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International Trade, Global Inequality and Specialization from a Political Economy Perspective

Clara Zanon Brenck

The New School for Social Research

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Abstract

In this paper I discuss possible explanations for persistent global inequalities from a political economy perspective. Different from what Smith and Marx assume in the long period method – that both capital and labor are full mobile –, I assume that labor is not mobile across regions. The lack of labor mobility is an important abstract problem to theorize about capitalist development in a globalized context. Including such assumption in the dual problem of consumption growth and wage-profit rate model sheds light to some channels in which uneven development and specialization may occur: different wages and equalized profit rates can be achieved by different labor qualities or different access to technologies. If labor qualities are different, wage differences would represent only the difference in labor productivity and effective wages would be equalized, without any specialization. If technologies are different, on the other hand, specialization may occur, and trade is thus established.

Keywords: Long Period Method, Labor Mobility, Global Inequality, Technological Differences, Specialization, Trade

1 Introduction

Classical Political Economists', mainly Adam Smith's and Karl Marx's, long-period method is a constructive approach to understanding political-economic problems. The central abstraction of the classical political economy theory – that labor and capital are universal, i.e., can be adapted to any skill or sector in the long period – is the core of the concepts of exploitation and surplus-value. This theory and reasoning are still relevant for addressing current political and economic problems.

The independent producer analogy of Marx's and Smith's approach, for example, can be generalized to a country or region: a country facing international trade specializes in the production of some set of commodities, given the available technology and the costs of production (the wage rate), and the gains from scale[1]. However, when understood worldwide, specialization patterns can lead to persistent international economic inequality – as is observed in the current global economy. Starting from an international trade literature, Mahutga (2006) uses a network system to argue that the hierarchical nature of the world system remained stable from 1965 to 2000, leading to an increasing inequality in terms of trade for those countries. As for income inequality, Chancel and Piketty (2021) show how global income inequalities have remained significantly stable in the past two centuries. "Between 1820 and 1910, both between country and within-country inequality were increasing. In contrast, both components have moved separately between since 1910: within-country inequality dropped sharply between 1910 and 1980 (while between-country inequality kept increasing), before rising again between 1980 and 2020 (while between-country inequality finally started to decline)" (Chancel and Piketty, 2021, p. 2).

Hence, to understand uneven development from a political economy perspective, it is important to think about how the flow of value is characterized in a globalized economy: what are the sectors and/or countries that contribute more to the surplus-value pool, and what are the ones that appropriate the greater part of it? To answer those questions, one needs to think deeply about the long-period method's assumptions and the consequences of changes in such assumptions. It seems that the full mobility of labor would not apply to the global economy, and relaxing this assumption can help understanding uneven development. In other words, the lack of labor mobility can be the abstract problem to think about uneven development in a globalized context. According to the long period method, without labor mobility, the exploitation rates would not equalize across the world, and effective wages could be different. But can uneven development (or the North-South differences) be explained only by different wage rates? Or does technology also play an important role?

In this paper, I address the problem of uneven development from a political economy perspective. By using a consumption-growth and wage-profit rate dual model of commodity production (Spaventa, 1970), where labor across countries (or regions) is not mobile, I show two possible explanations for the North-South differences: (i) the quality of labor between

[1] In an economy not directed by a centralized political process, the pattern of specialization is the reflection of individual firm and household decisions.

them is different; (ii) or the technology between them is different[2]. In each of these settings, uneven development is understood differently. In the first, it is mainly a quantitative difference – regions produce the same goods, but in different levels, since consumption levels will be different. In the second, on the other hand, specialization takes place, with each country (or region) specializing on the production of goods that maximizes its profit rate – which, in turn is equalized to the world profit rate by the mobility of capital. In the process of trade and competition, surplus value will be distributed and profit rates equalized. The directions of value flows can also be analyzed in this second setting. Reasons for why technology differences would persist even though capital is fully mobile can vary. A discussion on different theories on this topic is then pursued after I present the model results.

Hence, the purpose of the paper is twofold: generally, to get some insights about the political economy explanations for uneven development, including the patterns of specialization, regional trade and value flow around the world; and theoretically, to extend the dual consumption-growth / wage-profit rate (c-g/w-r) model to incorporate the lack of labor mobility and, consequently, specialization.

It consists, thus, in four more sections, in addition to this introductory one. The next section reviews the relevant literature and summarises the long period method and its results for the equalization of the rates of profit and exploitation. At the end of this section, I discuss the plausibility of the assumption that labor is full mobile in a global economy. The next section presents the consumption-growth / wage-profit rate (c-g/w-r) model (Spaventa, 1970). The following section extends it to include two regions and the lack of labor mobility – and, consequently, different wages between the regions. This exercise is thus separated into two subsections: first, I assume that only labor qualities are different, while in the second the technology is different, which means relaxing the assumption that the two economies can produce all products at the average rate of profit. The next and final section summarises the results, discusses other possibilities for uneven development from a political economic perspective, and avenues for future research.

2 The Long Period Method and the Labor Theory of Value

The Classical Economists' – especially Smith's and Marx's – Long Period Method emphasize the "self-organization" aspect of societies that produces regularities and tendencies when observed by a long period – what Marx calls "economic laws" (Marx, 1981b; Cogliano, 2011; Foley, 2011). The complex commodity production society, the division of labor and market exchange have a common logic of competition. The recognition of this common logic constitutes the "first step" of the abstraction (Foley, 2011).

We can think about the specialization and division of labor problem as a hub-and-spoke model, where the hub represents a diversified production and the spoke a specialized one. Thinking about the independent producer problem of needing to achieve all its needs, we can start with her being in the hub. However, due to positive returns to scale, independent

[2] Different explanations for the North-South inequalities are clearly also possible. I am not, however, intended to come up with an exhaustive list, but rather explore those two possibilities that originate from the abstraction proposed and can be then analyzed in the c-g/w-r framework.

producers will specialize in particular commodity production. Specialization in the hub-and-spoke framework implies that producers will produce more of their specialized product than they need for their consumption, and will somehow have to transform their production into the products they need – exchanging through the market is one way of doing it. This implies that the products are not use-values to the producer, who has too much of them, but exchange values in so far as they can be exchanged with other producers for whom the product is a use-value. In this connection, when something enters into the division of labor, it becomes a commodity: it will be an exchange-value to the producer. Hence, to meet every individual's needs exchange takes place, and money arises as a general equivalent to facilitate all the transactions in such system. "The sphere of exchange has a relative autonomy, but it is ruled, regulated and dominated by the conditions of production and reproduction. The operation of this double relation is what Marx means by the *law of value*: prices as the immediate regulators of reproduction, social labour-times as the intrinsic regulators of prices and hence of reproduction" (Shaikh, 1984). Smith differentiates market prices and natural prices: the former being the money value actually traded in the market in a particular time, while the latter is the one that equalizes the ratio of money income to labor effort for the producer and are, as a result, proportional to labor effort. Marx calls natural prices as prices of production – prices that equalize the profit rates. The long period method predicts that market prices can fluctuate from time to time and place to place but, in the long run, they will tend to average out natural prices (or prices of production). In other words, there is a gravitational tendency for "equilibrium", where the rates of profit and exploitation are equalized, as discussed further. This movement of producers among the branches of production creates negative feedback that pushes market prices back toward natural prices.

The extent to which specialization occurs and "products become commodities", in the sense that they will be produced via specialization and exchanged in a market, depends on the extent of the division of labor. The commodity boundary separates the needs met through commodity production and the ones met through household diversified production. As the economy develops and the market grows, the scale of independent producers increases and the financing of the means of production gets harder. Hence, those who have the means to buy capital become capitalists, and the others become wage-workers, who can only sell their labor-power to get the means to buy the commodities they need to survive. This setting is what constitutes the capitalist system. "Capitalist production as a way of organizing human labor socially through exchange is a special form of commodity production, and it depends on the emergence of the money form of value. [...] Capitalist firms operate to make a profit. They sell commodities for more money than they pay for the inputs that produce them. Over the whole system, capitalists thus appropriate a surplus value." (Foley, 2009).

In a society where there is private ownership of the means of production, and the social division of labor occurs (due to positive returns to scale), the exchange of commodities into the market will represent such commodities' value. In capitalist production, where two classes are formed (capitalists and workers), capitalists hire workers to produce commodities and generate value, but they don't pay to workers the exact full amount of money value they "produce" (the money wage is smaller than the money value of their labor time spent). Hence, the origin of surplus-value is in the production process itself, where capitalist producers extract more labor effort from (productive) workers than the labor-effort equivalent of the money wage they pay. In other words, unpaid labor time represents the exploitation of capitalists on workers and is what contributes to the surplus value pool. However, that surplus value generated "individually" does not go to the individual capitalist but to the pool of

surplus-value of the economy as a whole. That pool is thus distributed to individual capitalists through competition, and the realized surplus value is the result of this process.

> Treating the mobility of labor as part of the layered abstraction of Marx's analysis then leads to the revelation that the surplus-value produced in a particular sector of an economy cannot be directly observed due to the processes of circulation and capital migration that redistribute surplus-value to equalize the rate of profit of all capitals (Cogliano 2011, p. 1).

Labor and capital are thus seen at a level of abstraction where they are "universal", i.e., they can move from one employment and skill to another in the long run. Thus, the long-period method considers the free mobility of labor and capital across the sectors: what Adam Smith calls "perfect liberty". The main abstraction of classical political economists is the combination of those factors: the "commodity system of production in which the division of labor is organized through exchange of products as private property with free mobility of labor and capital" (Foley, 2011).

> The key insights of the long-period method, and Marx's use of it, follow from this full mobility and lead to consideration of the tendencies for the rate of profit and rate of surplus-value [or exploitation] to turbulently, and independently, tend toward equalization across sectors of production. (Cogliano, 2011, p. 2).

It is, thus, precisely the individual behavior towards a higher rate of profit, in the case of capitalists, or a lower rate of exploitation, in the case of workers, that end-up equalizing those rates. The equalization of rates of exploitation thus implies the conservation of the pool of unpaid labor in money surplus value. "The profit rate distribution is an unintended consequence of individual capitals seeking higher profit rates that give rise to observed statistical regularities such as a general rate of profit and, we will argue, regular fluctuations of individual rates of profit around the general rate." (Scharfenaker and Foley, 2017, p. 2).

2.1 What if Labor is not Mobile?

The assumptions of free mobility of labor and capital are essential for the results of equalization of the rates of exploitation and profit, respectively. Challenging such assumptions thus have important effects for the political economy theory and, in particular, for the long-period method.

Regarding empirical results, the equalization of the rates of profit hypothesis seems to have found significant evidence, confirming it. The work from Scharfenaker and Semieniuk (2017) show a clear tendency of convergence of profit rates for North American firms for the period 1962–2014: "for publicly traded U.S. firms, we have shown that profit rates are extremely well organized into a tent shape characteristic of the Laplace distribution." (Scharfenaker and Semieniuk, 2017, p. 491).

The equalization of the rates of exploitation, on the other hand, faces a major challenge: how to translate the theory's abstractions, like the free mobility of labor, into something close to reality? Measurement difficulties, such as how to measure labor effort, make it hard to model the equalization of the rates of exploitation and test it into real world data. In addition to that, there are several obstacles to such mobility: from physical to technical ones. It is not true to assume that labor is mobile between the US and China, for example: there are language, immigration, legal and cultural barriers.

Nonetheless, Marx did recognize that labor (and capital) are not equal across society, and that the "perfect liberty" assumption may not be realistic. Indeed, he acknowledged that if a labor is more complex than another, it should be rewarded with a higher wage rate (Marx, 1981a).

> However, in spite of these differences in the complexity of labor that may exist, the ongoing movements and development of capitalism will inevitably cause the tendency of the equalization of wages and working hours across spheres of production to exert itself. Thus, Marx deems it necessary to employ an equalized rate of surplus value [or exploitation] across sectors because it pertains to the general conditions of capitalism that are the focus of his investigation (Cogliano, 2011, p. 8).

Hence, he would argue that, for the theoretical discussion he was proposing, the fact that labor is not mobile in reality does not matter. The assumption of full mobility of labor is simply an abstraction from reality, necessary for theoretical purposes. However, if we do want to apply Marx's theory to understand trade and value flows in the world economy, we need to account for the lack of labor mobility. And this does not mean that we can't use the long period method and labor theory of value for such analysis.

What would, then, be the consequences of such labor barriers according to the long period method? The first answer to this question is that rates of exploitation would not be equalized among regions where labor is not mobile. However, to properly answer this question, i.e., to understand what would be the consequences for the flow of value, nations' capitalist development and specialization, it is necessary to build on other assumptions and construct a complete model for the analysis – which is the main contribution of this paper. The next section presents the baseline model. Its extensions and the theoretical discussions are found in the sections that follow.

3 The Baseline Model

The relationship between wages and the profit rate to set prices in a commodity production system was first elaborated by Sraffa (1975)'s *Production of commodities by means of commodities*. Later, Spaventa (1970) introduced the idea that, in fact, "two companion relationships, between the rate of profit and the wage- rate and between the rate of growth and consumption per head, can be obtained from the price equations and the quantity equations of a linear model where commodities are produced by means of commodities.".

The model used in this paper is based on this idea, and starts from the n-product linear model. The consumption-growth / wage-profit rate (c-g/w-r) model is a dual model that connects consumption and growth rates, in one side, and wages and profit rates, on the other side, to this n-product linear model.

Following Pasinetti (1977)'s Chapter five "The Sraffian System", I consider single product industries, for simplicity. Hence, consider an n-dimension product space with $x = \{x_1, \dots, x_n\}$ a quantity-like (column) vectors and $p = \{p_1, \dots, p_n\}$ a price-like (row) vectors, such that $px = p_1x_1 + \cdots + p_nx_n$ is a scalar representing the total (price) value of the quantities x. A technique is a pair $\{A, l\}$, with A being a (nxn) matrix of input-output coefficients, such that its elements $a_{i,j}$ represents the quantity of product i required to produce one unit of product j; and l is a vector with labor-requirements for each product. Each column of the $\{A, l\}$ array represents an *activity* that produces one unit of one of the products. A square input-output matrix with one activity for each product is called a *technique*. Because

there may be different ways to produce the same product, there may be more than one technique for each product. The collection of all the available techniques is called *technology*.

3.1 The c-g model

Having in mind the n-product linear model, one can start by thinking about it as a "consumption-growth" model, where total production x grows at a (given) uniform (scalar) ratio g; there is a scalar level of consumption c; and a semi-positive reference consumption bundle d. When wanting to solve this problem for x, we face an under-determined system, since we get n equations and n+1 unknowns (n quantities and 1 consumption level c). However, labor input can be normalized to unity, that is, $lx = l_1x_1 + \cdots + l_nx_n = 1$ to solve this problem. Hence, we have the following system and its solutions:

$$x = (1 + g)Ax + cd \qquad (1)$$

$$x = c[I - (1 + g)A]^{-1}d \qquad (2)$$

Pre-multiplying both sides by l:

$$lx = 1 = cl[I - (1 + g)A]^{-1}d \qquad (3)$$

$$c[g] = \frac{1}{l[I-(1+g)A]^{-1}d} \qquad (4)$$

In this model there is no price system to allow for the aggregation of inputs in production to a scalar value. For this reason, it is sometimes associated to a Socialist type of economy. These equations give two unique relationships between the growth rate, consumption, and quantity production (Spaventa, 1970). And, as we will see next, this model is the dual of a price-wage model.

3.2 The r-w model

The "r-w" model, or the Sraffian version of it, assumes that

> the value added in an economic system, which is equal to the value of the commodities which make up its national income (or net product), is distributed to the members of the community at the end of each 'year' in two forms: *wages* and *profits*. Wages are distributed in proportion to the physical quantity of labor which has been contributed; profits are distributed in proportion to the value of the means of production. It is assumed that labor is of a uniform quality and that both the wage rate and the profit rate are uniform all over the economic system (Pasinetti, 1977, p. 72).

In this way, the wage rate is denoted by w (scalar), and the profit rate by r, also a scalar – i.e., it is already assumed equal among all n sectors of this economy. Prices are then defined by the system of equations:

$$p = (1 + r)pA + wl \qquad (5)$$

In this setting, we have n equations (represented by the matrix notation above), but $n + 2$ unknowns (n prices, the wage and the profit rate). Hence, we need to choose one closure to this system, i.e., decide on whether profit rates or wages will be given. Let us, then, first consider profit rates to be given: $r = \bar{r}$. Now, we have $n + 1$ unknowns and two possible ways to follow: (i) consider one price of an arbitrary commodity equal to unity, such that all other prices and the wage rate will be relative to that commodity price (Pasinetti's solution);

(ii) or we define a semi-positive reference bundle d (column vector) such that $pd = 1$ – i.e., we include one more equation and now we have $n + 1$ unknowns and $n + 1$ equations. I follow, in this paper, the last solution.

The system is then represented by the following equations:

$$p = (1 + r)pA + wl \qquad (6)$$

$$pd = 1 \qquad (7)$$

And its solutions are:

$$p = wl[I - (1 + r)A]^{-1} \qquad (8)$$

Pre-multiplying both sides by d, we can solve for w:

$$pd = 1 = wl[I - (1 + r)A]^{-1}d \qquad (9)$$

$$w[r] = \frac{1}{l[I-(1+r)A]^{-1}d} \qquad (10)$$

As it can be seen from the solutions of both models, the c-g part is the dual of the w-r part. In (Spaventa, 1970) words: "The consumption relationship turns out to have exactly the same parametric form as the wage relationship, with the growth-rate in the place of the rate of profit and consumption per head in the place of the wage-rate, so that the two corresponding curves are the exact replica of each other." (Spaventa, 1970, p. 131)

However, they seem to be independent from each other (the c-g side reflect quantity relations, and the w-r side reflects nominal/price relations), unless some saving function is postulated. "If a savings function is postulated, the equilibrium equality between savings and investment establishes a relationship between the growth-rate and the rate of profit: given either the growth-rate or the rate of profit, all price and quantity variables are then simultaneously determined." (Spaventa, 1970, p. 132).

In the following, I will assume that this latter case is the one considered: there will be a direct relation between growth rates and profit rates, in a way that the equalization of profit rates will also equalize growth rates and determine simultaneously prices and quantities.

4 Relaxing the Assumption of Full Labor Mobility

What happens to the model just presented, when we have two economies with capital mobility but no labor mobility? In other words, what happens if the profit rate equalizes between those economies but the wage rate does not? To answer this question, I extend the previous c-g/w-r model to include two regions: A and B. The two regions face the same world prices p, for all commodities. This implicitly assumes that all products can be traded. Even thought this is a strong and unrealistic assumption, we start with this simpler case in order to better understand the functioning of the model after relaxing the assumption that labor is fully mobile. Considering the case where not every commodity can be traded will be then left for further work. Regional wages are w^i, regional production is x^i and regional profit rates are r^i, with $i = A, B$. Region A is stylized to represent the global north, and region B is stylized to represent the global south. This means that $w^A > w^B$. The growth rate g of the two regions

will be considered equal – otherwise one region would asymptotically disappear. Considering an uniform saving rate out of profits s_p in both economies, this assumption would follow from the equalization of the rates of profit, where $g = s_p\overline{r}$ (the 'Cambridge equation'). In other words, if profit rates are equalized and each region has the same propensity to re-invest out of profits, the Cambridge equation-type closure will imply equal growth rates. The consumption bundle d is also equal for both regions, while the consumption level c^i will differ (since wages are different).

If the wage rate is different in the two economies, it is necessary to have either different quality of labor between them, or they need to have access to different technologies. Otherwise, if the two regions have equalized profit rate (as predicted by the long period method, since capital is mobile), different regional wages and if all the products are traded at uniform prices and both regions have access to the same technology, the non-wage costs of production will be the same in both regions by definition, and the lower-wage region will have the lower prices and produce everything. It is important to note that this results is maintained even if the two regions have access to the same technology and can choose the technique applied in each of them – the one that maximized profits given the different wage rate. In this connection, it is worth mentioning some results from international trade theory. For instance, the Stolper-Samuelson theorem (Stolper and Samuelson, 1941) "asserts the existence of a special relationship between commodity and factor prices: namely, that an increase in the price of a commodity will bring about a more than proportionate increase in the price of the corresponding 'intensive' factor" (Chipman, 1969). In this way, the relative abundant factor gains and the relative scarce factor loses with international trade. Samuelson (1953) later argued that the Stolper-Samuelson theorem meant that trade in goods would be sufficient to equalize the remuneration of factors of production across countries. In other words, trade in goods would equalize profit and wage rates and therefore substitute for actual mobility of capital and labor.

To pursue the analysis of lack of labor mobility in the c-g/w-r model, the assumptions about labor quality and technology will then be separated into two different directions. First, I assume that the regions have access to the same technology, but the quality of labor is different between them. In this first scenario, both regions would produce the same products, and would not necessarily trade among each other. In other words, it is the equivalent of having a single closed economy with different qualities of labor. In the second, I assume that the technology can differ among regions, and thus specialization and trade will occur.

4.1 Different Quality of Labor

As mentioned previously, in order to have production in the two regions, who have access to the same technologies but have different wage rates, it is necessary to assume that the quality of labor is different between them. If the quality of labor is different, it is possible to find an equilibrium with production in both regions.

Consider, then, that this is reflected in labor requirements (measured by the abstract uniform labor effort). This means that region B (the south) will use more labor time in its production than region A (the north): $l^A < l^B$. The w-r part thus becomes:

$$p = (1 + r)pA + w^A l^A \qquad (11)$$

$$p = (1 + r)pA + w^B l^B \qquad (12)$$

$$pd = 1 \quad (13)$$

Where we get two different solutions for each price, but that need to be equal, since both regions face the same prices:

$$p = w^A l^A [I - (1+r)A]^{-1} = w^B l^B [I - (1+r)A]^{-1} \quad (14)$$

For them to be equal, we need, then, that $w^A l^A = w^B l^B$. This means that $w^A l_1^A = w^B l_1^B, \dots, w^A l_n^A = w^B l_n^B \Rightarrow \frac{w^A}{w^B} = \frac{l_1^A}{l_1^B} = \cdots = \frac{l_n^B}{l_n^A}$. Hence, the ratio between the labor requirements of each commodity in the two economies has to be the same, and has to be the same as the inverted ratio between the wage rate in both economies. The equilibrium difference in wages is then just compensating for the difference in labor quality, just as in a single economy with different qualities of labor. This means that effective wages are equal for the two economies. In other words, international trade in goods and competition seems to have the same effect as labor mobility in equalizing effective wages.

In the c-g model, I assume that $l^A x^A = l^B x^B = 1$ for both regions – i.e., the size of their population is the same. Hence, when we get that the consumption scalar will also be different by the proportion that wages and labor requirements are different. Hence, $c^A = \frac{1}{l^A[I-(1+g)A]^{-1}d}$ and, for economy B, $c^B = \frac{1}{l^B[I-(1+g)A]^{-1}d}$ (where it follows that $c^A > c^B$).

In this case, even though all products are produced in both regions, we would also have different quantities x^i produced in each Region:

$$x^A = (1+g)Ax^A + c^A d \quad (15)$$

$$x^A = c^A[I - (1+g)A]^{-1}d \quad (16)$$

And for Region B:

$$x^B = (1+g)Ax^B + c^B d \quad (17)$$

$$x^B = c^B[I - (1+g)A]^{-1}d \quad (18)$$

The difference between quantities produced in each region can also reflect the different in labor quality – the higher the labor requirements, the smaller the consumption scale and, thus, the smaller the production, in the case of economy B when compared to A. But recalling the dual relation of the c-g and w-r models, it can also represent the effect on consumption side due to wage differentials: since wages are smaller in region B, consumption levels will also be smaller and, thus, production will be smaller.

To summarize, assuming that regions have access to the same technology but have different labor qualities means that both regions can produce all goods at the average profit rate, and uneven development is a reflection of lower labor productivity, thus leading to lower consumption and production in the global South. This assumption, however, does not allow for specialization patterns to be explained. In order to do that, we need to relax the assumption that the two regions face the same technology.

4.2 Different Technologies

I will now relax the assumption that both economies can produce all goods at the average world rate of profit, as they face different technologies ($\{A, l\}^i$, for $i = A, B$). This means that, given the world prices and the regional wage, if the profit rate for that sector in that region falls short of the world average profit rate, the commodity is not produced in that region, or if the commodity is produced in the region, the profit rate on it at the regional wage must be equal to the average profit rate. This assumption is mathematically called as *Complementary Slackness*. One reason for difference in technological opportunities might be natural resource (such as land) differences between the regions, in light of Ricardo's comparative advantage theory. Another reason may be related to Krugman's 'new trade' theory, that points to technological difference based on network externalities as an important factor (Krugman, 1994). In addition to that, there's also Kaldor's principle of 'circular and cumulative causation', that:

> it is nothing else but the existence of increasing returns to scale – using that term in the broadest sense – in processing activities. These are not just the economies of large-scale production, commonly considered, but the cumulative advantages accruing from the growth of industry itself – the development of skill and know-how; the opportunities for easy communication of ideas and experience; the opportunity of ever-increasing differentiation of processes and of specialisation in human activities ((Kaldor 1970, 484)).

Here, I follow Smith and Marx's assumption about labor characteristics. Labor will be considered abstract and universal. This means that there is no qualitative difference between the labor of the two regions and they are, in principle, interchangeable – i.e., if there were full mobility of labor, they could move from one sector to the other. Since prices are the same for the two regions, and labor effort is universal for the whole system, this leads to an equalized monetary expression of labor time (MELT) in the system as well.

The assumption of the equalization of the rate of profit across regions means that there must be a pair of techniques, one for each region, which are profit-rate maximizing given the wage in the region, thus leading to the same profit rate in both regions. The price of production at which any product can be produced in a region is defined for the common profit rate, which is given by:

$$\bar{r} = \max_{i,j} r_j^i \quad , \quad i = A, B \; ; \; j = 1, \dots, n \qquad (19)$$

The pattern of specialization of the two regions in production will be determined by the regional rates of profit, since any product will be produced in the region where its rate of profit is higher. This Complementary Slackness condition can be translated into the following equation:

$$\text{Min}\left[\bar{r} - r_j^i, x_j^i\right] = 0 \qquad (20)$$

Equation 20 means that, if $\bar{r} = r_j^i$, i.e., if the regional rate of profit of sector j is equal to the world average, then $x_j^i \geq 0$, i.e., it is possible to have some production in sector j of region i. If $x_j^i = 0$, on the contrary, then it means that $\bar{r} \geq r_j^i$. i.e., if the production in sector j of region i is equal to zero, the profit rate of that sector in that region falls short of the average profit rate, so that the good cannot be produced in the long period in that region.

The profit rates of each region and sector will be defined by the price equation from the r-w model:

$$p = \left(1 + r^i\right)pA^i + w^i l^i\,, \quad i = A, B \qquad (21)$$

Where r^i stands now for a vector of sectoral profit rates in region $i = A, B$. The pattern of production, on the other hand, will be given by the c-g model, and some modification should be done to include exports and imports. Since it is possible that some region will not produce some product, but still needs it as input and/or for final demand, then each region will have to trade for any products it does not produce. In this way, equation 1 from the c-g model has to be modified to:

$$x^i + y^i = (1 + g)Ax^i + c^i d\,,\ i = A, B \quad (22)$$

Where $y^i = m^i - e^i$ stands for net imports, with m^i and e^i representing imports and exports, respectively, of regions $i = A, B$. Since our model has only two regions, it is clear that imports from one region are equal to exports from the other. Hence, from construction, $y^A + y^B = 0$.

To move forward analytically with such model, it is useful to work on an example: consider there are 3 goods in such economy. Good 1 stands for the industrial good, such as steel; good 2 for the agricultural good, as food; and good 3 is gold. We can then stylize the two regions. Let region A be the global north, while region B represents the global south, i.e., region A will be more productive and hold more capital, while region B will be more labor-intensive – because wages in region B are smaller than in region A ($w^A > w^B$), region B will use more labor in its production process ($l^A < l^B$). This assumption tries to reflect the characteristics associated with a "core-periphery" model: "core production is relatively capital intensive and employs skilled, high wage labor; peripheral production is labor intensive and employs cheap, often politically coerced labor" (Chase-Dunn 1998, p. 77). However, as mentioned before, we abstract from labor quality differences in this section.

Since labor in the two regions is of the same quality, it means that exploitation in region B is higher than in region A. In other words, unpaid labor time is greater in region B than in A. Suppose that the technique in use in each region (the one that maximizes regional profits) are the following (where a_{ij} is the amount of good i used in production of good j)[3]:

Region A

$$A^A = \begin{bmatrix} a_{11}^A & a_{12}^A & a_{13} \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix} \qquad l^A = \begin{bmatrix} l_1^A \\ l_2^A \\ l_3^A \end{bmatrix} \qquad (23)$$

[3] Since I assume that the available technology in both regions is different, consider that the technique in use in each region, as exemplified here, was not available to the other region. That is, region B could not produce all goods using only the capital good, as region A does, for example.

Region B

$$A^B = \begin{bmatrix} a_{11}^B & 0 & a_{13} \\ 0 & a_{22}^B & 0 \\ 0 & 0 & 0 \end{bmatrix} \qquad l^B = \begin{bmatrix} l_1^B \\ l_2^B \\ l_3^B \end{bmatrix} \qquad (24)$$

Comparing the techniques of the two regions we can say that: (i) gold isn't an input for any product; (ii) to produce gold we need only the industrial good, with the same input-output coefficient (a_{13}) is the same in the two regions; (iii) the production of the industrial good uses only the industrial good itself, in both regions, but with different intensity: since region A is more productive, $a_{11}^A < a_{11}^B$; and (iv) the agricultural good is produced with machinery and labor in region A, while in region B it needs the agricultural product itself and labor to produce it. This can be understood as an assumption that the agricultural sector is more capital-intensive in the north, when compared to the south.

Now that I have an explicit example, I can solve the model, starting from the r-w side.

The r-w Model

Having defined the available technique in use in each region, we can then find equilibrium prices and profit rates in this setting[4]:

Region A

$$p_1 = (1 + r_1^A)p_1 a_{11}^A + w^A l_1^A \quad (25)$$

$$p_2 = (1 + r_2^A)p_1 a_{12}^A + w^A l_2^A \quad (26)$$

$$p_3 = (1 + r_3^A)p_1 a_{13} + w^A l_3^A \quad (27)$$

Region B

$$p_1 = (1 + r_1^B)p_1 a_{11}^B + w^B l_1^B \quad (28)$$

$$p_2 = (1 + r_2^B)p_2 a_{22}^B + w^B l_2^B \quad (29)$$

$$p_3 = (1 + r_3^B)p_1 a_{13} + w^B l_3^B \quad (30)$$

Since both regions face the same world prices p, we can equalize those equations to get some relation between the profit rates of each sector in both regions. For p_1, we then equalize equations 25 and 28:x

[4] Formally, the correct solution for this problem would be one where techniques are defined together with prices and profit rates. As mentioned previously, the technique chosen is the one that maximizes the rate of profit given the costs (prices of inputs and wages). However, this would mean a too complicated analytical solution, so I assume the given techniques as stylized here, and leave the rigorous formal solution for future work

$$(1+r_1^A)p_1a_{11}^A + w^A l_1^A = (1+r_1^B)p_1a_{11}^B + w^B l_1^B$$
$$p_1[(1+r_1^A)a_{11}^A - (1+r_1^B)a_{11}^B] + w^A l_1^A - w^B l_1^B = 0 \quad (31)$$

One sufficient condition for it to be zero is that $(1+r_1^A)a_{11}^A = (1+r_1^B)a_{11}^B$ and $w^A l_1^A = w^B l_1^B$. Since $a_{11}^A < a_{11}^B$, this would mean $r_1^A > r_1^B$, and since $w^A > w^B$, this would mean $l_1^A < l_1^{B-5}$. This result makes sense: region A is the "global north", thus the most productive region. Hence, the labor coefficient in the production of the industrial good will be smaller in region A, when compared to region B, and the profit rate in the industrial sector is higher in region A than in region B. By equalizing equations (26) and (29) a similar analysis can be done for the agricultural good:

$$(1+r_2^A)p_1a_{12}^A + w^A l_2^A = (1+r_2^B)p_2a_{22}^B + w^B l_2^B$$
$$(1+r_2^A)p_1a_{12}^A - (1+r_2^B)p_2a_{22}^B + w^A l_2^A - w^B l_2^B = 0 \quad (32)$$

Applying the same reasoning as before, two sufficient conditions for equation 32 to be satisfied are: $(1+r_2^A)p_1a_{12}^A = (1+r_2^B)p_2a_{22}^B$ and $w^A l_2^A - w^B l_2^B$. The result for the labor coefficient is similar than the one obtained before: $l_2^A < l_2^B$, that is, region B is more laborintensive in the agricultural sector as well. As for the profit rates, we need now to compare not only the input-output coefficients, but also the prices of the two goods. For region B to produce the agricultural good, that is, for $r_2^A < r_2^B$, we need that $p_1a_{12}^A > p_2a_{22}^B$. This means that the cost of the agricultural machinery in region A has to be higher than the cost of agricultural inputs in region B. Indeed, that sounds like a reasonable assumption, since the industrial good is usually more expensive, and region B is labor-intensive.

Finally, for gold production, we equalize equations 27 and 30:

$$(1+r_3^A)p_1a_{13} + w^A l_3^A = (1+r_3^B)p_1a_{13} + w^B l_3^B$$
$$p_1a_{13}[r_3^A - r_3^B] + w^A l_3^A - w^B l_3^B = 0 \quad (33)$$

Hence, in this case, two sufficient conditions are $r_3^A = r_3^B$ and $w^A l_3^A = w^B l_3^B$. This means that, also in the production of gold, region B will be more labor-intensive: $l_3^A < l_3^B$. In fact, getting the three sufficient conditions outlined previously, we get that the differential in labor-intensity between the two regions, in all sectors, is equal to the "wage-gap": $\frac{w^A}{w^B} = \frac{l_1^B}{l_1^A} = \frac{l_2^B}{l_2^A} = \frac{l_3^B}{l_3^A}$. This means that region B will be more labor intensive as much smaller its wages are. Different from the previous case, however, this does not mean that the quality of labor is different. It means that the intensity of labor use in region B is higher. In the production of gold, the two regions will have the same profit rates.

The complementary slackness assumption will mean that: Region A will produce the industrial good and gold, and Region B will produce the agricultural good and gold. The equalization of the rates of profit means that $r_1^A = r_2^B = r_3^A = r_3^B$. In other words, the profit rates of all sectors that are going to have production (industrial sector in region A, agricultural sector in region B, and gold sector in both regions) will have the same profit rate, that I call $\Bar{r}$. Now we can find the prices for each good:

From equation 25:

$$p_1 = \frac{w^A l_1^A}{[1-(1+\bar{r})a_{11}^A]} \qquad (34)$$

From equation 29:

$$p_2 = \frac{w^B l_2^B}{[1-(1+\bar{r})a_{22}^B]} \qquad (35)$$

And from equations 27, 30 and 34:

$$p_3 = \frac{(1+\bar{r})w^A l_1^A}{[1-(1+\bar{r})a_{11}^A]} a_{13} + w^A l_3^A = \frac{(1+\bar{r})w^A l_1^A}{[1-(1+\bar{r})a_{11}^A]} a_{13} + w^B l_3^B \qquad (36)$$

where I substitute all sectoral and regional profit rates by the equalized value $\bar{r}$.

Equation 36. means that the price of gold will depend on the production of steel (since it is its only input), and, thus, on wages from region A, regardless if it is being produced in region B - again, the reason being that only region A will produce the input for gold: the industrial good.

The c-g model

Having prices and profit rates defined, together with the specialization of each region, I now turn to the c-g model to understand how production will be distributed (hence, how trade will be set). The consumption level of each region will follow its wages, that is, $c^A > c^B$. The consumption basket d will be the same for the two regions, and will be composed only by food and gold, i.e., $d = (0, d_2, d_3)$. I assume a single saving rates out of profits (s_π) in the two regions, in a way that the Cambridge equation holds, and growth rates would be equal when the profit rates are equal $(g = s_\pi r)$.

Hence, let's look at the production per good. The industrial good is produced only in region A. Hence, total supply of the industrial good in region B will be imported. In Region A, the industrial good is used as input to the production of the industrial good itself and to the production of gold, while in Region B it is used as inputs for the production of gold. This means that:

$$\begin{gathered} x_1^A - e_1^A = (1+g)(a_{11}^A x_1^A + a_{13} x_3^A) \\ m_1^B = (1+g) a_{13} x_3^B = e_1^A \\ x_1^A = (1+g)(a_{11}^A x_1^A + a_{13} x_3^A + a_{13} x_3^B) \end{gathered} \qquad (37)$$

where e_1^A stands for the exports of product 1 from region A, and m_1^B stands for imports of product 1 from region B, which are equal, by construction. To solve for x_1^A we need, then, the values of x_3^A and x_3^B.

The Agricultural good is produced only by Region B. Hence, total supply of the agricultural good in region A will be imported. In Region A, the agricultural good is used only for final

use, while in Region B it is used as an input to its own production and as a final good. This means that:

$$\begin{gathered} m_2^A = c^A d_2 = e_2^B \\ x_2^B - e_2^B = (1+g)(a_{22}^B x_2^B) + c^B d_2 \\ x_2^B = \frac{(c^A + c^B) d_2}{1-(1+g)a_{22}^B} \end{gathered} \qquad (38)$$

Gold is produced in both regions, and it is used only for final consumption. This gives us:

$$\begin{gathered} x_3^A = c^A d_3 \\ x_3^B = c^B d_3 \end{gathered} \qquad (39)$$

Since $c^A > c^B$, the production of gold will be higher in region A. We can then substitute equations 39 into 37, to solve for x_1^A and m_1^B :

$$x_1^A = \frac{(1+g)(a_{13}(c^A + c^B) d_3}{1-(1+g)a_{11}^A} \qquad (40)$$

$$m_1^B = (1+g) a_{13} c^B d_3 \qquad (41)$$

With those solutions, we can then compare the two region's trade balance. We defined $y^i = m^i - e^i$, the net imports, with $i = A, B$. Hence:

$$y^A = \begin{bmatrix} m_1^A - e_1^A \\ m_2^A - e_2^A \\ m_3^A - e_3^A \end{bmatrix} \Rightarrow y^A = \begin{bmatrix} -(1+g) a_{13} c^B d_3 \\ c^A d_2 \\ 0 \end{bmatrix} \qquad (42)$$

$$y^B = \begin{bmatrix} m_1^B - e_1^B \\ m_2^B - e_2^B \\ m_3^B - e_3^B \end{bmatrix} \Rightarrow y^A = \begin{bmatrix} (1+g) a_{13} c^B d_3 \\ -c^A d_2 \\ 0 \end{bmatrix} \qquad (43)$$

Where $y^A + y^B = 0$.

In this setting, trade can be characterized by unequal exchange: the south is importing capital, while the north is importing agricultural good. This result is obviously a reflection of the techniques being used in each region, who were chosen to compose the stylized regions (north and south). However, I think that analyzing such specialization patterns can still lead to a relevant discussion of uneven development. Thinking about Dependency Theory, for example, can be helpful for understanding and extrapolating some of the results. The dependency theory has its theoretical roots on the debate of the development of capitalism in "backward nations" and is closely related to the Marxist theory (Prebisch, 1962, Santos, 1970). In this way, the theory bases its analyses on class and social relations both within the periphery countries and also between them and the developed nations. If we consider that the agricultural good is less valued (has lower prices) than the industrial good, in the model

constructed here the south would be in a term of trade disadvantage[5]. In other words, the south would specialize in the production of a "less valuable" good than the north, and would then be falling behind.

In this connection, it is also important to understand how the flow of value (in Marx's sense of value) will be characterized in this setting. As mentioned previously, labor is of the same quality and, thus, it is more exploited in the lower wage region B. Since the whole system has the same monetary expression of labor time (MELT), it means that the monetary expression of unpaid labor is greater in region B. If we represent the monetary expression of unpaid labor as melt $-w^i$, where melt = monetary expression of labor time and i=A,B, that becomes clear. Total unpaid labor $\left(ul^i\right)$ in each region is, thus, equal to $\left(melt - w^i\right)l^i x^i$. Explicitly:

$$\begin{aligned} ul^A &= (\text{ melt } - w^A)\left\{l_1^A\left[\frac{(1+g)(a_{13}(c^A+c^B)d_3}{1-(1+g)a_{11}^A}\right] + l_3^A[c^A d_3]\right\} \\ ul^B &= (\text{ melt } - w^B)\left\{l_2^B\left[\frac{(c^A+c^B)d_2}{1-(1+g)a_{22}^B}\right] + l_3^B[c^B d_3]\right\} \end{aligned} \tag{44}$$

Since there is no labor mobility, but there is capital mobility, it means that monetary expression of unpaid labor produced in each region may not be equal to the surplus value realized in each region. That is only true for the system as a whole, that is, total unpaid labor time of the two regions together will be equal to total surplus value realized in the system. Since the south (region B) has more exploitation, it will probably be contributing more to the pool of world surplus value, and the North (region A) may be appropriating part of the unpaid labor generated in the south. Understanding how surplus value realized is distributed is, thus, essential for understanding the flow of value between those economies. The unique prices of production, the process of competition distribute surplus value among the regions and the sectors in a way to equalize profit rates.

5 Concluding Remarks

In an attempt to understand uneven development through a political economy framework, this paper extended the dual model of consumption - growth and wages - profit rates to relax the assumption of full labor mobility across two regions, stylized as the north and the south. In this way, the lack of labor mobility would mean that wage rate would not necessarily equalize between those regions, with the less developed region (region B, the global south) having lower wages than the developed region (region A, the global north). In a first exercise, I assume that both regions have access to the same technology – and would thus end up using the same "dominat" technique – but have different labor qualities: labor in the south is less productive than in the north. In order to have production in both regions, I show that this labor quality difference has to be proportional to the wage differential. In other words, the wage difference would be representing exactly the difference in labor productivity and

[5] For this to be the case in this model $a_{22}^B > a_{11}^A$, that is, the amount of the agricultural good needed to produce one unit of the agricultural product needs to be higher than the amount of the industrial good needed to produce one unit of industrial product.

effective wages would, thus, be equalized. In this setting, the level of production is different between the two regions, but both of them are able to produce all goods. Trade, in this sense, is only responsible for equalizing efficient wages.

In a second exercise, on the other hand, I assume that labor is of the same quality, but the regions face different technologies. This means that their cost of production are different not only because wages are different, but also because they end up using different techniques. By exemplifying a possible technique chosen by each region, I show that specialization may occur, and trade is thus established. The example used lead to a solution where the global north produces the industrial good, while the global south produces the agricultural good (and both regions produce gold). In this setting, I believe that the question of how the flow of value is characterized between the two economies becomes clearer. In other words, having specialization patterns with the same labor quality, one can think about how and where unpaid labor time is being extracted, and how realized surplus value is being distributed – a discussion that I consider extremely relevant for understanding the globalized economy we live in, and the possible class and nations conflicts that exist in it. This second scenario is more interesting as it is capable of explaining more of the "stylized facts'" of the global economy. This preliminary analysis has important insights that some limitation of access to technology between regions must accompany this unequal outcome. One possible candidate for the cause of this limitation is some kind of scale economies, either absolute, or endogenous as in Krugman's "new trade" theory or as in a Kaldorian framework.

However, those are not the only explanations for uneven development. Even within the Classical Political Economists, one can try to explain uneven development by using a Ricardian comparative advantage reasoning. In this way, different wages and equalized profit rates can be sustained if there are non-tradable goods or non-tradable inputs (such as land or natural resources), whose prices differ in equilibrium. Difference in non tradable resources, would characterize the comparative advantage of a region in relation to the other, and could, thus, explain the patterns of specialization. Hence, in this setting, even by facing the same technology, the regions could chose different techniques of production, due to their non tradable cost of goods (which can be inputs for some tradable good production). In other words, there may not exist a unique "dominant" technique for the two economies. In a similar reasoning from the complementary slackness mechanism proposed here, regional sectors would then evaluate their costs of production (or their profit rates) and specialize on the one with lower costs (or higher profit rates). Prices, techniques, the equalized profit rate and patterns of production would, thus, be simultaneously determined. However, Ricardian comparative advantage theory, based on resource differences, can explain some features of the global division of labor, but doesn't seem effective to understand persistent global inequality. For instance, in some cases the rich North countries are resource-poor and the poor South countries are resource-rich.

Hence, exploring alternative theories for global inequality is an important next step in this research. In this way, one area that needs further development is to explain why different countries or regions may face different technologies, even with full mobility of capital. In other words, why technology does not follow capital and become roughly equally accessible over a long time horizon? As mentioned previously, Krugman's new theory or Kaldor's circular and cumulative causation may be helpful in understanding this matter. Technological agglomeration (network) effects with economies of scale need to be included in such political

economy approach to provide an explanation for persistent global inequality over longer time periods.

Exploring further the explanation for uneven development from a political economy perspective can lead to important contributions to this discussion. Translating some of those models into numerical examples and empirical research could be one way of moving on with this research, while generalizing and sophisticating the theoretical model could be another (complementary) path.

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