The Challenge of Market Power under Globalization

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Abstract

Many prominent globalization features are explained by understanding it as factor exchange between economies at different levels of development, rather than trade. A convergence club model of technological change incorporating trade and foreign direct investment, explains scenarios of miracle growth, as well as persistent development and underdevelopment. Steady state features include extraordinary profits of transnational corporations obtained through cheap-factor-seeking investments in underdeveloped host countries. The increased profit-to-labor ratio explains lower interest rates, and, through tax competition, lower corporate taxes and more conservative policies. This corporate influence weakens institutions for balancing market power, defying equitable economic and political governance everywhere.

1. Introduction

Globalization, a single market with developed and underdeveloped countries, renders factors of production, rather than products, the key component of exchange. Inherent market power in technologies, a significant force in domestic markets, has become even more pronounced at the international level. Hence important features of globalization are reflected in a model of technological convergence clubs that includes trade and foreign direct investment (FDI). This model can explain scenarios of miracle growth, as well as persistent development and underdevelopment. Its steady state features include the extraordinary market power and profits of transnational corporations (TNCs), that result from the application of leading technologies in underdeveloped host economies with low wages. Technological competition closes the circle. When installed technological as well as institutional capacities, defining practical knowledge and wages, as well as social frictions, vie to attain leading edge productivity, existing relative advantages and disadvantages lead to steady state lags in technological levels or growth rates between countries, and therefore in a persistently polarized globalization.

In this new global setting, it follows that TNCs as a set, endowed with extraordinary resources, can become the technological leadership, with domestic enterprise in all countries the technological followers. In addition, tax competition between countries, combined with higher TNC resources to influence policy, result in lower corporate taxes and more conservative policies. Thus, the increased profit to wage ratio under globalization leads to a less equitable governance that is less willing to control market power. One essential policy for meeting the twin global challenge of market power and underdevelopment is to harmonize global corporate taxes and use the proceeds for sustainable economic development everywhere.

Section 1 recounts how globalization emerged through liberalization, and compares the resulting roles of FDI and trade, and trends in corporate taxes. Section 2 presents the globalization model. Section 3 applies the model in a tax competition framework. Conclusions follow.

2. FDI, trade and taxes

The acceleration of globalization in the 1980's began with Ronald Reagan and Margaret Thatcher's liberalization policies. Faced with the stagflation crisis of the 1970's and the first oil crisis, they restarted economic growth by freeing trade and investment. In November 1982, a ministerial meeting of the General Agreement on Tariffs and Trade proposed what became the Uruguay Round of negotiations, "the largest negotiation of any kind in history," launched in 1986, concluded in 1994, and signed by 123 countries, that led to the creation of the World Trade Organization in 1995.[1] Amongst the issues addressed in the negotiations were investment, trade in services, and intellectual property. Meanwhile, the Washington Consensus (a term coined in 1989) implemented the standard New Classical reform in any developing country that faced a crisis, recommending and imposing liberalization of trade and foreign direct investment (FDI), privatization, and deregulation.

Concurring with Western liberalization, China's introduction of market mechanisms in its economy in December 1978, and the fall of the Berlin Wall in 1989, created a global market economy.

2.1. **The FDI and trade components of globalization.** Liberalization tapped a huge potential for economic growth. For twenty five years worldwide exports grew at a rate of 6.2%, approximately doubling as a proportion of world GDP from, 14.5% in 1982 to 30.6% in 2006.[2] While this classifies as miracle growth, FDI grew at an average real rate of 14.6% a year. Of this investment, a great part consisted of mergers and acquisitions, for example 89.3% in 2007. While aggregate world exports of goods and non-factor services reached U.S. $17 trillion dollars in 2007, aggregate sales of foreign affiliates of transnational corporations reached U.S. $31 trillion, surpassing 50% of world GDP in the years 2008-2010. TNCs have come to play a central role in the global economy. At $6 trillion, the gross product of foreign affiliates of TNCs reached 43.7% of the $15 trillion US GDP. In 2010, TNCs accounted for one-quarter of world GDP. The 100 largest non-financial TNCs produced 14.1% of world GDP in 2007.

In fact market concentration has been the norm rather than the exception for US production during the 20th Century. From 1935 to 1992, the average production of the four largest firms in 459 industries was 38.4% of all shipments. Similarly, from 1992 to 2002, the 200 largest manufacturing companies accounted for 40% of manufacturing value added. Thus in the US the equilibrium level of concentration was higher than at the global level, where it therefore stands to increase further.[3]

In 2010, more than half of FDI went to developing economies. As we shall show in our model, what results from FDI between developed and underdeveloped economies is a polarized form of globalization that admits miracle growth, development and underdevelopment, and is characterized by huge steady-state profit flows with very significant impacts. In 2007, FDI profits amounted to $1.1 trillion, a profit rate of about 7% of their gross income. About 30% was reinvested. Much

[1] Information from http://www.wto.org/english/thewto_e/whatis_e/tif_e/fact5_e.htm, the World Trade Organization web page, accessed 11/15/2008.

[2] The following discussion is based on the 2009 and 2011 World Investment Reports (UNCTAD, 2009, 2011) unless stated otherwise. These are trully treasure troves of information on the world economy. Serious attempts have been made to silence UNCTAD as a source of information and analysis (Khor, 2012a, 2012b, Prashad, 2012).

[3] Data from U.S. Census Bureau – Economic Census. 1992. "Concentration Ratios for the U.S." http://www.census.gov/epcd/www/concentration92-47.xls.. Consistently with market power, Hall (1988) shows in a study of US industry that marginal cost is often well below price.

of the remaining 70% must have remained offshore, as indicated by the following three pieces of information. First, the US $700 billion trade deficit was of the same size as these profits, equivalent to about 5% of US GDP that year, indicating a mass of capital invested in US brokerage instruments under foreign corporate names. This approximate relationship between the profits of US foreign affiliates and the US trade deficit has held for many years, see Figures 1 and 2 in Mayer-Foulkes (2009).[4] Second, the frequent lobbying for tax holidays by US corporations generating profits abroad (see Marr and Highsmith, 2011). Third, as reported by Tax Justice International (Henry, 2012), between $21 and $31 trillion dollars in assets were held offshore at the end of 2010, that is, between 1.4 and 2.1 times the US GDP!

Quite a diverse set of authors is concerned with the pressures that the worsening degree of global economic inequality puts on democracy, such as Martin and Schumann (1997), Rodrik (2011, 2012), Kurlantzick (2013), and Fuentes-Nieva and Galasso (2014).

Globalization also raised inequality in the U.S. Let us note that skill biased technological change, the most accepted cause for increased inequality for the bulk of the population in the US (e.g. Berman, Bound and Machin 1998), is directly linked to globalization in two ways. First, the outsourcing of labor intensive work raises the proportion of skill intensive work, in itself a skill-biased change in the composition of production technologies. Second, R&D to increase the productivity of the remaining workforce itself also constitutes skill-biased technological change. The rising share of the top 1% is surely also linked to the global profits of large US corporations. What percentage of the population held the 5% of GDP earned as profits abroad in 2007?

Let us turn to the institutional setting of market power.

2.2. **The institutional deficit under globalization.** An institutional deficit occurs under globalization simply because there is no global government. The global economy can only be governed by the coordinated actions of several governments from the largest economies, as occurred after the 2008 crisis. This tends to render any economic policy under globalization more laissez faire than it would be in a national context.

A central indicator for governance, as well as income redistribution, is taxation. For example, it is quite clear that global governance —the production of global public goods and equity— will require global agreements on taxation. The need for global tax agreements is highlighted by what has happened in their absence. In particular I discuss tax competition and tax havens.

2.2.1. *Globalization and TNC taxes.* Besides huge profit flows and decreasing interest rates, another notable trend of the last thirty years has been a global decrease of statutory corporate tax rates, see Figure 1. According to Overesch and Rincke (2011), "over the past 25 years, corporate tax rates in Europe show a remarkable downward trend. In 1983, the mean statutory corporate tax rate of 13 Western European countries was 49.2%. As of 2008, the average tax rate of these countries had eroded to 27.2%." These authors review a series of studies finding support for the tax competition hypothesis for the OECD. They carry out careful econometric estimates that support this same hypothesis, emphasizing that while the short-run impact of tax competition on corporate tax rates

[4]The same paper explains the long-term decrease in interest rates and its contribution to the 2008 crisis. The model presented here, and an extended model including capital in Mayer-Foulkes (2013), underpin this explanation.

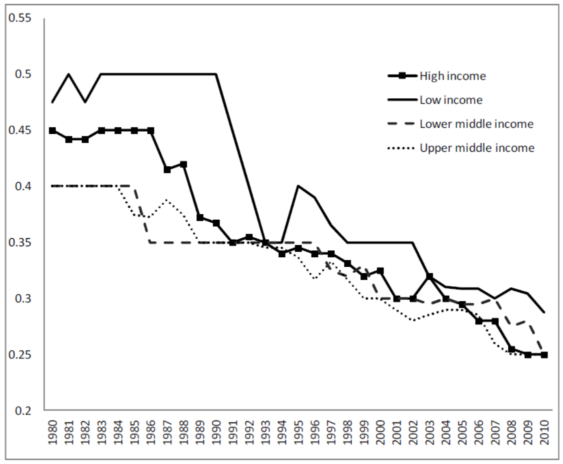

FIGURE 1. Median statutory corporate tax rates by World Bank country income group, 1980-2010. Source: Keen and Konrad (2012).

may be modest, as countries' tax systems respond to each other over time, tax competition effects exhibit a significant, long-term multiplier effect.

Establishing the determinants of corporate tax rates is complex. Keen and Konrad (2012) review the theory of tax competition. They point out its achievements as well as complexity, with much remaining to be done. Devereux and Loretz (2012) explain the endogeneity issues in tax competition. Because of transfer pricing, "tax rates based on revenues may contain both the cause (low tax rates) and the consequence (large amount of profits shifted into the country) of tax competition." Tax competition is particularly strong in the European Union (EU), where the many new, small, member states have provided further impetus to the downward competition. In 2003, the EU Council adopted a voluntary Code of Conduct to combat harmful tax competition.

2.2.2. *Tax havens and the distortion of globalization.* Not only is there an important degree of tax competition across countries, reducing corporate taxes and shifting the tax burden to other constituencies, there is also an important degree of tax evasion. As I mentioned above, an important proportion of FDI profits remains offshore: \$21 to \$31 trillion dollars in assets had accumulated offshore at the end of 2010 (Henry, 2012).

While tax competition has an important impact on firm location, tax havens imply an even more pernicious distortion, favoring international over national production, simply because international production has an easier access to tax avoidance. As international production and value chains develop, tax avoidance provides the incentives to shift domestic production to an international context in which, at least on paper, it can appear to take place beyond the reach of tax officials.

After presenting the globalization model in the following section, an application of its results to a tax competition model shows that globalization has a deep impact on the global tax regime and more generally on the institutional balance that can be provided for market power.

3. The Globalization Model

My objective is to model the process of globalization, understood as trade and foreign direct investment (FDI) between economies with different steady state levels of development. These different levels of development will result either from institutional or from technological differences, included in the same model. The model will explain the main facts of globalization highlighted in the introduction, based on the prominent role of FDI. Globalization:

(a) Increases economic growth.
(b) Increases the economic participation of TNC profits, and lowers worker participation.
(c) Admits development, underdevelopment and miracle growth.
(d) Increases the profit to labor ratio.
(e) Leads to lower taxes and more conservative policies through tax competition.

The model will explain these stylized facts as features of the steady state. I do not consider issues such as sustainability which might lead to important changes in this respect.

For simplicity I analyze the interaction of two economies, a developed and a less developed economy. These could represent the whole of the developed and underdeveloped world, the US and China, or any underdeveloped country vis a vis the developed world. It can also represent, in a second stage, the set of transnational corporations vis a vis the set of domestic firms. My model in endogenous technological change is based on the multiple contributions of Aghion and Howitt.

Consider two Economies 1 and 2 that produce a continuum of tradeable goods indexed by $\eta \in [0,1]$, where each η refers to a sector. Domestic firms in Economies 1 and 2 have different technological levels $A_{1t} > A_{2t}$, representing different levels of development, that change endogenously.

Under economic autarchy each economy produces the full set of goods. Nevertheless the economies exchange ideas. The more advanced technologies of Economy 1 have a positive impact on technology in Economy 2.

Under trade and FDI (most free trade agreements are also free investment agreements) production sectors $\eta \in [0,1]$ fall into three disjoint types. Domestic production and innovation in Economy 1, carried out by Economy 1 innovators, occurs on the subset of sectors $\Theta_{1t} = [0, \xi_{1t})$. Likewise domestic production and innovation in Economy 2 occurs in sectors $\Theta_{2t} = [\xi_{1t}, \xi_{1t} + \xi_{2t})$. Finally, FDI occurs on the subset $\Theta_{FDI} = [1 - \xi_{FDI}, 1]$. The measures of these sectors add up to one:

$$|\Theta_{1t}| + |\Theta_{2t}| + |\Theta_{FDIt}| \equiv \xi_{1t} + \xi_{2t} + \xi_{FDI} = 1. \tag{3.1}$$

Index the three sector types (domestic sector in Economy 1 or 2, or FDI sector) with $j \in \{1, 2, FDI\}$, and refer to the variables ξ_{1t}, ξ_{2t}, ξ_{FDI} as their *number*.

FDI, and therefore globalization, can be modelled as occurring in two modes. In the first, corresponding to an initial period of globalization, there is an exogenous subset of sectors $\Theta_{FDI} = [1 - \xi_{FDI}, 1]$ on which it is feasible for innovators from Economy 1 to produce in Economy 2. Using their higher technologies, Economy 1 producers outcompete the Economy 2 domestic sector on the set Θ_{FDI} and obtaining the benefits of cheaper labor. The reverse cannot occur for innovators from Economy 2, since they are not competitive in Economy 1. Because it combines advanced technologies with cheap labor, profits will be higher in the FDI sector. The expansion of ξ_{FDI} along time represents a progression of trade and investment agreements and other social arrangements making FDI possible.

The second way to model FDI becomes relevant when new investment possibilities appear for the TNC sector in Economy 1. This second mode corresponds to a second stage of globalization in which every economy has a domestic and a cheap factor seeking FDI sector, and is therefore an Economy 2. Economy 1 will now consist of the sector of transnational corporations, without a population, but with technological level A_{1t}. Thus the model for the second mode of FDI and globalization is a direct application of the model for the first mode.

I thus construct a simple, two-economy innovation-based growth model with trade and FDI. Innovation occurs as follows. In each economy there is in each sector $\eta \in [0, 1]$, a single, infinitely lived innovator who invests in innovation and becomes a national or world monopolist, under autarky or trade, producing in the presence of a competitive fringe. Innovation is cheaper for the producing incumbent than for the competitive fringe, and she therefore has an innovation advantage. Her monopoly therefore persists indefinitely, both in autarky and under trade, so long as her sector is assigned by trade for production in her economy.

The international assignment of production therefore also implies an international assignment of innovation, not only between domestic but also between international producers. In effect this is equivalent to identifying the producer and innovator with the holder of market power over good $\eta \in [0, 1]$, even if she subcontracts some of the innovation and production tasks.

In each economy, domestic or FDI knowledge resides in a set of firms, each monopolizing production in some sector $\eta \in [0, 1]$. The firms are symmetric and have the same technological level A_{1t} or A_{2t} in each type of sector. In the case of domestic firms, these may in addition draw substantial skill inputs from their own economy, at the same technological level A_{1t} or A_{2t}. The firm's installations, entrepreneurial skills and the brunt of its skilled workforce all correspond to its technological level A_{1t} or A_{2t}. This does not exclude the use of special knowledge inputs at the leading technological level A_{1t}, incorporated as part of the externality of the leading technological edge.

Innovation requires private inputs. First, the firm's own knowledge inputs we have just described, complemented in the domestic case with local skills, and second, in the form of material inputs. This model uses a variant of Howitt and Mayer-Foulkes' (2005) model of endogenous technological change. For simplicity, innovation occurs with certainty. Next, instead of considering as input a *public* global nascent leading edge technology, itself formed as an innovation externality, that innovators are implementing in their own line of production, I consider that other firms' *private* leading edge technologies have positive externalities on the incumbent's innovation investment, producing nascent possibilities in proportion to their technological level. This has two advantages. First, I do not need to posit an additional variable representing the global stock of leading edge technology. Second, I model a purely private global knowledge system, which concords with the much more sophisticated knowledge currently used throughout production, which need not be open to the public, and with the diminished current public knowledge system with much less public support for science. Private knowledge cannot be held fully watertight and diffuses through employees, technical advisers, products, and so on, provoking positive externalities from one firm to another. This diffusion accounts for Gerschenkron's (1952) "advantage of backwardness" and generates a force for convergence. It can for example include embodied technological knowledge promoted by suppliers for use in the near future, contracting leading edge technicians to help implement a new level of firm know-how, and so on. By contrast dependence of innovation on the firm's own knowledge and starting point accounts for a "disadvantage of backwardness," and generates a force for divergence.

A scale effect occurs in innovators incentives through the impact of the development of the lagging economy on the relative size of global profits. Since the time scale in which individual firms operate is short compared to the evolution of the global economy, and to avoid the additional variables involved in infinite perfect foresight, I define a myopic decision maker who lets her time horizon tend to zero and only has perfect foresight as Δt goes to zero. This in turn simplifies the scale effect by bringing it to the current time. It is shown that even though FDI obtains extraordinary profits, the fact that this occurs through lower costs reduces its innovation incentives below the incentives for Economy 1 domestic firms. This seems unrealistic in that a transnational corporation with lower technology would soon face international competition from other Economy 1 domestic innovators. Therefore I assume in the first mode of globalization that the FDI innovator decides to innovate at the same rate as Economy 1's domestic innovators for strategic reasons, so as not to fall behind them. Hence both the domestic sector in Economy 1 and the FDI sector maintain the same technological level A_{1t}. However, strategic considerations and more resources can also eventually allow FDI innovators to outcompete Economy 1 innovators and to find FDI possibilities in Economy 1, thus leading to the second mode of globalization.

To construct the model, we describe production, trade, FDI, and innovation.

3.1. **Production.** Let the population of Economies 1 and 2 be $\mathcal{L}_{it}$, $i = 1, 2$. Under autarchy at each time t two state variables will fully define the state of both economies: the technology levels A_{1t}, A_{2t} of each economy. Under free trade and FDI, the global economy will be fully defined by the state variables, ξ_{FDI}, A_{1t}, and A_{2t}.

Let us now turn to the production functions. We consider two inputs, labor and a composite good x consisting of the combination of all goods $\eta \in [0, 1]$ according to:

$$\ln(x) = \int_0^1 \ln(x(\omega))\, d\omega. \tag{3.2}$$

This definition implies that all goods are symmetrically demanded in production according to a Cobb-Douglass function. They will also be symmetrically demanded in consumption. Let the price of the composite good be the numeraire.

Definition 1. *The production function in sectors $\eta \in \Theta_{jt}$ of type $j \in \{1, 2, FDI\}$ is:*

$$y_{jt}(\eta) = [x_{jt}(\eta)]^{\alpha} [q_j A_{jt} l_{jt}(\eta)]^{1-\alpha}, \quad j \in \{1, 2, FDI\}. \blacksquare \tag{3.3}$$

Complementing labor with a composite good flow allows for the determination of a wage without introducing an additional state variable such as capital. Here $y_{jt}(\eta)$ is the quantity produced of good $\eta \in \Theta_{jt}$. q_j is a fixed productivity factor representing the effects of such non-technological factors as geography, institutions and policies that influence a country's total factor productivity (e.g., Mankiw, Romer & Weil, 1992). This might under certain circumstances differ in the domestic and foreign sectors. A_{jt} is the technological level in each sector type. $l_{jt}(\eta)$ is labor employment. The FDI technological level is $A_{FDIt} = A_{1t}$.

Definition 2. *Define the relative state variables*

$$a_t = \frac{A_{2t}}{A_{1t}}, \quad q = \frac{q_2}{q_1}, \quad \bar{q} = \frac{q_2}{q_{FDI}}, \quad \lambda_t = \frac{\mathcal{L}_{2t}}{\mathcal{L}_{1t}}. \tag{3.4}$$

For FDI to be viable on sectors $[1-\xi_{FDI}, 1]$ *we assume* $q_2 A_{2t} < q_{FDI} A_{1t}$.■

For simplicity we also assume Economy 2 lags behind Economy 1 in its production and innovation institutional characteristics, so $A_{2t} \leq A_{1t}$, and $0 < a_t, q, \bar{q} \leq 1$.

3.2. **Choice of inputs.** Let w_{1t}, w_{2t} be the domestic wage levels in Economies 1 and 2. The FDI sector also pays labor w_{2t}, so $w_{FDIt} = w_{2t}$. When producers minimize costs, the ratio of composite good input to labor they choose is:

$$\frac{x_{jt}(\eta)}{l_{jt}(\eta)} = \frac{\alpha w_{jt}}{1-\alpha}, \quad j \in \{1, 2, FDI\}. \tag{3.5}$$

It follows that the production cost z_{jt} of each unit of good $\eta \in \Theta_{jt}$ is constant in η,

$$z_{jt} = \frac{\left(w_{jt}/q_j A_{jt}\right)^{1-\alpha}}{\alpha^\alpha \left(1-\alpha\right)^{1-\alpha}}, \quad j \in \{1, 2, FDI\}. \tag{3.6}$$

Each domestic sector has a competitive fringe that can produce using a lower technological level $\chi^{-1} A_{jt}$, with $\chi > 1$. This implies domestic producers sell at a price:

$$p_{jt} = \chi^{1-\alpha} z_{jt}, \quad j \in \{1, 2\}. \tag{3.7}$$

Assume now that FDI technologies are beyond the reach of Economy 2 competitive fringe producers, and therefore that the competitive fringe for FDI producers consists of domestic producers in Economy 1. Assume that these are small producers who can trade but cannot afford to produce abroad. It follows that FDI products are sold at the same prices as domestic products in Economy 1.[5] Their price will therefore be given by $p_{FDIt}(\eta) = \chi^{1-\alpha} z_{1t}(\eta)$.

Because the production function, wages and prices are constant across sector η, so also are the quantities $x_{jt}(\eta)$, $l_{jt}(\eta)$, $y_{jt}(\eta)$, so we can drop the variable η from the notation.

3.3. **Trade and FDI.** Under trade and cheap-factor-seeking FDI, production responds to global demand, and global prices are formed, which in turn determine local wages. Let the instantaneous consumer utility $U = U(C_t)$ depend on a subutility function C_t for an agent consuming $c_t(\eta)$ units of sector η goods, $\eta \in [0, 1]$, according to the Cobb-Douglass function

$$\ln(C_t) = \int_0^1 \ln(c_t(\eta))\, d\eta. \tag{3.8}$$

Then the Cobb-Douglass choice for 1) consumption preferences and 2) the composite good used for production and research inputs, implies aggregate world expenditure across sectors will be constant.

[5]If the price of FDI products where proportional to A_{2t}, the level of production would become large as $A_{2t}/A_{1t} \to 0$ (the case of divergent equilibria, see below) something that seems unrealistic. Intermediate cases with less than full profits could be posed leading to similar results.

It will turn out that prices will also be constant across sectors. Therefore so will production, consumption and input levels of all goods $\eta \in [0,1]$.

Comparative advantage could be considered in the model, for example as fixed productivity effect $e^{-\vartheta_1 \eta}$ for Economy 1 and $e^{-\vartheta_2(1-\eta)}$ for Economy 2. Then comparative advantage would combine with technological advantage to determine the equilibrium levels of ξ_{1t}, ξ_{2t}. Trade would increase aggregate productivity and consequently also makes more resources available for innovation. However, the present model emphasizes the role of FDI, so for the sake of simplicity comparative advantage is not considered. We can still imagine there is a small fixed sectorial productivity effect that decreases along η for Economy 1 and increases for Economy 2, so that those sectors allocated for domestic production in Economy 1 lie to the left of those sectors allocated for domestic production in Economy 2.

We now work out how production is allocated across the two economies. The boundary ξ_{1t} between domestic sectors in Economies 1 and 2 is determined endogenously and would shift to the right or to the left if p_{1t} were different to p_{2t} (by attracting more domestic sectors into production in the economy offering the cheaper price) except possibly in the boundary cases $\xi_{1t} \in \{0, 1-\xi_{FDI}\}$. Now $\xi_{1t} > 0$, because otherwise labor in Economy 1 would not be employed, making w_{1t} very low and additional production possible, so the only boundary case is $\xi_{1t} = 1 - \xi_{FDI}$, when all labor in Economy 2 is employed in the FDI sector. In this case employment in domestic production in Economy 2 is not competitive with employment in FDI sectors, so there is no domestic supply and there is no price p_{2t}. Without loss of generality we can set $p_{2t} = p_{1t}$.[6] Now similarly p_{FDIt} cannot be more than p_{1t}, otherwise FDI sectors would loose their markets to domestic sectors in Economy 1. On the other hand, the competitive fringe for FDI sectors is in Economy 1, so p_{FDIt}will be at least p_{1t}. Hence $p_{FDIt} = p_{1t}$. It follows that all prices p_{1t}, p_{2t}, p_{FDIt} are equal. We can therefore define p_t by $p_{1t} = p_{2t} = p_{FDIt} = p_t$. Now, since each good η has the same price, the cheapest way to produce one unit of composite good is by using one unit of each good η. Hence the cost of one unit of composite good is $\int_0^1 p_t d\eta = p_t$. But this is the numeraire, so $p_t = 1$. Since expenditure is constant across sectors, it also follows that production quantities are equal. Hence, summarizing:

Proposition 1. *Prices and quantities of production are constant across sectors η,*

$$p_{1t} = p_{2t} = p_{FDIt} = 1, \quad y_{1t} = y_{2t} = y_{FDIt} = y_t. \tag{3.9}$$

Hence costs and wages have expressions

$$z_{jt} = \chi^{-(1-\alpha)}, \quad w_{jt} = \frac{\alpha^{\frac{\alpha}{1-\alpha}}(1-\alpha)}{\chi} q_j A_{jt}, \quad j \in \{1,2\}. \tag{3.10}$$

Proof. (3.9) was just explained above. (3.10) follows from (3.6) and (3.7).■

As a consequence of trade, the cost and price of domestic goods is the same in both economies. Since these goods are produced in the same quantities $y_{1t} = y_{2t}$, the participation of profits, labor and the composite good input are the same, $w_{1t} l_{1t} = w_{2t} l_{2t}$ and $x_{1t} = x_{2t}$. The only difference is

[6]Note if all sectors are involved in FDI then wages are not fully defined domestically, and neither is the home technological level. We will assume below that home knowledge does continue to exist and follows the same dynamics, although other analyzes are possible.

that Economy 2 employs more labor at a lower institutional and technological level, with wages proportional to productivity.

In the case of FDI, lower costs lead to a different participation structure.

Definition 3. *The cost ratio of FDI to domestic producers in Economy 2 is:*

$$b_t \equiv \frac{z_{FDIt}}{z_{2t}} = \left(\frac{w_{2t}/q_{FDI}A_{FDIt}}{w_{2t}/q_2 A_{2t}}\right)^{1-\alpha} = (\bar{q}a_t)^{1-\alpha} < 1. \blacksquare \tag{3.11}$$

Now let π_{jt} be the profits in each type of sector $j \in \{1, 2, FDI\}$.

Proposition 2. *The income participation in each type of production sector is:*

$$x_{it} = \frac{\alpha y_t}{\chi^{1-\alpha}}, \quad w_{it}l_{it} = \frac{(1-\alpha)\,y_t}{\chi^{1-\alpha}}, \quad \pi_{it} = \frac{\chi^{1-\alpha}-1}{\chi^{1-\alpha}}y_t, \quad i \in \{1,2\}, \tag{3.12}$$

$$x_{FDIt} = \frac{\alpha b_t y_t}{\chi^{1-\alpha}}, \quad w_{2t}l_{FDIt} = \frac{(1-\alpha)\,b_t y_t}{\chi^{1-\alpha}}, \quad \pi_{FDIt} = \frac{\chi^{1-\alpha}-b_t}{\chi^{1-\alpha}}y_t. \tag{3.13}$$

Proof. By (3.9), for any product, the price is 1 and the quantity produced is y_t. In the case of domestic products, by (3.10) the cost is $\chi^{-(1-\alpha)}$. A proportion α of this accrues to the composite good (whose price is one); a proportion $1-\alpha$ to wages; and the profit to income ratio is price minus cost $1-\chi^{-(1-\alpha)}$. This proves (3.12). (3.13) follows similarly on noting that, by (3.11), for FDI sectors costs are lower by a factor b_t.$\blacksquare$

Let us call the domestic profit to income ratio $1-\chi^{-(1-\alpha)}$, due to market power generated by innovation, *normal*. By contrast, the higher profit to income ratio $1-b_t\chi^{-(1-\alpha)}$ for FDI is an *extraordinary* profit rate.

3.4. **Labor allocation and aggregate income.** It follows from the labor participation expressions in Proposition 2 and (3.10) that the labor employment ratios between sector types are:

$$\frac{l_{1t}}{l_{2t}} = \frac{w_{2t}}{w_{1t}} = \frac{q_2 A_{2t}}{q_1 A_{1t}} = qa_t, \quad \frac{l_{FDIt}}{l_{2t}} = b_t. \tag{3.14}$$

To complete the instantaneous description of the economy, observe:

Remark 1. *The labor market clearing conditions, setting demand equal to supply, are:*

$$\begin{aligned} \xi_{1t}l_{1t} = L_{1t} &= \mathcal{L}_{1t}, \\ \xi_{2t}l_{2t} + \xi_{FDI}l_{FDIt} &= \mathcal{L}_{2t}. \blacksquare \end{aligned} \tag{3.15}$$

Definition 4. *Let* $\xi_{FDIt} = \min\left[\xi_{FDI}, \frac{\lambda_t q}{\lambda_t q + \bar{q}^{1-\alpha}a_t^{-\alpha}}\right]$. *When* $\xi_{FDIt} < \xi_{FDI}$, *this is the maximum number of sectors that a relatively small and backward Economy 2 can supply to Economy 2. In this case Economy 2 is a "banana republic", with all of its labor employed by FDI.*

Next define the "FDI multiplier" $\Lambda_{FDIt} = \frac{1}{1-\xi_{FDIt}(1-b_t)}$.[7]

Proposition 3. *Employment levels in each type of sector are given by:*

$$l_{1t} = (\mathcal{L}_{1t} + qa_t\mathcal{L}_{2t})\,\Lambda_{FDIt}, \quad l_{2t} = \frac{l_{1t}}{qa_t}, \quad l_{FDIt} = \frac{b_t l_{1t}}{qa_t}. \tag{3.16}$$

[7] The *banana republic* scenario, with an economy's labor employed by FDI in a small set of sectors, draws its name from a real occurrence. One could of course consider instead that the model breaks down if $\frac{\lambda_t q}{\lambda_t q + \bar{q}^{1-\alpha}a_t^{-\alpha}} < \xi_{FDI}$.

Hence the domestic sector measures are:

$$\xi_{1t} = \frac{1}{(1+\lambda_t q a_t)\,\Lambda_{FDIt}}, \quad \xi_{2t} = \frac{\lambda_t q a_t}{(1+\lambda_t q a_t)\,\Lambda_{FDIt}} - b_t \xi_{FDIt}. \tag{3.17}$$

Proof. Using (3.14), labor market-clearing relations (3.15) imply $\xi_{1t} = \frac{\mathcal{L}_{1t}}{l_{1t}}$, $\xi_{2t} + \xi_{FDIt} b_t = q a_t \frac{\mathcal{L}_{2t}}{l_{1t}}$. Hence, substituting in (3.1), $\frac{\mathcal{L}_{1t}}{l_{1t}} + q a_t \frac{\mathcal{L}_{2t}}{l_{1t}} + \xi_{FDIt}(1-b_t) = 1$. The conclusions follow. The banana republic case follows from the condition $\xi_{2t} \geq 0$.■

Proposition 4. *Let gross world product be* $Y_t = \int_0^1 y_t d\eta = y_t$. *Then*

$$Y_t = \frac{\alpha^{\frac{\alpha}{1-\alpha}}}{\chi^{\alpha}} L^G \Lambda_{FDIt}, \quad \textit{where} \quad L^G = q_1 A_{1t}\mathcal{L}_{1t} + q_2 A_{2t}\mathcal{L}_{2t} \tag{3.18}$$

is aggregate global labor in efficiency units. Let X_t *be the aggregate input of composite good. The aggregate global net product is:*

$$Y_t - X_t = \frac{\alpha^{\frac{\alpha}{1-\alpha}}}{\chi^{\alpha}} L^G \left(\Lambda_{FDIt} - \frac{\alpha}{\chi^{1-\alpha}}\right). \tag{3.19}$$

Proof. Substituting the expressions for x_{1t} and l_{1t} in (3.12) and (3.16) to obtain y_{1t} from (3.3), $y_t = \left[\alpha\chi^{-(1-\alpha)} y_t\right]^{\alpha} \times \left[q_1 A_{1t}(\mathcal{L}_{1t} + q a_t \mathcal{L}_{2t})\Lambda_{FDIt}\right]^{1-\alpha}$. Solving for $y_t = Y_t$ and substituting L^G, (3.18) is obtained. Again using (3.12) and (3.3), the aggregate composite input is: $X_t = \xi_{1t}x_{1t} + \xi_{2t}x_{2t} + \xi_{FDIt}x_{FDIt} = (\xi_{1t} + \xi_{2t} + \xi_{FDIt}b_t)\frac{\alpha y_t}{\chi^{1-\alpha}} = (1 - \xi_{FDIt}(1-b_t))\frac{\alpha y_t}{\chi^{1-\alpha}} = \frac{\alpha Y_t}{\Lambda_{FDIt}\chi^{1-\alpha}}$.■

Proposition 4 quantifies the inefficiency associated with market power. In the absence of FDI, $\xi_{FDIt} = 0$ and the FDI multiplier is $\Lambda_{FDIt} = 1$. If we set $\chi = 1$, markets are perfect, profits are zero, and the net aggregate global product is maximal and equals the aggregate product of labor, $\alpha^{\frac{\alpha}{1-\alpha}}(1-\alpha)L^G$. If we now admit "normal" innovation market power $\chi > 1$, the distortion introduced through prices in the input ratio between labor and the composite good reduces aggregate output to $(\alpha^{\frac{\alpha}{1-\alpha}}/\chi^{\alpha})(1 - \frac{\alpha}{\chi^{1-\alpha}})L^G$, which has a negative derivative $\alpha^{\frac{1}{1-\alpha}}\frac{1-\chi^{1-\alpha}}{\chi^2}$ in χ.

When FDI is admitted ($\xi_{FDIt} > 0$) the use of more advanced technologies in Economy 2 increases gross output by a factor $\Lambda_{FDIt} = \frac{1}{1-\xi_{FDIt}(1-b_t)}$, the FDI multiplier, so long as $b_t < 1$. However:

Proposition 5. *The aggregate global labor income* $W_t = w_{1t}\mathcal{L}_{1t} + w_{2t}\mathcal{L}_{2t}$ *is constant in* ξ_{FDIt}*:*

$$W_t = \frac{\alpha^{\frac{\alpha}{1-\alpha}}}{\chi}(1-\alpha)L^G. \tag{3.20}$$

As ξ_{FDIt} *expands, additional product is assigned to profit:*

$$\Pi_t = Y_t - X_t - W_t = \frac{\alpha^{\frac{\alpha}{1-\alpha}}}{\chi^{\alpha}} L^G \left(\Lambda_{FDIt} - \frac{1}{\chi^{1-\alpha}}\right). \tag{3.21}$$

Proof. (3.20) follows from (3.10) and (3.18). (3.21) subtracts (3.20) from (3.19).■

Summarizing, aggregate net product increases with the number of FDI sectors and decreases with market power. Profits increase with the number of FDI sectors and market power. Wages decrease with market power and depend only on the technological levels A_{1t}, A_{2t}. Only when TNCs are unable to extract the full profit rate $\frac{\chi^{1-\alpha}-b_t}{\chi^{1-\alpha}}$ do wages increase with the number of FDI sectors.

The main instantaneous features of the model are presented in Figure 2.

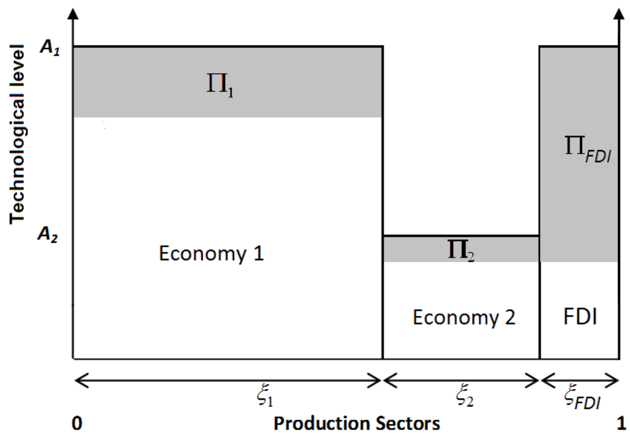

Figure 2. Diagram for the globalization model, showing the continuum of goods and the allocation of production across domestic and FDI sectors on the horizontal axis, and technological levels on the vertical axis. Profits are in grey, wages in white. Each agent then consumes all goods symmetrically according to her income, implicitly defining trade volumes. In a model with capital the increased profit to wage ratio leads to lower interest rates.

3.5. **Technological change.** The income distribution described for globalization is a consequence of the technological and the institutional lags a_t and $\bar{q}$. When underdevelopment is persistent, and we describe these lags as steady state features, then the static equilibrium properties also become steady state features. For example even if $a^* = 1$, if there are differences in the fixed productivity factor provided to FDI, so $q_2 < q_{FDI}$, then $b^* < 1$, $\Lambda^*_{FDI} > 1$ implying persistence in the static properties of globalization mentioned above.

Here we show that globalization is consistent with full divergence in levels (the lagging economy tending to an equilibrium proportional lag) and in growth rates (tending to a lower growth rate).

As mentioned above, in each economy there is in each sector a single, infinitely lived innovator who can produce an innovation for the next period. Observe that sector η will only be in production in one economy, either 1 or 2, because under the equilibrium wages it will have a slight comparative advantage in this economy. Hence it also has a slight advantage for production after innovation, and therefore innovation in sector η will only occur in the economy that produces it.

I consider a myopic innovator who maximizes profits in the short term Δt by choosing innovation inputs. Then I let $\Delta t \to 0$ and obtain a continuos time model.

Following Howitt and Mayer-Foulkes (2005), the effectiveness of innovation investment of the sector η entrepreneur has three components. The first is derived from knowledge and is proportional to the skill level $S_{jt} = A_{jt}$ that she has been able to accumulate in production, which we assume is the technological level of her firm. This generates a disadvantage of backwardness. The second component consists of nascent, positive externalities from other firms' technological edge, $((1+\sigma) A_{1t} - A_{jt}) \Delta t$. The term $(1+\sigma) A_{1t}$ represents this technologically multiplying impact, presenting itself in diverse forms as nascent possibilities, for example embodied in the use of other firm's embodied technologies at time $t + \Delta t$. The difference measures how far back our innovating firm is from these nascent possibilities. However, the effectiveness of these combined inputs is inversely proportional to the level of the nascent possibilities, the fishing out effect. The third component is a material input $v\Delta t$. Innovation occurs with certainty combining these components so that the firm obtains a technological level $A_j(t+\Delta t, v)$ according to:

$$A_j(t+\Delta t, v) = A_{jt} + \mu_j \left(\frac{((1+\sigma) A_{1t} - A_{jt}) S_{jt} \Delta t}{(1+\sigma) A_{1t}} \right)^{\beta} (v\Delta t)^{1-\beta}, \quad j \in \{1, 2, FDI\}. \tag{3.22}$$

This means that the impact of innovator's skill on the technological change that a firm can obtain is proportional to the skill level, proportional to its distance to the nascent technological frontier, and inversely proportional to the nascent technological frontier. In addition, this skill impact combines with material inputs according to a Cobb-Douglass function. The parameter μ_j represents the innovation productivity of the combined inputs.

Using myopic perfect foresight, so that a given firm correctly expects the new technological levels $A_{jt+\Delta t}$, the profits level of an individual firm innovating to a technological level $A_{t+\Delta t}$ is:

$$\pi(t+\Delta t, A_j(t+\Delta t, v)) = (1 - b_{jt+\Delta t} \left(\frac{A_{jt+\Delta t}}{\chi A_j(t+\Delta t, v)} \right)^{1-\alpha}) y_{t+\Delta t}, \tag{3.23}$$

where $b_{jt} = 1$ for $j = 1, 2$ and $b_{jt} = b_t = (\bar{q} a_t)^{1-\alpha}$ for $j = FDI$, since $\frac{A_{jt+\Delta t}}{A_j(t+\Delta t, v)}$ measures the comparative reduction in costs. Hence the profit maximizing rate of innovation investment is obtained by maximizing:

$$\max_v e^{-\delta \Delta t} \pi(t+\Delta t, A_j(t+\Delta t, v)) - (1-\phi_j) v \Delta t, \tag{3.24}$$

where $e^{-\delta \Delta t}$ is the discount factor, and $\phi_j \in (0,1)$ represents an innovation subsidy, a (positive or negative) proxy for all distortions and policies affecting the incentives to innovate.

Proposition 6. *For a firm, the maximization just described is equivalent to maximizing the rate of increase of profits minus the costs of innovation,*

$$\max_v \left[\frac{d}{d\Delta t} \pi(t, A_j(t+\Delta t, v)) \Big|_{\Delta t=0} - (1-\phi_j) v \right], \tag{3.25}$$

where $\frac{d}{d\Delta t} A_j(t+\Delta t, v)$ *follows from (3.22). Thus, knowing the necessary derivatives with* Δt *at* $\Delta t = 0$ *serves as a definition of myopic perfect foresight.*

Proof. The first order condition for (3.24) is:

$$\frac{\partial}{\partial v} \left[e^{-\delta \Delta t} \pi(t+\Delta t, A_j(t+\Delta t, v)) \right] - (1-\phi_j) \Delta t = 0. \tag{3.26}$$

Because at $\Delta t = 0$ $A_j(t, v) = A_{jt}$, $\frac{\partial}{\partial v} \pi(t, A_j(t, v)) = 0$. Subtracting this from (3.26), dividing by Δt, and taking the limit as $\Delta t \to 0$, implies

$$\frac{\partial^2}{\partial \Delta t \partial v} \left[e^{-\delta \Delta t} \pi(t+\Delta t, A(t+\Delta t, v)) \right] \Big|_{\Delta t=0} - (1-\phi_j) = 0. \tag{3.27}$$

But the function in square brackets in (3.27) has continuous second order derivatives in Δt and v. Hence the order of the partial derivatives can be reversed. The terms $\left. \frac{\partial \left[e^{-\delta \Delta t} \pi(t+\Delta t, A(t, v)) \right]}{\partial \Delta t} \right|_{\Delta t=0}$ are independent of v, so (3.27) is equivalent to: $\frac{\partial}{\partial v} \frac{\partial}{\partial \Delta t} \left[\pi(t, A(t+\Delta t, v)) \right] \Big|_{\Delta t=0} - (1-\phi_j) = 0$. This is the first-order condition of problem (3.25). The functional form of the functions ensures a unique maximum given by the first order condition. The converse, namely that from (3.25) follows maximizing profits at $t+\Delta t$ as $\Delta t \to 0$, follows from the properties of derivatives.■

In our case the first order condition for (3.25) reads

$$\frac{(1-\alpha)\, b_{jt}\left(\chi^{-1}A_{jt}\right)^{1-\alpha}}{A_{jt}^{2-\alpha}}(1-\beta)\,\mu_j\left(\frac{((1+\sigma)\,A_{1t}-A_{jt})\,S_{jt}\Delta t}{(1+\sigma)\,A_{1t}}\right)^{\beta} v^{-\beta} y_t = 1-\phi_j.$$

Letting $\bar{\mu}_j = \frac{(1-\alpha)(1-\beta)}{\chi^{1-\alpha}(1-\phi_j)}\mu_j$, material inputs v are therefore given by:

$$v^{\beta} = b_{jt}\bar{\mu}_j\left(\frac{((1+\sigma)\,A_{1t}-A_{jt})\,S_{jt}}{(1+\sigma)\,A_{1t}}\right)^{\beta}\frac{y_t}{A_{1t}}.$$

Note that FDI firms have *lower* incentives to innovate even though their profits are higher, because they face *lower costs*. This holds so long as strategic competition with Economy 1 firms is not considered. As mentioned before, we therefore assume for the first mode of globalization that FDI firms decide to innovate at the same rate as Economy 1 domestic firms, keeping $A_{FDIt} = A_{1t}$. Thus we now only consider profit maximization by domestic innovators in both economies. Recall that ex-post $\frac{\partial}{\partial \Delta t}A\left(t+\Delta t, v^{*}\right) = \dot{A}_{jt}$, because all domestic firms in the same Economy are symmetric. Hence the rate of technological change obtained is:

$$\dot{A}_{jt} = \mu_j\left(\frac{((1+\sigma)\,A_{1t}-A_{jt})\,S_{jt}}{(1+\sigma)\,A_{1t}}\right)\left(\bar{\mu}_j\frac{y_t}{A_{1t}}\right)^{\frac{1-\beta}{\beta}}, \quad j\in\{1,2\}. \tag{3.28}$$

Since y_t depends on a_t, a relative scale effects is introduced that could complicate the dynamics but is simplified under myopic perfect foresight. Now set:

$$\tilde{\mu}_j = \mu_j\bar{\mu}_j^{\frac{1-\beta}{\beta}} = \left(\frac{(1-\alpha)\,(1-\beta)}{\chi^{1-\alpha}\left(1-\phi_j\right)}\right)^{\frac{1-\beta}{\beta}}\mu_j^{\frac{1}{\beta}}. \tag{3.29}$$

I refer to this final parameter $\tilde{\mu}_j$ as each Economy's *innovativity.* $\tilde{\mu}_j$ is *decreasing* in market power χ, because, following the derivation above, the higher the market power, the relatively lower the input costs and therefore the lower the impact of technological improvement on profit.

Proposition 7. *Let $\Upsilon\left(a_t\right) = \frac{Y_t}{A_{1t}} = \frac{\alpha^{\frac{\alpha}{1-\alpha}}}{\chi^{\alpha}}\frac{L^G}{A_{1t}}\Lambda_{FDIt}$ be the relative size of the world economy compared to technological level A_{1t}. Optimization under perfect myopic foresight results in a rate of technological change*

$$\dot{A}_{jt} = \tilde{\mu}_j\frac{(1+\sigma)\,A_{1t}-A_{jt}}{(1+\sigma)\,A_{1t}}A_{jt}\Upsilon\left(a_t\right)^{\frac{1-\beta}{\beta}}, \quad j\in\{1,2\}. \tag{3.30}$$

The rates of change of the technological levels in Economies 1 and 2 are therefore:

$$\frac{\dot{A}_{1t}}{A_{1t}} = \frac{\sigma}{1+\sigma}\tilde{\mu}_1\Upsilon\left(a_t\right)^{\frac{1-\beta}{\beta}}, \quad \frac{\dot{A}_{2t}}{A_{2t}} = \tilde{\mu}_2\left(1-\frac{a_t}{1+\sigma}\right)\Upsilon\left(a_t\right)^{\frac{1-\beta}{\beta}}. \tag{3.31}$$

The relative size $\Upsilon\left(a_t\right)$ of the world economy compared to technological level A_{1t} has a positive, bounded, scale effect on the growth rate $g\left(a_t\right) = \frac{\dot{A}_{1t}}{A_{1t}}$ of Economy 1, and on the convergence rate of Economy 2, that is increasing in ξ_{FDIt}. From (3.31) follows the rate of growth of the relative *technological level* a_t,

$$\frac{\dot{a}_t}{a_t} = \left(\left(1 - \frac{a_t}{1+\sigma}\right)\tilde{\mu}_2 - \frac{\sigma}{1+\sigma}\tilde{\mu}_1\right)\Upsilon(a_t)^{\frac{1-\beta}{\beta}}. \tag{3.32}$$

Economy 2: (a) diverges in growth rates with Economy 1 to a steady state $a^* = 0$ *if* $\tilde{\mu}_2 < \frac{\sigma}{1+\sigma}\tilde{\mu}_1$*; (b) diverges in levels converging to a steady state* $a^* = 1 + \sigma - \sigma\frac{\tilde{\mu}_1}{\tilde{\mu}_2}$ *if* $\tilde{\mu}_2 \in [\frac{\sigma}{1+\sigma}\tilde{\mu}_1, \tilde{\mu}_1]$*; and (c) overtakes Economy 1 if* $\tilde{\mu}_2 > \tilde{\mu}_1$*. Economy 2 is initially or eventually becomes a banana republic if* $a^* = 0$ *or if* $\frac{\lambda_t q}{\lambda_t q + \bar{q}^{1-\alpha}a^{*-\alpha}} \leq \xi_{FDI}$.

Proof. (3.30) rewrites (3.28) using (3.29) and the definition of $\Upsilon(a_t)$. Cases $j = 1$ and 2 of (3.30) yield the rates of change $\frac{\dot{A}_{1t}}{A_{1t}}, \frac{\dot{A}_{2t}}{A_{2t}}$. To obtain the steady states, note that $\left(1 - \frac{a_t}{1+\sigma}\right)\tilde{\mu}_2 - \frac{\sigma}{1+\sigma}\tilde{\mu}_1$ is decreasing in a_t and equal to $\frac{\sigma}{1+\sigma}(\tilde{\mu}_2 - \tilde{\mu}_1)$ at $a_t = 1$. Thus Economy 2 overtakes Economy 1 if $\tilde{\mu}_2 > \tilde{\mu}_1$. On the other hand the same expression is negative at $a_t = 0$ if $\tilde{\mu}_2 < \frac{\sigma}{1+\sigma}\tilde{\mu}_1$. Hence under this condition Economy 2 diverges in growth rates with Economy 1, with $\lim_{t\to\infty}\frac{\dot{A}_{2t}}{A_{2t}} = \tilde{\mu}_2\Upsilon(0)^{\frac{1-\beta}{\beta}} < \lim_{t\to\infty}\frac{\dot{A}_{1t}}{A_{1t}} = \frac{\sigma}{1+\sigma}\tilde{\mu}_1\Upsilon(0)^{\frac{1-\beta}{\beta}}$. In the intermediate cases Economy 2 diverges in levels with Economy 1, to the given steady state. Observe that the steady state conditions are not affected by Υ, which expresses all of the impact of ξ_{FDIt}. Therefore the dynamics are not qualitatively affected by Economy 2 being small and backward enough to be a banana republic.■

Thus FDI produces an increase in the world growth rate, and a temporary increase in the relative growth rate of lagging economies. If the innovativity $\tilde{\mu}_2$ of a lagging economy remains constant, so does its relative steady state level a^*.

The model explains a variety of scenarios that can occur with globalization. For example, suppose a set of economic reforms increases innovativity from $\tilde{\mu}_2^-$ to $\tilde{\mu}_2^+$. Then the steady state of Economy 2 will increase. If before the reforms $\tilde{\mu}_2^- < \frac{\sigma}{1+\sigma}\tilde{\mu}_1$, and after them $\frac{\sigma}{1+\sigma}\tilde{\mu}_1 < \tilde{\mu}_2^+ < \tilde{\mu}_1$, then Economy 2, which was at first growing slower than Economy 1, will first grow faster than Economy 1, perhaps experiencing "miracle growth," then converge to the same growth rate as Economy 1 but remain at a lower income level. (This could describe the case of China.) Alternatively, if $\frac{\sigma}{1+\sigma}\tilde{\mu}_1 < \tilde{\mu}_2^- < \tilde{\mu}_2^+ < \tilde{\mu}_1$, Economy 2 will experience a transitional but less dramatic period of faster growth. Finally, if $\tilde{\mu}_2^+ > \tilde{\mu}_1$, Economy 2 will overtake Economy 1.

Similarly the model addresses the existence of the banana republic scenario, as well as emerging from it, although the technological dynamics in Economy 2 are not very clear in this case.

3.6. **Transnational corporations as leading sector.** Since TNCs have higher resources than domestic Economy 1 firms, even though their incentives for innovation derived from the cost structure in Economy 2 are lower, they have strategic incentives to innovate more than domestic firms in Economy 1, to be able to take over more sectors of production. These firms will have integrated production structures (e.g. Baldwin, 2012), allowing their operations in advanced economies to take on the characteristics of FDI, perhaps employing cheap human capital rather than cheap unskilled labor. In addition, they will dedicate economic and political resources to increasing ξ_{FDIt}. Non-equity modes of investment are an example of a new way to expand FDI (UNCTAD, 2013).

Thus we now consider the case when TNCs as a set constitute the leading knowledge system and can therefore be considered as Economy 1. We analyze the relation between the TNC sector and any country or set of countries, which constitutes Economy 2. TNCs have no population and no domestic sectors, so $L_{1t} = 0$ and $\xi_{1t} = 0$. Instead TNCs employ labor in the FDI sector of Economy 2. Their internal organization can be assigned some institutional level q_1, which is mediated by contractual relations rather than institutional relations as is q_2.

Proposition 8. *Suppose TNCs as a set constitute the leading knowledge system and can therefore be considered as Economy 1, and consider a country or set of countries forming Economy 2. Suppose that innovation occurs according to (3.22) as before, with a_t the relative technological level between Economy 2 and Economy 1. Then steady states of a^* occur as in Proposition 7.*

Proof. Everything follows through as before with $\xi_{1t} = 0$, $\mathcal{L}_{1t} = 0$, and $l_{1t} = 0$, including equations (3.18) to (3.21). In particular $\Upsilon(a_t) = \frac{\alpha^{\frac{\alpha}{1-\alpha}}}{\chi^{\alpha}} q_2 a_t \mathcal{L}_{2t} \Lambda_{FDIt}$. Proposition 7 now holds as before.■

3.7. **The participation of profits in income.** One measure of the increase of inequality and market power under globalization is the income participation ratio between profits and wages.

Proposition 9. *The income participation ratio between profits and wages, itself a measure of market power, rises under globalization. Under autarchy or in the domestic sectors of Economy 1 and 2 this ratio is:*

$$R_{it} \equiv \frac{\pi_{it}}{w_{it} l_{it}} = \frac{\chi^{1-\alpha} - 1}{1-\alpha}, \quad i \in \{1, 2\}. \tag{3.33}$$

In the FDI sector of Economy 2 the ratio is:

$$R_t^{FDI} \equiv \frac{\pi_{FDIt}}{w_{2t} l_{FDIt}} = \frac{\chi^{1-\alpha} - b_t}{1-\alpha} \tag{3.34}$$

Suppose that FDI innovators from Economy 1 producing in Economy 2, assign a proportion ψ^1 of their profits to Economy 1 and a proportion ψ^2 to Economy 2. Then the income participation ratio between profits and wages in each economy is:

$$R_t^1 \equiv \frac{\xi_{1t}\pi_{1t} + \psi^1 \xi_{FDIt}\pi_{FDIt}}{\xi_{1t} w_{1t} l_{1t}} = \frac{\chi^{1-\alpha} - 1 + \psi^1 \frac{\xi_{FDIt}}{\xi_{1t}} \left(\chi^{1-\alpha} - b_t\right)}{1-\alpha}, \tag{3.35}$$

$$R_t^2 \equiv \frac{\xi_{2t}\pi_{2t} + \psi^2 \xi_{FDIt}\pi_{FDIt}}{(\xi_{2t} + \xi_{FDIt}) w_{2t} l_{2t}} = \frac{\chi^{1-\alpha} - 1 + \psi^2 \frac{\xi_{FDIt}}{\xi_{2t}} \left(\chi^{1-\alpha} - b_t\right)}{(1 + \frac{\xi_{FDIt}}{\xi_{2t}})(1-\alpha)} \tag{3.36}$$

The global profit to wages income participation ratio is:

$$R_t^G \equiv \frac{\xi_{1t}\pi_{1t} + \xi_{2t}\pi_{2t} + \xi_{FDIt}\pi_{FDIt}}{\xi_{1t} w_{1t} l_{1t} + \xi_{2t} w_{2t} l_{2t},} = \frac{\chi^{1-\alpha} - 1 + \frac{\xi_{FDIt}}{\xi_{1t}+\xi_{2t}} \left(\chi^{1-\alpha} - b_t\right)}{1-\alpha}. \tag{3.37}$$

Let an influential allocation of FDI profits across Economies 1 and 2 be one for which $\psi^1 > 0$, $\psi^2 > \frac{\chi^{1-\alpha}-1}{\chi^{1-\alpha}-b_t}$, and $\psi^1 + \psi^2 < 1$. Influential profit allocations exist, and under them the profit to wage ratio is higher under FDI in both economies and in the global economy than under autarchy or trade in the original economies:

$$R_{it} < R_t^i, \quad R_{it} < R_t^G, \quad i \in \{1, 2\}. \tag{3.38}$$

Proof. The profit to wage ratios follow from (3.12) and (3.13). Since $\frac{\chi^{1-\alpha}-1}{\chi^{1-\alpha}-b_t} < 1$, influential allocations exist. The inequalities follow from $b_t < 1$ (FDI viable, Definition 2).■

4. On the institutional deficit

Much of the institutional debate focuses on economic rules of the game such as property rights, and the capacity to provide productive infrastructure, included in q_j above. Here I focus on institutions that can address the problems posed by market power, including problems in efficiency, equity and, less frequently mentioned, responsibility. Western countries have traditionally held corporations accountable before the law, regulating and taxing them quite considerably during the postwar period of prosperity. Addressing global market power is clearly necessary and requires the capacity to control and tax TNCs.

In the present section an application of the globalization model to tax competition explains an increase in political power on the part of TNCs, expressed as a decrease in the taxes they pay. This also shows that controlling market power has become more difficult under globalization.

The theory of international tax competition considers decision makers who maximize objective functions that differ from the social welfare (Keen and Konrad, 2012). These objective functions can represent selfish dictators, or the impact of the political process, as in the case of representative government with lobbying for tax rate choices. For our purposes here, I shall assume that corporate taxes are defined through such an optimization process, therefore including a plutocratic impact. Now, this or an extended optimization process, simultaneously defines tax levels for labor. For example, Wachtel (2002) reports that while corporate taxes decreased in the US and the EU, labor taxes simultaneously increased.

I next assume that the welfare optimization involves first maximizing production and then distributing it. Therefore I assume for simplicity that there is agreement between the various actors on the optimal levels of productive infrastructure and other public services, eschewing any discussion of competition between the domestic and FDI sectors through the assignment of productive resources. What remains is determining what adjustment will be made using taxes to the distribution of income and the regulatory environment, and so on.

Under these simplifying assumptions the institutional capability for optimizing the role of corporate market power in society can be measured by the tax levels that result from an optimization process as just described, that are dedicated to transferring income from domestic and TNC profits to various social uses. This "tax rate" can also be considered a "political will" function for reducing any negative impacts of market power, implying a cost for corporations. Let us call this the "market power tax" MPT. I assume a closed form solution exists for this function, that depends negatively on the number of countries competing, and on the resources that domestic and transnational corporations have, compared to labor, to lobby for a lower MPT.

Here we can consider the following economic scenarios. First, autarky, so there is no tax competition. Second, trade without FDI. Third, trade and FDI with two tax competitions going on, one between m_1 identical leading countries, jointly comprising Economy 1, and another between m_2 identical lagging countries jointly comprising Economy 2. Finally, globalization when Economy 1 is the set of TNCs and there are m_2 identical countries. In each of the two types of countries I assume that the resulting equilibrium tax or political will is a function

$$MPT_i = MPT_i(\underset{(-)}{m_i}, \underset{(-)}{R}), \quad i = 1, 2. \tag{4.1}$$

of the number of countries m_j involved in the tax competition and of the profit to wage participation ratio R. Countries of each type are identical and have a characteristic function MPT_i.

Using the notation in section (3.7) and the results of Proposition 9 it follows that:

Proposition 10. *For both types of Economies 1 and 2, equilibrium market power taxes under autarchy are higher than under trade, and these in turn are higher than under trade and FDI, this last under an influential allocation of FDI profits:*

$$MPT_i(1, R_{it}) > MPT_i(m_i, R_{it}) > MPT_i(m_i, R_t^i), \quad i \in \{1, 2\}. \tag{4.2}$$

In the case when TNCs form the leading sector, the result for Economy 2 holds for all economies. Also, equilibrium market power taxes desired by the domestic sector in Economy 2 are higher than those desired by the FDI sector, $MPT_2(1, R_t^2) > MPT_2(1, R_t^{FDI})$.

Finally, under FDI the equilibrium market power tax desired globally is lower than that desired under just trade in Economies 1 or 2, $MPT_i(m_i, R_{it}) > MPT_i(m_i, R_t^G)$, *where we assume the global polity is consistent with (4.1) in that* $MPT_i(m_i, R) > MPT^G(m_1 + m_2, R)$, $i = 1, 2$.

Thus in every case, under an influential allocation of FDI profits, to be able to reproduce the original market power balance, national and global polities must wield a stronger political will than the original polities of Economy 1 or Economy 2.■

The difficulties of taxing and controlling TNCs places significant challenges to economic and political equity as countries compete for the economic favor of global market power. The model provided here shows that these problems are direct consequences of globalization. Redressing the original political balance of market power requires a stronger political will than before.

In addition, so long as TNC profits have access to tax avoidance, a distorted assignment of production will result, with domestic production and the corporate tax base eroding as they shift to international production.

The issue of global taxation is slowly but surely rising to the forefront. See Picciotto (2012) for details on a unitary taxation scheme for TNCs. Conconi et al. (2008) propose the introduction of a single EU corporate tax. Mayer-Foulkes (2009) proposes a harmonization of TNC taxes.

5. Conclusions

The model demonstrates that the main features of globalization result from its characterization as factor exchange due to FDI between economies at different levels of development. In the instantaneous equilibrium, FDI increases the economic participation of TNC profits rather than wages (Propositions 5). Dynamically, FDI produces a permanent increase in the leading technology growth rate, and a temporary increase in the relative growth rate of lagging Economy 2, explaining a variety of dynamic scenarios that can occur with globalization, including miracle growth and divergence in growth rates or in levels (Proposition 7). This demonstrates that globalization is consistent with development and underdevelopment. Globalization can evolve to a mode in which TNCs as a set become the leading sector (Proposition 8). Increased TNC profits relative to worker income in all countries (Proposition 9) provides TNCs with increased resources to influence policy. Combined with tax competition, these result in lower corporate taxes and more conservative policies less willing to tax market power (Proposition 10).

The article also defines perfect myopic foresight (here myopic means to look into the proximate future, rather than not looking into the future, as found in some other literature) and shows that maximizing profits in the short term, with perfect foresight as $\Delta t \to 0$, is equivalent to maximizing the rate of change of profits (Proposition 6).

The model shows that if the innovativity of the competitive fringe rises, so that market power χ is reduced, the participation of wages rises, production is more efficient (Propositions 4 and 5), and innovativity $\tilde{\mu}_2$ rises as well, as commented after equation (3.29).

Thus the model upholds Adam Smith's result that market power diminishes welfare, without assuming profits are zero. It shows that, under globalization, increased TNC market power derives from and is as persistent as underdevelopment. Theories that do not explain the existence of both profits and underdevelopment cannot explain the main facts and challenges of globalization.[8]

Addressing the problems posed by market power is an essential part of public policy. We showed in an application of the model that under globalization controlling the increased market power of TNCs requires a stronger political will than before. One essential first step for meeting the twin global challenge of market power and underdevelopment is to harmonize global corporate taxes and use the proceeds for sustainable economic development everywhere.

6. References

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[8]This includes models that assume away the existence of profits, such as trade models under perfect equilibrium, or models with a free entry hypothesis leading to zero profits. In a related topic, Mayer-Foulkes (2011) proves that finance and threats can produce market power for profit where perfect competition would otherwise hold.

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