerging countries, such as China, where increase in asset prices and quasi-stagnation of wages gave rise to increasing inequalities between capital holders and workers.

This paper is closely related to the literature arguing that differences in initial income inequalities and market size may lead to different patterns of development. In a seminal paper, Murphy et al. (1989) argue that a country can profitably industrialize if sales are high enough to cover fixed setup costs for the emergence of increasing return technologies. They suggest two conditions conducive to industrialization. First, a leading sector must growth and provide the source of autonomous demand for manufacture. Second, income generated by this sector must be broadly enough distributed so that it materializes as demand for a wide range of domestic manufactures.

We first consider a tractable two-country trade model with nonhomothetic preferences and income heterogeneity. We choose to focus on the framework of Matsuyama (2000) and Foellmi et al. (2007) that include non-homothetic utility function with 0/1 preferences. As in Jackson (1983), consumers choose the number of varieties instead of quantities. The richer the household, the higher the number of varieties purchased by the household. Firms have

¹Nassau William Senior (26 septembre 1790 - 4 juin 1864)
access to two alternative technologies to produce a given variety: a traditional technology with no fixed cost (which is profitable for small scale production) and a modern technology with a fixed cost (which is profitable only for large scale production). Non homotheticities imply that demand for a good of a given variety depends on the shape of the income distribution. As in Murphy et al. (1989) a more equal distribution increases the sales of high varieties goods and allows to cover fixed setup costs necessary to make the adoption of increasing returns (more efficient) technologies profitable.

It is important to note that in our model, profits and inequalities interact in equilibrium. Larger profits increase demand but also inequalities (because rich households own more firms’ shares) and so the portion of demand addressed to the competitive (less efficient) sector. Lower inequalities increase the share of demand addressed to the monopolistic (more efficient) sector and so profits and inequalities. Consequently, the overall pattern of expenditure in a society has implications for the distribution of income. This interaction between income inequalities and average income can be relied on some historical experiences. As Ray.D. (1998) notes, England and the United States presented an interesting contrast during the nineteenth century. The twist in the tale is that mass production also possibly ensured the existence of a large group of individuals - not so rich not so poor - whose demands sustained mass production. A large market for one variety lends an advantage to a country producing under increasing returns to scale and generating positive profit.

We distinguish two channels through which an increase of demand leads to output growth inside a country. The first one is through an intensive margin. The second channel is an extensive one. First, poor households can afford more varieties of manufactured goods already produced with the more efficient technology. Because this sector is characterized by increasing returns, aggregate profit and national income increase. Second, richer households can access to more differentiated goods, and extend their basket of consumption. Some high variety goods become more largely distributed in the economy, and their production can be made using the increasing returns technology.

All intensive and extensive effects are driven by demand effects. Of course, we believe that specialization may occur from supply effects and the existence of some comparative advantage in some activities but we voluntary choose to focus in our point of view on a less documented side of the trade activities: namely the demand side.

Finally, trade between different countries in terms of income or inequality generates a modification of the demand distribution between sectors which impacts the industrialization
process, the terms of trade and the welfare distribution within countries. Our framework
hopefully provides a basic tool for studying the interactions between changes in tariffs on
welfare and inequalities inside and between countries.

We show in this paper that a redistributive policy is always profit increasing in a closed
as well as in an open economy for the countries which redistribute. This increasing profit
is obtained by an intensive use of manufactured goods, and possibly by an extensive one
depending on the initial income distribution. Anyway, the intensive positive impact always
dominates the generally negative extensive one, whatever the distribution of the wealth, and
the initial level of income. More surprisingly, the impact of a redistributive policy on the
income of a partner country is non trivial. It depends on the relative size of the countries,
and on the initial degree of inequalities in the economies. In fact, the industrialization
process depends exclusively on the size of the middle class defined at the national level.

A redistribution policy in a poorer partner country may diminish the extensive and intensive
margins. At first it may decrease the purchasing power of the foreign rich households who
import our industrialized good, and second it may influence the terms of trade. In this case
we note a negative externality. However, the same redistributive policy in a similar country
will generate a positive externality. More precisely, we obtain non monotone relationships
between degree of inequalities in a country and level of income of the trade partner. We can
observed a U-shape or an inverted U-shape depending of the relative size of the countries.

Next, we explore the welfare implication of trade agreement in our model. We compare
aggregate and individual welfare under autarky with the corresponding welfare under free
trade. In a two sectors model, Bougheas and Riezman (2007) suggest that trade has opposite
effects on the income inequality of the two partner countries. In contrast, Zhu and Trefler
(2005) find that inequality increases in both countries. Bougheas and Riezman (2007)
explain this opposite result by the fact that Zhu and Trefler (2005) are interested in trade
between developed and developing countries where trade is driven because of a technological
gap while they are interested in trade between countries with similar technologies, but
different endowment distributions and preferences. In our contribution, the technology gap
is endogenously determined and depends on the demand characteristic. By consequence,
trade influences the industrialization process, the terms of trade and income distributions.
Moreover, the number of varieties is endogeneous in our model and reproduces the fact that
we observe a continuing growth in diversity at all income levels.

3See Matsuyama (2000) and Flam and Helpman (1987) who show also that one country's income distribution policy may affect another country's income distribution.
1 Literature Review

The relation between income inequality and trade has received great attention recently as levels of income inequality in many countries have been increasing\(^4\). In this literature, households have a more or less high willingness to pay for high quality, or numerous varieties according to their relative position in the income ladder. Following Grossman and Helpman (1991), we suppose that there is a continuum of varieties of goods but we do not introduce a continuum of qualities for every variety. However unlike Grossman and Helpman, the part of every variety in the basket of the household will not be supposed constant over time, but will evolve with the level and the distribution of the per capita income in the economy.

The income inequality can be modeled in very different framework by assuming differences in levels of human capital as in Bougheas and Riezman (2007), differences in labor productivity as in Yeaple (2005), differences in kinds of labor (skilled and unskilled) that enter separately in the production function, or differences in physical capital as in Mitra and Trindade (2005). We assume a model without capital but with rents. We assume that the wages are less dispersed than rents earning in the economy. A redistributive policy reduces then the share of rents in the household income. It reduces also inequalities and expand the number of sectors adopting the more efficient monopolistic technology.

As in Desdoigts and Jaramillo (2006), we focus on the impact on inequalities on industrialization and trade pattern. But unlike them, we consider that the income distribution is endogenous and depends on the aggregate profit in the economy.

2 The model

2.1 Households

We set up a model where rich households consume more varieties of goods. Higher wealth does not lead to buy a bigger quantity of every good but a larger number of them. Essential goods, which are bought by all the consumers, are produced on a large scale by industries with increasing returns. The luxury goods are the last varieties to be bought and concern only the richest households. More specifically, they are produced in small quantities by industries with constant returns.

We consider a continuum of households in the interval $[0, N]$. Households utility is given by:

$$U = \int_0^\infty m(q)x(q)dq$$  \hspace{1cm} (1)

where $x(q)$ lies in $\{0, 1\}$ and $m$ is non increasing. As income increases, the number of goods consumed increases but not the quantity of each one. At this stage, the labor supply is fixed to $\ell$ for each household. Households own firms and they only differ by the share $k$ of aggregate profit they hold. Let $G(k)$ the cumulative distribution of shares among households ($g = dG$) one has:

$$\int_0^\infty g(k)dk = 1 \quad \quad \int_0^\infty kg(k)dk = 1$$

We assume no inequalities in wage earning (every households supply the same labor and have the same productivity). The income $R(k)$ of the household owning a share $k$ of capital can be written as:

$$R(k) = \frac{\ell}{\gamma} + k\frac{\Pi}{N}$$

with $\Pi$ the aggregate profit of the economy. The revenue $R(k)$ represents also the last variety she consumes.

Labor income allows an household to buy at least varieties on the segment $[0, \frac{\ell}{\gamma}]$. This segment represents the most essential goods which are hold by all. For $q > \frac{\ell}{\gamma}$, the aggregate demand of the sector $q$ is equal to the number of households who own a share of capital that exceeds $K(q) = \frac{N}{\Pi} \left( q - \frac{\ell}{\gamma} \right)$. Demand for the sector $q$ is given by

$$D(q) = \begin{cases} N & \text{if } q \leq \frac{\ell}{\gamma} \\ (1 - G(K(q)))N & \text{if } q \geq \frac{\ell}{\gamma} \end{cases}$$

2.2 Firms

Two different technologies are available for the production of a variety $(i)$, a constant return technology using labor $(y(i) = l(i)/\gamma$ with $\gamma > 1)$ and a increasing return technology...
As the size of the sector increases, a firm can adopt the increasing return technology and the sector becomes monopolistic.

A sector will become a monopolistic one if demand exceed \( \frac{h}{\gamma - 1} \). As maximum demand for a sector equals the number of households, we assume that \( \frac{h}{\gamma - 1} < N \). Under assumption [A], monopolistic firms will set the same price than firms of the competitive sector (which is taken as the numeraire) and thus make positive profits (see appendix). Aggregate (pure) profits is denoted \( \Pi \).

### 2.3 Equilibrium

The labor market equilibrium is given by:

\[
\ell N = L_c + L_m = \gamma y_c + y_m + \bar{q} h = (\gamma - 1)y_c + y + \bar{q} h
\]

where \( \bar{q} \) represents the last standardized variety produced by the monopolistic sector, \( y \) the level of total production and the competitive production of the most sophisticated goods is designed by \( y_c \). In order to close the model, we evaluate the level of total production \( y \) and competitive production \( y_c \) as a function of profits. Let \( \bar{k} \) such that \((1 - G(\bar{k}))N = \frac{h}{\gamma - 1}\) (the consumption bundle of the household \( \bar{k} \) exactly corresponds to monopolistic sectors).

A sector \( q \) is monopolistic if and only if \( q \leq \bar{q} = R(\bar{k}) = \frac{\ell}{\gamma} + \bar{k} \frac{\Pi}{N} \) (see figure 1). The level of the production in the competitive sector depends on demand of richest households:
\[ y_c = N \int_q^\infty (1 - G(K(q))dq = \Pi \int_k^\infty (1 - G(k))dk \]

Production is splits between profits and compensations

\[ y = \Pi + \frac{\ell N}{\gamma} \]

The two last relations and the labor market equilibrium gives the level of profits:

\[ \Pi = \frac{(\gamma-1)N - h}{1 + (\gamma-1)A + kh \gamma} \]

where

\[ A = \int_k^\infty (1 - G(k))dk \]

### 2.4 Redistributive policies

Profits and inequalities interacts in equilibrium. Larger profits increase demand but also inequalities and so the share of demand addressed to the competitive (less efficient) sector. Lower inequalities increase the share of demand addressed to the monopolistic (more efficient) sector and so profits and inequalities. To illustrate this mechanism, we assume that the government implement a redistributive policy by taxing consumption with a rate \( t \) and redistributing equally among households the tax income. The real after tax income of an household that own a share \( k \) of profits is now equal to: Let \( t \) the transfer to households (all taxation is equally reallocate to them) and \( t_c \) the tax rate, one has:

\[ R(k) = w \ell + k \Pi + t = w \ell + t_c py + k \Pi \]

The consumption bundle of the households \( k \) is of the form \( [0, Q(k)] \) where:

\[ Q(k) = \frac{1}{\gamma(1 + t_c)} \ell + \frac{t_c}{1 + t_c} y + \frac{k}{1 + t_c} \Pi \]

which can be rewritten as:

\[ Q(k) = \frac{\ell}{\gamma} + \frac{k + t_c}{1 + t_c} \Pi \]

Let \( q \geq \frac{\ell + \gamma t_c y}{\gamma(1 + t_c)} \)
\[ K(q) = \frac{(1 + t_c)q - (\ell/\gamma + t_c y)}{\Pi} \]

which can be rewritten as:

\[ K(q) = \frac{(1 + t_c)}{\Pi} \left( q - \frac{\ell}{\gamma} \right) - t_c \]

Aggregate demand of the sector \( q \) is:

\[ D(q) = \begin{cases} N & \text{if } q \leq \frac{\ell + \gamma t_c y}{\gamma (1 + t_c)} \\ (1 - G(K(q)))N & \text{if } q \geq \frac{\ell + \gamma t_c y}{\gamma (1 + t_c)} \end{cases} \]

We obtain:

\[ R(k) = \frac{\ell}{\gamma} + \frac{k + t_c}{1 + t_c} \frac{\Pi}{N} \]

The level of profits writes:

\[ \Pi = \frac{(\gamma - 1)N - h}{(1 + h) + \frac{(\gamma - 1)A + (k - 1)h}{1 + t_c} \gamma} \]

**Theorem**: Aggregate production increase with \( t_c \).

**Proof**: As production is equal to \( \ell/\gamma + \Pi \), production increase if and any if profits increases with \( t_c \). The condition is that \( (\gamma - 1)A + (k - 1)h > 0 \) which is equivalent to \( \bar{k} + E(k|k > \bar{k}) > 1 \). The function \( \bar{k} \mapsto \bar{k} + E(k|k > \bar{k}) \) is non decreasing and \( E(k|k > 0) = 1 \) allows to conclude.

An increase in \( t_c \) allows to tax profits instead of compensation. As inequalities are driving by inequalities in firm owning and share of profits, this induces a redistribution in favor of low income households and concentrates demand on the more efficient increasing return sector.

Aggregate profits increase too, but their purchasing power decreases. The reallocation of demand does not systematically increase the number of monopolistic sectors as it can be achieve by an increase of demand on pre-existing monopolist sectors.
3 Open economy model

In an open economy, a household who chooses to buy a variety can address the national producer or choose to import this variety of foreign countries. We suppose that, in each country, the preferences of the households are heterogeneous. Some of them strongly value the exoticism and buy the foreign variety whereas others households with a strong preference for local goods choose to buy national products. The heterogeneousness of the preferences guarantees an intra branch trade even when the relative prices are not equal to one. For all that the request for a variety is always a decreasing function of its relative price. When the price of a local variety increases, even the consumers the most attached to the national good finish to import the variety which they wish to buy.

Preferences of consumers are define along two dimensions. The first one already exists in the one country model: it consists on the differentiation of products according to the income-elasticity. A consumer will purchase firstly essential commodities and, as income increases, less essential products. For each product, there exist now a "national" variety and a "foreign" variety and each consumer can range them in terms of utility.

3.1 The model

The economy now consists in two countries $i \in \{0, 1\}$; for $i$ a country, $-i$ denotes the other country. Country $i$ is populated by $N_i$ households and producing a continuum of goods indexed by $q$. In country $i$, households supply the same unit of labor $\ell_i$ but differ in capital owning $k \sim G_i$ of monopolistic firms. Income of the household in country $i$ and owning a share $k$ of capital writes:

$$R_i(k) = \frac{\ell_i}{\gamma_i} + k \frac{\Pi_i}{N_i}$$

(2)

To be as closed as possible to the closed economy model, we will assume that, for each variety and each household, three cases may appear:

- The household does not consume the variety $q$ at all (he is not rich enough)
- He consumes exactly one unit of the domestic variety $q$
- He consumes exactly one unit of the foreign variety $q$
Thus, in country $i$, the utility of an household is given by:

$$U_i = \int_0^\infty m(q) \left( \nu \frac{1}{2} x_i(q) + (1 - \nu) \frac{1}{2} x_{-i}(q) \right) dq$$

where $0 < \nu < 1$ measures the preference for domestic goods and is distributed according to the cumulative $F_i$ (we also assume that $\nu$ and $k$ are independent) and, for any $q > 0$, $(x_i(q), x_{-i}(q))$ lies in $\{(0,0), (1,0), (0,1)\}$.

In the model, firms in each country will set the very same price. To say it differently, there exists no comparative advantages (sectors share the same production function): the trade pattern will not depend on the specialization of production between countries. We then assume that a consumer who prefers to buy a foreign variety does the same for all varieties she consumes. The choice between domestic and foreign varieties will depend on the term of trade $\tau_i = p_i/p_{-i}$. If $\nu > \frac{\tau_i}{1 + \tau_i^\phi}$, it consumes only domestic products; if $\nu < \frac{\tau_i}{1 + \tau_i^\phi}$, it consumes only foreign products. In each case, his consumption bundle is given by the budget constraint.

$$\begin{cases} 
  x_i(q) = 1 \text{ for } 0 \geq q \geq R_i(k) & \text{if } \nu > \frac{\tau_i}{1 + \tau_i^\phi} \\
  x_{-i}(q) = 1 \text{ for } 0 \geq q \geq \tau_i R_i(k) & \text{if } \nu < \frac{\tau_i}{1 + \tau_i^\phi}
\end{cases}$$

The demand of the sector $q$ in country $i$ depends on the number of domestic and foreign households buying goods produced in country $i$ and rich enough to buy the entire set of goods $[0,q]$. Let $K_i(q)$ the capital endowment of the household in country $i$ that exactly consume goods produced in $i$ lying in $[0,q]$. Demand addressed to sector $i$ writes:

$$D_i(q) = \left[ 1 - G_i(K_i(q)) \right] \left[ 1 - F_i \left( \frac{\tau_i^\phi}{1 + \tau_i^\phi} \right) \right] N_i + \left[ 1 - G_{-i}(K_{-i}(\tau_i q)) \right] F_{-i} \left( \frac{\tau_{-i}^\phi}{1 + \tau_{-i}^\phi} \right) N_{-i}$$

### 3.2 Equilibrium

Let $\hat{q}_i$ the threshold values such that sectors are monopolistic before and competitive after. Contrary to the simple case of the single economy, there is no simple expression for
the threshold sector and his value will be determined by equilibrium conditions. The last monopolistic sector verifies:

$$D_i(\bar{q}_i) = \frac{h_i}{\gamma_i - 1}$$  \hspace{1cm} (3)

The demand side allows to evaluate the level of monopolistic production:

$$y_{i,m} = \left[ 1 - F_i \left( \frac{\tau_i^\phi}{1 + \tau_i^\phi} \right) \right] \int_0^{\bar{q}_i} (1 - G_i(K_i(q))) \, dq N_i$$

$$+ F_{-i} \left( \frac{\tau_{-i}^\phi}{1 + \tau_{-i}^\phi} \right) \int_0^{\bar{q}_i} (1 - G_{-i}(K_{-i}(\tau_0 q))) \, dq N_{-i}$$

The level of profits in the monopolistic sector derives from the labor market equilibrium:

$$\Pi_i = \frac{(\gamma_i - 1)y_{i,m} - \bar{q}_i h_i}{\gamma_i}$$  \hspace{1cm} (4)

The trade balance equilibrium writes:

$$\frac{F_1 \left( \frac{\tau_1^\phi}{1 + \tau_1^\phi} \right)}{F_0 \left( \frac{\tau_0^\phi}{1 + \tau_0^\phi} \right)} = \frac{N_0 \int_0^\infty [1 - G_0(K_0(\tau_1 q))] \, dq}{N_1 \int_0^\infty [1 - G_1(K_1(\tau_0 q))] \, dq}$$  \hspace{1cm} (5)

The economy is defined by \((N_i, \ell_i, \gamma_i, h_i, F_i, G_i)\), endogenous variables are given by \((\bar{q}_i, \Pi_i, \tau_i)\). They verify equations (5), (3), (4).
3.3 Welfare analysis

In average, the welfare of the consumer who holds a share \( k \) of the aggregate capital in the country \( i \) is the following:

Let \( \mathcal{M}(q) = \int_0^q m(\bar{q})d\bar{q} \)

\[
W_i(k) = \bar{\nu}_i \left\{ \begin{array}{c}
\frac{\phi}{\phi + 1} \left[ 1 - \left(\frac{1}{1 + \tau_i}\right)^{\frac{\phi + 1}{\phi}} \right] \mathcal{M}(\tau_i R_i(k)) \\
+ \left(1 - \bar{\nu}_i\right) \mathcal{M}(R_i(k))
\end{array} \right\}
\]

We calculate the average welfare between households who differ in terms of preferences on the origin (domestic or foreign) of goods.

3.4 Trade pattern

TO BE COMPLETED
References


A Appendix

A.1 Optimal pricing

We show that under certain assumption, \( p = \gamma (1 + \tau_c)w \) is a Nash equilibrium for monopolistic firms.

Assume that every firm in \([0, q^*]\) sets the excluding of taxes \( \bar{p} = \gamma w \) except \( q \).

The profit of the firm \( q \) depends on the price \( p \) she sets. Suppose she expects to have a demand that corresponds to a firm \( \tilde{q} \) such that \( \frac{1 + \gamma \tau_c}{\gamma (1 + \tau_c)} y \leq \tilde{q} \leq q \) (it is clearly non optimal to mimic a firm outside this range). Due to the demand of households, she has to set the price \( p = \frac{m(q)}{m(\tilde{q})} \bar{p} \) (in order to at the same rank than the \( \tilde{q} \) firm). Her profits are:

\[
\Pi(q, \tilde{q}) = \left( \frac{m(q)}{m(\tilde{q})} \bar{p} - w \right) (1 - G(K(\tilde{q}))) - w_0
\]

The condition for the price \( \bar{p} \) to be optimal for every monopolistic firm is:

for all \( \frac{1 + \gamma \tau_c}{\gamma (1 + \tau_c)} y \leq \tilde{q} \leq q \leq q^* \), \( \frac{m(q)}{m(\tilde{q})} \gamma^{-1} \leq 1 - G(K(\tilde{q})) \)

A.2 Computing \( A \)

\[
A = \int_{\ln(\bar{k})}^{\infty} (1 - G(k))dk = \frac{1}{\sigma \sqrt{2\pi}} \int_{\frac{\ln(\bar{k})}{2\sigma^2}}^{\infty} e^{-\frac{(\ln(t) - \mu)^2}{2\sigma^2}} dt dk = \frac{1}{\sigma \sqrt{2\pi}} \int_{\frac{\ln(\bar{k})}{2\sigma^2}}^{\infty} t \cdot e^{-\frac{(\ln(t) - \mu)^2}{2\sigma^2}} dt = \frac{1}{\sigma \sqrt{2\pi}} \int_{\frac{\ln(\bar{k})}{2\sigma^2}}^{\infty} e^{-\frac{(k - \mu)^2}{2\sigma^2}} e^k dk - kG(k)
\]

\[
\frac{e^{\frac{\mu^2}{2\sigma^2}}}{\sigma \sqrt{2\pi}} \int_{\ln(\bar{k})}^{\infty} e^{-\frac{(k - \mu)^2}{2\sigma^2}} dk - kG(\bar{k})
\]