Working Paper No. 1074

Political Conflict, Green Capabilities, and Growth Patterns in a Kaleckian Small Open Economy

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December 2024

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ISSN 1547-366X

ABSTRACT

The paper presents a Kaleckian extended model exploring sustainable development, defined as growth that is economically stable, socially inclusive, and environmentally respectful. The model links CO_2 emission trends with public investments in green capabilities, represented by the share of renewables in total energy supply. It incorporates three key actors: green capitalists (G), brown capitalists (B), and workers (R), whose alliances influence taxes, social expenditure, and green capabilities investments. Three political coalitions are formed: green-red (GR), green-brown (GB), and red-brown (RB). The GR coalition promotes sustainable and inclusive growth but may face trade imbalances depending on public investment's ability to boost non-price competitiveness. The GB alliance yields sustainable but non-inclusive growth with a high long-term deficit. The RB coalition results in environmentally unsustainable outcomes but may produce stable growth with income redistribution during high commodity export demand. Applying the model to Mexico highlights fiscal space challenges for public investment and income redistribution amidst emissions reduction targets.

JEL: B50, Q43, Q56

1. INTRODUCTION

Gap models have a long tradition in the study of economic development. This paper revisits these models and suggests new extensions with a focus on sustainable development, defined as a growth path which is sustainable in three dimensions: economic (stable growth with external equilibrium), social (growth is inclusive), and environmental (that which respects the ecological limits of the planet). In recent years, a three-gap model has been suggested that helps put together these three dimensions within a single analytical framework (ECLAC 2020; Althouse et al 2020; Porcile et al. 2023). In addition, Guarini et al. (2023) have sought to combine this framework with different policy scenarios representing different political alliances. Such alliances are the result of the combination of three different actors: green capitalists (G), brown capitalists (B) and workers (reds, R). Each actor is associated with specific objectives to be attained, reflected in key parameters of the model—namely taxes, social expenditure, and public investment in green capabilities.

The paper is organized into five sections, besides the introduction and the concluding remarks. Section 2 provides a systematic historical overview of the origin and more recent development of gap models. Section 3 analyzes the Economic Commission for Latin America and the Caribbean's (ECLAC) latest contribution to the three-gap model for sustainable development, identifying additional aspects in each dimension that justify the need for an extension in the considered variables and elements. Section 4 introduces the Kaleckian model with social actors and the formation of alliances. Lastly, Section 5 analyzes the results through the growth patterns generated by different combinations of public policy parameters applied to Mexico.

2. THE EMERGENCE OF GAP MODELS

Gap models have played a significant role in comprehending the distinct structural behavior of economies, particularly within the context of challenges faced by Latin America during the post-war period. The field of economic development has drawn valuable insights from

this body of literature, as it effectively identifies the constraints within growth models, aligning with the specific requirements of less developed economies.

During the 1940s, concerns regarding the foreign exchange constraint attracted the attention of Latin American economists, who perceived this phenomenon as an external constraint stemming from the development process itself (Bacha 1984). The Two-Gap Model (2GM)[1] formalized this issue, as outlined by Chenery and Bruno (1962) and Chenery and Strout (1966), explaining the regional process of import substitution prior to the debt crisis.

This model was conceived as a toolbox for policymakers in designing scenarios tailored to less developed economies. Specifically, it analyzed the interaction between external restriction—understood as the limit on the growth of an economy given the availability of foreign exchange for importing capital goods—and savings restriction, seen as the limit on growth due to the availability of domestic savings for investment.

The model aimed to explain the balance-of-payments crisis in the growth process, characterized by a period of excess savings over investment and, consequently, high unemployment. The 2GM highlighted the well-known challenges faced by peripheral economies in achieving a balance between these two gaps (Chisari and Fanelli 1990).

The integration of the fiscal gap would occur due to the impact of the profound debt crisis in Latin America in the 1980s. Imbalances in the balance of payments would be based on a governmental financial crisis and capital flight. The formulation of the Three-Gap Model (3GM) [Bacha (1990); Solimano (1990); Taylor (1993); Ros (1992); Fanelli & Frenkel (1990)] would be grounded in stylized facts observed in the region related to the growth restriction explained by the reduction of public investment and its effect on complementarity with the private sector.

[1] According to Taylor (1994), this would have been a model inspired by an extension of the Harrod-Domar formulation, incorporating the external account due to the necessity of importing capital goods to promote investment in underdeveloped economies.

According to Bacha (1990), the traditional three-gap model is delineated as an exercise in maximizing investment for a highly indebted, and fiscally constrained, developing economy. Considering the national accounts identity $I = (Y - C) + (M - X)$, then, the savings constraint or internal gap (IS)[2] is defined as:

$$IS = S_p^* + (T - G) + (F - J) \tag{1}$$

Then, imports, M, are divided into capital goods, M_k, and other imports, M_0, thus, m is obtained from $M_k = mI$; E^* is understood as the critical value of net exports given by world demand. In this context, we refer to the external constraint or foreign gap (IE):

$$IE = (1/m)[E^* + (F - J)] \tag{2}$$

From the government budget constraint (I_g):

$$I_g = \left(S_p - I_p\right) + (T - G) + (F - J) \tag{3}$$

The fiscal constraint is obtained (IT)[3]:

$$IT = (1 + k^*)\left[f\left(p, h_{ph}\right) + (T - G) + (F - J)\right]) \tag{4}$$

In general, the traditional three-gap model posits the identity:

$$(S - I) + (T - G) = (X - M) \tag{5}$$

[2] It is assumed that the balance of payments $(M - X)$ equals the net capital flow, F, minus the net factor services to abroad, J, resulting in $M - X \equiv F - J$. Private consumption is denoted by C_p, and government consumption by G; domestic income, Y, is the sum of private income, Y_p, plus government gross income, T; finally, S_p^* represents private saving at the potential production level, yielding IS.

[3] By dividing investment into its private and public components, $I = I_g + I_p$, private investment depends on government investment, so its maximum level is$I_p = k^* \cdot I_g$; meanwhile, a function of the inflation rate (p) and the propensity to hoard (h_{ph}) is added.

This foundation will be revisited later as the basis for proposing the political coalitions model, primarily focusing on the fiscal constraint.

2.1. The Balance-of-Payment Constraint Model Tradition

Among demand-driven, post-Keynesian macroeconomic models, we find the theory of the Balance-of-Payments–Constrained Growth Model (BPCGM), promoted by Thirlwall in the 1970s, and later known as Thirlwall's Law. This branch of long-term growth study has become one of the most scrutinized and most applied models among heterodox economists.[4] Its broad theoretical foundations integrate influential outcomes such as Harrod's foreign trade multiplier, Prebisch's center-periphery model, and Chenery's Two-Gap Model (2GM) (Thirlwall 2012; Blecker 2022).

The fundamental theoretical divergence from orthodox thinking is rooted in the explanation of the balance-of-payments adjustment process. In neoclassical thought on growth theory, the long-term relevance of the balance of payments and the increase in demand is considered negligible as it is believed that, in the long run, prices will adjust to ensure that all factors of production are fully utilized, and hence there cannot be a demand-side constraint on growth (Solow 1956).

In this context, Thirlwall's (1979) work emerges, inspired by Kaldor's (1970) four-equation model, which posits that production growth is determined by the growth of exports in a cumulative causation process proposed by Myrdal (1957). In its general form, Thirlwall argues that long-term income growth is equal to the growth rate of export volume, divided by the income elasticity of import demand. In other words, in the long run, no country can grow faster than the equilibrium rate of the balance of payments in the current account.[5]

[4] However, this approach has faced criticisms [Razmi (2011); Ros (2013)], regarding its theoretical logic (the assumption of infinite supply elasticity of exports and the claim that adjustments through relative prices are irrelevant) and empirical evidence (the presence of tautological evidence that almost any economy fulfills as long as the growth rates of exports and imports are comparable). A comprehensive analysis of this issue is undertaken by Blecker (2016).

[5] The neoclassical counterpart is found in the supply-side constraints on factor accumulation and total factor productivity growth (Blecker 2016).

The origins of this proposition are based on three significant contributions, as indicated. Firstly, there is Harrod's foreign trade multiplier, $1/m$, where m represents the marginal propensity to import. However, Thirlwall (2012) points out that Harrod (1939) did not include The Balance-of-Payments–constrained rate of growth in the relationship between the current, warranted, and natural growth rates.

Secondly, the contributions of Prebisch (1950) and the ECLAC tradition stress the importance of the pattern of specialization in shaping the evolution of the terms of trade and the Balance-of-Payments constraint.

Finally, the 2GM developed by Chenery and Bruno (1962)—linked to the Prebisch model—contributes its analysis of exchange rate and savings constraints, where the prevailing scarcity of foreign exchange is crucial for the development process. In a subsequent effort, García-Molina and Ruíz-Tavera (2009) combine the BPCGM with the 2GM, resulting in a unified Dynamic Gap Model.

The integration of these theories allows for a transition toward comprehending Thirlwall's (1979) canonical BCGPM. In this model, two imperfect substitute goods are assumed: a domestic product that can be sold either domestically or exported, and an imported good produced abroad.

Beginning with the balance-of-payments equilibrium condition, where it is assumed that there are no net long-term capital flows or transfers, the following is derived:

$$P_d X = P_f M E \tag{6}$$

Where P_d is the domestic price level, P_f is the foreign price level; E is defined as the nominal exchange rate (in domestic currency per unit of foreign currency), X and M represent the volume of exports and imports, respectively. Now, the demand functions for exports and imports are:

$$X = a\left(\frac{P_d}{P_f E}\right)^{\eta} Z^{\varepsilon} \qquad \eta < 0, \varepsilon > 0 \tag{7}$$

$$M = b\left(\frac{P_f E}{P_d}\right)^{\psi} Y^{\pi} \qquad \psi < 0, \pi > 0 \tag{8}$$

In the above equation, a and b are positive constants; Z represents external income; η and ε denote the price and income elasticities of export demand, respectively; ψ and π, represent the price and income elasticities of import demand, respectively. Now, if we define $P_f E/P_d$ as the real exchange rate (RER), an increase implies a real depreciation of the national currency.

By applying logarithms to expressions (7) and (8), differentiating with respect to time, and substituting into equation (6) to obtain the growth rates—indicated in lowercase—Thirlwall (2012) derives:

$$y_B = \left[(1 + \eta + \psi)\left(p_d - p_f - e\right) + \varepsilon(z)\right]/\pi \tag{9}$$

In the simple version, external income and elasticities are exogenously determined. An important assumption is made that changes in $\left(p_d - p_f - e\right)$ do not affect the long term. If the Marshal-Lerner condition is not satisfied ($\eta + \psi \approx -1$), the expression is canceled out. However, if the condition is satisfied, relative prices do not vary significantly, i.e., $\left(p_d - p_f - e\right) \approx 0$. In either case, the equation transforms into the growth rate with the balance-of-payments equilibrium, known as Thirlwall's Law, which, in terms used by Perraton (2003), is presented in its strong form as follows:

$$y_B^* = \frac{\varepsilon(z)}{\pi} \tag{10}$$

If, in addition, $\left(p_d - p_f - e\right) = 0$, then $x = \varepsilon(z)$, modifying equation (11) in its weak form,

$$y_B^{**} = \frac{x}{\pi} \tag{11}$$

then this model would prove its validity through the contributions of three main tests developed by McGregor and Swales (1985), McCombie (1989), and Alonso (1999). Later, Palley (2003) and Setterfield (2006) would engage in a debate about the endogeneity of the income elasticity of import demand.

However, the model's generalization across multiple sectors and different actors would reveal that, not only does the relationship between the volume of imports and exports matter but so too does what is exported (sectors) and to whom it is targeted (trade among various economies).[6]

A contribution directly linked to the perspective of Latin American structuralism is made by Cimoli and Porcile (2014) and Cimoli, Pereira, and Porcile (2019), who identify that the periphery's growth rate, relative to the center is determined by the ratio between the income elasticities of the demand of their respective bases,

$$y^E = (\varepsilon/\pi)y^C \tag{12}$$

where y^E and y^C represent the growth rates of the periphery and the center, respectively, while ε and π denote the income elasticities of exports and imports. Consequently, there exists a growth rate that fulfills condition (12), preventing a path of external debt.

[6] Nell (2003) disaggregated global income growth rates, accounting for varied income elasticities of export and import demand across trading partners. This showed that the balance of payments constraint could be specific to certain countries rather than applying broadly. Alternatively, Araujo and Lima (2007) and Guovea and Lima (2010) show in their Multisectoral Thirlwall's Law Model (MSTL) how modifying export and import sector composition can boost an economy's growth rate without increasing external income.

A key result is that, to achieve convergence in per capita income between the center and the periphery, the elasticity ratio must satisfy $(\varepsilon/\pi) > 1$, so the periphery can grow more than the center (y^E/y^C). This condition depends on the pattern of specialization in the productive structure, ideally supported by "authentic competitiveness" or based on technological absorption and the development of new capabilities.

The inherent asymmetries between both economies are manifested in the productive and technological gap that determines the elasticity ratio (ε/π), elucidating the periphery's specialization pattern in low-tech export sectors, coupled with a substantial dependence on high-tech imports. Viewed from this standpoint, structural change emerges as a central solution to surmount the disadvantaged position of the periphery (Porcile et al. 2023). This is a determining factor for the three-gap model with sustainable development, presented later.

Furthermore, these contributions are augmented by the research of Dutt (2002) and, subsequently, by Sasaki (2021) through the integration of demand regimes governed by either wages (wage-led) or profits (profit-led). Additionally, Spinola (2020) introduces Goodwin cycles, concentrating on the analysis of productivity gaps in both regions.[7]

Efforts to enhance the BCGPM not only relied on integrating sectors and trading partners but also on additional components of the balance of payments to reconstruct expression (6). According to Thirlwall (2012), this holds true for the capital flow; as in some underdeveloped economies, deficits over extended periods were financed by capital inflows. This led Thirlwall and Hussain (1982) to incorporate the capital flow ($C > 0$).

Nonetheless, the model still had weaknesses, as it did not impose limits on the current account deficit financed by capital inflows, and thus, the level of a country's indebtedness. McCombie and Thirlwall (1997), Moreno-Brid (1998–9), and Barbosa-Filho (2004)

[7] Most recently, Trigg's (2020) extension employs input–output analysis, enabling the examination of the exchange of intermediate goods among any number of economies. This approach yields a general solution for the growth rate constrained by the balance of payments within the framework of a Multinational Sectorial Thirlwall Law Model (MCSTL).

addressed this aspect. Moreover, if the current account deficit is financed through debt, it became necessary to incorporate interest payments, as explored by Elliot and Rhodd (1999); Ferreira and Canuto (2003), Moreno-Brid (2003), Vera (2006), and Alleyne and Francis (2008).

Finally, it is important to note that another fundamental extension revolves around the influence of the Kaldorian tradition, which underpins the mechanism of Myrdal (1957) cumulative causation. In this context, the Verdoorn Law takes center stage in the discussion regarding the rate of growth of labor productivity as a function of the growth rate of output.

The Verdoorn coefficient indicates that the faster the growth rate of output in manufacturing, the faster the growth rate of labor productivity will increase in this sector. While Verdoorn (1949) initially pointed out this relationship in the manufacturing sector, the formalization for aggregate production in cumulative causation was proposed by Dixon and Thirlwall (1975). Later, Thirlwall and Dixon (1979) would find that cumulative causation would not occur in the long term if the balance-of-payments constraint is satisfied, and relative prices remain constant. In this context, the notion of the operationality of the Verdoorn relationship in the equilibrium growth rate with a balance-of-payments constraint would materialize in the medium term, contingent on variations in relative prices (RER).[8]

In conclusion, subsequent contributions to Thirlwall's (1979) canonical model have allowed the development of a comprehensive body of literature, yielding increasingly sophisticated theoretical and empirical insights. In the heterodox context, theoretical discourse has spurred the assimilation of certain fundamental conclusions from this approach into the subject matter of other economic paradigms. The following section introduces the presentation of one of the most recent contributions to the tradition of the BPCGM, through the articulation of ideas from the Latin American structuralist school.

[8] See Blecker and Setterfield (2019). Ribeiro, McCombie, and Lima (2017), who study different scenarios in the short, medium, and long terms, depending on the behavior of productivity and wages.

3. THE THREE-GAP MODEL OF SUSTAINABLE DEVELOPMENT

A Three-Gap Model of Sustainable Development (3GMSD, in which an S for sustainable is added to the “old” three-gap model) has been suggested as ann adaptation of the analysis of ecological macroeconomics, addressing fundamental obstacles to solving climate change within the context of a theory of the divergence of two regions with different patterns of specialization. Ecological macroeconomics, rooted in the post-Keynesian sphere, has focused on studying the economic potential of investment oriented toward "green" capital accumulation. Therefore, the primary obstacle lies in the absence of demand directed toward this objective.

The critical perspective on ecologically unequal exchange (EUE) has facilitated the recognition that prevailing trade patterns still adhere to a global economic hierarchy. According to the extensive analysis conducted by Althouse, Guarini, and Porcile (2020), the observed reductions in emissions, particularly in successful decoupling cases, have been accomplished through the growth associated with the outsourcing of environmentally polluting and resource-intensive activities to developing economies.

In this context, international trade enables technologically advanced central economies to shift environmentally more destructive processes to peripheral production. Therefore, it is crucial to imbue considerations within ecological macroeconomics with a structuralist perspective, avoiding environmental solutions that lead to even more unequal patterns in the global economic structure (Guarini and Porcile 2016).

The most recent contributions of structuralism have focused on the construction of gap models toward a practical proposal for the region and policymakers (Bárcenas 2022). The analytical framework developed by Gramkow and Porcile (2022) to articulate the three dimensions of sustainable development begins by identifying three growth rate types: the maximum rate compatible with external balance, the maximum rate compatible with environmental objectives in the region, and the minimum rate necessary to promote

equitable conditions. In this sense, the differences between these rates create three types of gaps: environmental, social, and economic (ECLAC 2020).

The 3GMSD integrates the three pillars of sustainable development goals by defining a set of variables (ECLAC 2020). The theoretical foundation is grounded in the integration of diverse theories within the post-Keynesian sphere, combining significant concepts in Schumpeterian innovation, technological diffusion, and demand-led Keynesian growth models (Porcile et al. 2023).

3.1. The Growth Rates

First, according to Gramkow and Porcile (2022), the maximum growth rate consistent with the external constraint is determined by equation (12), previously defined. Furthermore, the introduction of the maximum rate aligned with environmental goals in the region is accomplished through the "center-periphery environmental sustainability frontier" (Althouse et al. [2020], ECLAC [2020]; Gramkow and Porcile [2022]), achieved by rewriting the Kaya identity[9] to encompass two regions:

$$y^A = \frac{1}{\alpha}[(z^C - x) + \alpha(z^P - z^C) - (1-\alpha)y^C] \; with \; h = -x \qquad (13)$$

Where $\alpha = \left(\frac{H^P}{H^P + H^C}\right)$ represents the share of emissions from the periphery in the total ($H = H^P + H^C$). The lowercase letters in equation (13) (z, y, x, h) represent growth rates of periphery (P) and the center (C), where z^i is the increase in environmental efficiency or the reduction of emissions per unit of product. The environmental constraint implies the reduction of emissions at a certain rate, supported by research within the scientific field that addresses these needs $(-x)$.

[9] The Kaya identity, introduced by Yoichi Kaya in *Environment, Energy, and Economy: Strategies for Sustainability,* links CO_2 emissions to population, income per capita, energy intensity, and carbon intensity. It highlights that emissions will increase with economic and population growth unless carbon intensity is lowered or energy intensity is reduced (Kaya and Yokobori 1997).

The environmental transition, demanding emission reduction measures and substantial changes in production processes, poses an additional challenge for peripheral economies. The insufficient productive capacity of less-developed economies combines with the need to redirect existing processes toward new green technologies, i.e., green productive capacity. Technological asymmetries could worsen, giving rise to "spurious competitiveness" based on the relocation of highly polluting production phases from the center to peripheral economies.

In this context, the prevailing development style and growth model have created a new "empty slot" in environmental sustainability. Here, higher income is associated with a high environmental footprint, as noted by Samaniego, Sánchez, and Alatorre (2022). The market's historical inability to internalize the environmental costs of production and mass consumption is now evident in accelerated actions and the proliferation of agreements among economies. Due to their asymmetric nature, these agreements have introduced a new environmental gap (ECLAC 2020).

The market has bi-furcated, and the production structure has been oriented toward a transition that involves the presence of capital in green sectors, as opposed to those polluting industries reliant on fossil fuels. Consequently, the cost of learning and adapting to new, less environmentally harmful production techniques has been shouldered by consumption—specifically, the working class.

Thirdly, economic growth linked to structural change correlates with a rise in formal employment, indicating the minimum rate required to foster equitable conditions. Gramkow and Porcile (2022). This statement assumes that growth rooted in genuine competitiveness will result in an expansion of higher-skilled job opportunities, thereby reinforcing the bargaining power of the workforce and, consequently, enhancing the share of wages in total income (σ). Thus, the growth rate necessary for inclusion (y^S) is related to the desired wage share compatible with reducing inequality (σ^S).

The importance of structural change is crucial for this goal. A distinctive feature of peripheral economies is the presence of "structural heterogeneity" which means significant differences in labor productivity within economic structures, resulting in a dual labor market with a large informal sector of workers. Therefore, sustainable development policies involve restructuring production to address this phenomenon.
In their most recent extension, Porcile et al. (2023) incorporate the necessary technological change to drive the convergence of growth rates toward y^S. In their framework, they observe that the formal employment growth rate ($\widehat{N}$) is equal to the growth rate with external restrictions (y^E) minus the long-term labor productivity growth rate (a). In this regard, technological change influences through the increase in labor productivity and, additionally, in the reduction of emissions by introducing new processes.

The distributive conflict emerges as a political and economic determinant for policies aimed at sustainable development based on structural change. Strengthening the bargaining power of workers enables the generation of income that social policy can redistribute (ECLAC 2020).

3.2. The Three Gaps Approach

The discrepancies in the three growth rates (y^E, y^S, y^A) give rise to three gaps of sustainable development:

Social Gap	$(y^S - y^E)$
Enviromental Gap	$(y^E - y^A)$
Sustainable development Gap	$(y^S - y^A)$

Sustainable development occurs if and only if y^E, y^S, y^A, are such that $y^E = y^S = y^A$ in the long run, with y^S being the highest rate. However, unlike y^E, the other two growth rates lack market economic foundations to close such gaps.

The empirical findings of Samaniego, Sánchez, and Alatorre (2022) demonstrated that the current economic structure generates insufficient growth to meet social goals while still

maintaining an excessive environmental footprint in Latin America. It also confirms the enduring constraint on the growth rate due to a specialization pattern, intensifying the region's heavy reliance on trade that is centered around the exploitation of natural resources and their prices, as an attempt to address the significant external constraint posed by the balance of payments.[10]

Now, the overlap between the framework of the traditional three-gap model developed in Section 2 and the 3GMSD is clear, thus raising the question: How does the 3GMSD interact with the traditional three-gap model—the one in which there is a total saving gap, a public savings gap, and a foreign exchange gap? The BPCGM clearly has a direct link with the foreign exchange gap, since the constraint on growth emerges from the inability of the peripheral economy (given its export and import elasticities) to pay for the imports growth demands.

The association with the fiscal gap is also straightforward. Investing in social welfare and green innovations requires high levels of monetary transfers, investments in education and R&D, and investing in the technological and physical infrastructure of the leading sectors in the environmental transition. This investment will put pressure on the fiscal side, especially in economies where the tax burden tends to be low when compared to the rest of the world. The fiscal gap can be seen as emerging from the efforts to close the social and environmental gaps.

What about the total savings gap? In a model of Keynes-Kaleckian inspiration, total savings are endogenously driven by the fiscal and the external gaps. The causality comes from decisions of investment to total savings as the aggregate, macroeconomic result of those decisions. The incentives to invest provided by the fiscal policy, income distribution, and

[10] They indicate that the minimum growth rate necessary to eradicate poverty by 2030 with the current sectoral structure and fiscal policy is 4 percent. If the region maintains its current growth rate until 2030, the social gap would be 1.3 percentage points each year. The environmental boundary suggests that, to maintain the decarbonization rate, the economic growth rate compatible with the unconditional emissions reduction goal is merely 0.1 percent per year. Regarding the growth rate compatible with the external constraint, the elasticity quotient is around unity, being lower for the Caribbean and slightly higher for Mexico and Central America. In essence, the region has the potential to grow at most at the same rate as the rest of the world.

international competitiveness are important. For this reason, it will be considered that the savings gap is not explosive when the external deficit per unit of GDP and the fiscal deficit per unit of GDP are stable.

Within this context, the 3GMSD aims to expand via the political coalition model in the subsequent section, building upon the previously established framework.

4. THE POLITICAL COALITION: IMPLICATIONS OF FINANCING SUSTAINABILITY DEVELOPMENT

In addition to the preceding interaction between the 3GMSD and the 3GM, the models contain key conceptual differences. The first and most obvious is that the social and environmental dimensions are not contemplated in the 3GM, while they are at the core of the 3GMSD. The second difference—closely related to the previous one—is that only the external constraint is binding.

The savings and fiscal gaps are endogenous to the foreign exchange gap, reproducing the assumption embedded in the BPCGM—in which, through different mechanisms, public expenditure and all autonomous expenditures in general must take the values necessary for making equilibrium in the external sector possible. As a result, while the foreign exchange gap tends toward zero (i.e., the external debt to capital ratio or the external debt to exports ratio is stable), the other gaps may remain high or even increase. Environmental and social sustainability may be declining with no spontaneous economic forces in place working to prevent an acute crisis or even catastrophic events from happening. This makes especially important to clarify the role of public spending (especially public investment) in closing the gaps, and the fiscal sustainability of such spending.

In this regard, the current analytical proposal derived from the 3GMSD examines the importance of coalitions among interacting agents by outlining the different pathways generated by their alliance decisions. Within the framework of the ECLAC (2020) 3GM,

the aim is to contribute to the discussion regarding the decisive role in defining the objectives pursued by public expenditure.

The heterodox approach that lays the foundation of the Kaleckian model, inherent to the political relations between the bargaining power of the working class and capitalist interests, is integrated through coalitions that manage to influence public spending and taxation. Thus, the closing of each gap is linked to the alliance interests of different economic actors and their power to impose national interests.

4.1. Simple Model of Coalitions

In this section, we present a highly simplified version of the 3GMSD coalition model with fiscal equilibrium. Following Guarini et al. (2023), we assume three actor types that may form different alliances which shape the value of the parameters of the model and give rise to different growth paths: green actors (G) that focus on the environment, red actors (R) that focus on inclusion and redistribution, and brown capitalist actors (B) whose sole aim is to boost growth. We assume that two actors form an alliance that leaves the other actor out of power. The basis for this assumption is that there are overlapping interests among the three actors, but this overlapping occurs mostly between two of them and not among the three at the same time. For instance, greens and reds may converge because green sectors offer opportunities for better-paid formal jobs, or because the greens support social policies that improve income distribution. Browns and reds may converge around a mutual interest in fostering growth and job creation in "dirty" industries. It may even happen that brown and greens may converge on the need of using the fiscal space for public investments in new technology and infrastructure, as opposed to income redistribution. The kind of coalition that will prevail depends on the productive structure of the economy and its interaction with the political power of the different actors. We assume that these political forces are exogenous and discuss how different alliances shape the parameters of the model.

The combinations considered are three: the GR (green-red) coalition, the GB (green-brown) coalition and the BR (brown-red) coalition. The simplified version of the model assumes no

initial public or external debt but discusses the sustainability in the long run of the stock of debt that emerges from the short-run equilibria.[11]

It is important to note that a fundamental difference between the green-red and brown-red coalitions lies in the divergence concerning the external competitive interest of green and brown capitalists. While brown capitalists anchor their external integration through the price competitiveness of their exports, specifically the impact on wages, green capitalists are interested in non-price competitiveness linked to innovation toward the green transition.

We define below the behavioral functions. For tractability, we will assume they are linear, all expressed as share of GDP, as follows:

$$Z = \theta g \tag{14}$$

$$C = w + j \tag{15}$$

$$I = b_1 + b_2 g + g \tag{16}$$

$$CA = x_f + x(Z, w) \tag{17}$$

$$T = t(1 - Z)(1 - w) + t^f x_f \tag{18}$$

$$S^K = (1 - w)[1 - (1 - Z)t] - t^f x_f \tag{19}$$

$$S^P = t(1 - Z)(1 - w) + t^f x_f - j \tag{20}$$

First, we define green capabilities as the share of renewables in total energy consumption, represented by the variable Z. The government invests a share g of total income to build these capabilities and the impact of public investment on green capabilities depends on a parameter $\theta > 0$, that reflects the strength of the technological basis of the country.

[11] As, McCombie and Thirlwall (1994) and Moreno-Brid (1998-99) have pointed out, the balance of payments constraint can be algebraically associated to a, say, maximum ratio of the trade deficit to GDP or the stock of foreign debt to GDP that is consistent with a long-term rate of expansion of real GDP to be sustained without detonating a balance of payments crisis. As, the vast literature on stock-flow models and the "twin deficits" illustrates [Godley & Cripps (1983); Godley & Lavoie (2007); Caldentey and Rojas (2020); and Mellini & Silva (2022)] this conclusion can be translated to a key related issue: the fiscal budget constraint on long-term economic growth. Indeed, in any balance-of-payments constrained economy, its public sector´s budget deficit or its outstanding stock of public debt as proportions of GDP cannot unboundedly augment without bringing about a fiscal crisis; typically accompanied by a balance-of-payments or foreign exchange crisis.

We take on the usual Kaleckian assumption that workers do not save, and capitalists do not consume (Kalecki 1971). Hence total consumption, $C = (w + j)$, equals workers' consumption, which depends on the wage share w and monetary transfers to informal or subsistence workers (a share j of total income Y)[12]. The role of j is to help reduce the poverty rate and inequality since most empirical studies have shown that many workers (especially informal workers) are below the poverty line in Latin America.

Total investment, I, depends positively on an accelerator ($b_1 Y$), public investment gY, and the stimuli provided by public spending (crowding in effect, $b_1 gY$). As regards the current account, we divide total exports into two groups, namely fossil exports (or more generally carbon-intensive exports), x_f, and other net exports, $x(Z, w)$, where carbon-intensive exports are taxed with a tax t^f which does not affect the international price of the commodity, under the assumption that the periphery is a small country. Other net exports $x(Z, w)$ respond negatively to the wage share, w (which is associated with higher unit labor costs), and positively to green capabilities, Z (which fosters international competitiveness), hence $x_w < 0, x_Z > 0$. Lastly, savings are divided into the private and public components.

Note that private savings are $S^K = (1 - w)[1 - t(1 - Z)] - t^f x_f$ and public savings are $S^G = t(1 - w)(1 - Z) + t^f x_f - j$. Hence, total savings as a share of GDP are $S^T = 1 - w - j$. The short-run macroeconomic equilibrium requires $S^T = I + CA$. Using equations (14–20), we find that:

$$1 - w - j = b_1 + (1 + b_2)g + x^f + x(Z, w) \qquad (21)$$

The GR Scenario

Imagine that an alliance between unions (reds) and the "educated bourgeoisie" (Gatti 2022) concerned with inclusion and the environment (greens) takes office. Both actors recognize

[12] Notation clarification: The lowercase j represents monetary transfers to the informal sector, while the uppercase J in equation (2) refers to net factor services abroad.

that their interests arise from the non-price competitiveness pursued by green capitalists, who define, as a key objective, a certain share of green energy in the total supply of energy, Z^G:

$$Z^G = \theta g^G \tag{22}$$

Where g^G is the required share of public investment in GDP to attain the desired share of renewables in the energy supply. The other members of the coalition, the red actors, define in turn a desired amount of redistribution $j = j^R$ and wage share $w = w^R$.

The government levies a tax over profits from brown energy sources ($t(1 - Z)(1 - w) = t(1 - \theta g^G)(1 - w)$), plus a tax applied on exports of fossils per unit of GDP ($t^f x_f$). We assume that the GR coalition is concerned with fiscal equilibrium, which requires:

$$g^G + j^R = t^*(1 - \theta g^G)(1 - w^R) + t^f x_f \tag{23}$$

Therefore:

$$t^* = \frac{g^G + j^R - t^f x_f}{(1 - \theta g^G)(1 - w^R)} < t^c \tag{24}$$

The parameter t^c is the maximum level of taxes compatible with the ability of the capitalist to evade taxes and send their capital abroad. This limit is understood as a necessary social constraint that enables a politically stable green transition, considering the political aspects of a Kalecki (1943) analysis.

As mentioned, the current account balance per unit of GDP is:

$$CA = x_f + x[\theta(g^G), w^R], x'(\theta) > 0, \theta'(g^G) > 0, x'(w^R) < 0 \tag{25}$$

Where x is the share of net exports in GDP which increases with green capabilities and falls with the labor share (unit labor costs). Z represents green capabilities, which in turn

are a monotonically increasing function of g. Note that as a function of its technological backwardness, it is very likely that $x^n[\theta(g^G, w^R)]$ is negative in a peripheral economy.

If there is budget equilibrium and if g^G, w^R, and j^R are given, it will be true that savings minus investment in the private sector must be equal the current account balance:

$$(1 - w^R)[1 - t^*(1 - \theta g^G)] - t^f x_f = b_1 + b_2 g^G + x_f + x^n[\theta(g^G, w^R)] \quad (26)$$

If g^G is set by the greens, and w^R by the reds, and x_f is exogenous, there is no way of ensuring that the current account will satisfy $x_f + x^n[\theta(g^G, w^R)] = 0$. With a balanced budget ($t = t^*$), since g^G will tend to be high, and w^R will be high too, compromising price competitiveness, it is very likely that the term on the lefthand side of equation (25) is negative, and the current account is in deficit. The external position of the country will deteriorate over time which is unstainable in the long run.

Still, there exists a combination of the parameter θ and the function x that delivers a balanced current account. Since θ is a technological parameter, the possibility of sustaining a high growth path requires: i) a substantial effort in terms of industrial and technological policy (in $\theta = \theta^G$); and ii) that effort translates into a sharp rise of international non-price competitiveness and net exports (the function x should respond strongly to changes in θ and less strongly to w^R).[13]

In sum, a coalition of unionized workers and the educated bourgeoisie should be able to deliver inclusive, sustainable growth only if their preferred policies are supported by rapid innovation in green technologies, those technologies have a positive effect on international, non-price competitiveness, and the tax burden associated with the desired levels of public

[13] The delineation of financing and implications of industrial and technological policy captured by θ, given the expressions and fiscal policy parameters we have presented, is a future line of analysis appropriately recommended by Marwil J. Davila-Fernández during the Seventh International ASTRIL Congress at the University of Roma Tre.

investment plus income redistribution is not so high as to produce a rebellion from the capitalist sector (in terms of political changes or massive capital outflows).

Note, in addition, that a green transition would imply a higher Z (and hence less taxes) and lower exports of brown goods (and hence less foreign exchange and less taxes), reinforcing the fiscal and external vulnerability of the growth path. Finally, the assumption that the public sector remains on the budget constraint can be lifted without loss of generality, in which case the private and public sector may both show a deficit equal to the total deficit in current account.

The GB Scenario

Assume now that the green actors reach the conclusion that the alliance with the reds is rather unstable because of external imbalances and decide to join forces with the not-so-well-educated brown capitalists. It will continue to be true that $g = g^G$, but now the capitalists have power and set the maximum tax burden they are ready to accept at $t = t^B$ and the maximum wage share and redistribution at $w = w^B$.

On the other hand, by expressing the fiscal sustainability of equation (23) with the new parameters, we obtain:

$$g^G + j^* = t^B(1 - \theta g^G)(1 - w^B) + t^f x_f \qquad (27)$$

By solving for j^*, a minimum social threshold j^c is established, allowing for an adequate flow of monetary transfers to preserve political stability without the risk of strikes, as well as for social policy projects.

$$j^* = t^B(1 - Z^G)(1 - w^B) + t^f x_f - g^G > j^c \qquad (28)$$

While equation (25) is still valid, a new equilibrium emerges with much lower social expenditures. Total (public and private) savings are equal to public and private investment plus the current account balance, hence:

$$1 - w^B - j^B = b_1 - (1 + b_2)(1 - \theta g^G) + x_f + x\big(\theta(g^G), w^B\big) \qquad (29)$$

Assume that the private sector is not far from equilibrium in terms of savings and investment expenditures, meaning that the current account deficit will be entirely defined by the budget deficit, which will tend to be very high, because the tax rate will be low and public investment in green technology will be high. Even if the amount of redistribution is low, nevertheless there will be a tendency in this economy toward running a very high fiscal deficit ($t^B\,(1 - \theta g^G)(1 - w^B) + t^f x_f - g^G - j^B < 0$).

This is not a sustainable scenario: as in the previous case, the external sector would be running a deficit that cannot be paid in the long run. To some extent, this could be corrected by the lowering labor costs (i.e., not just by reducing j but also by reducing w). Brown capitalists and green actors will be quite happy, but the social and political environment will be one of instability and mounting tensions if this measure exceeds the minimum value, j^c, required for political stability among workers (which is a fertile ground for populist politicians of all strains).

The RB Scenario

This is a scenario in which brown capitalists and unions agree on that the environment is not a matter of real concern (or that it is the responsibility of someone else) and promote an agenda focused on rapid economic growth based on classical political struggle about the direct dispute regarding price competitiveness. The public investment desired by the capitalists is $g = g^B$ and a maximum tax burden $t = t^B$. It will not be directed at green capabilities, a feature that can be captured in the model by a low $\theta = \theta^B$.

Unions demand a higher wage share captured by $w = w^R$. They may also demand higher redistribution, $j = j^R$, especially if there is no significant cleavage between unionized and non-unionized workers.

In equilibrium:

$$1 - w^R - j^R = b_1 + (1 + b_2)(1 - \theta^B g^B) + x_f + x\big(\theta(g^B), w^R\big) \quad (30)$$

Note that, if green capabilities are important for international competitiveness and the price elasticity of exports is high, then the external sector will run a significant deficit. If capitalists push for a low tax rate, then the adjustment of the fiscal deficit will be done mostly through a reduction in public investment, with further negative consequences for competitiveness and economic growth in the subsequent period. Additionally, the classic bargaining power between brown capitalists and workers arises through the struggle for financing a desired monetary transfer, j^R, through sufficient tax collection, t^B. This represents a growth path heavily dependent, at the end of the day, on x_f, which makes it particularly vulnerable to the cycles of commodity prices and external shocks.

4.2. The Political Economy of Growth Patterns

In general, every actor was associated with a set of parameters oriented toward individual objectives, namely: green actors (g^G, Z^G, θ^G), red actors (w^R, j^R), and brown capitalists ($w^B, j^B, t^B, \theta^B, g^B$). The political economy implied by these coalitions allows for the combination of parameters shaping growth patterns with different outcomes.

First, in the GR coalition, stability depends very much on a high response of exports to non-price competitiveness and a weak response to price competitiveness. The parameter t^C is sensitive to political economy and globalization, which implies that t^* may be too low to ensure a balanced path for the budget deficit. The θ parameter, plays a central role throughout the industrial and technological policy efforts to achieve a desirable structural change for sustainability development. The long-term decreasing tax collection, regarding a lower brown-goods export, will have to be compensated for by a new fiscal policy once the economy can build an inclusive and sustainable growth pattern.

Second, the GB coalition stability depends on a high response of exports to price and non-price competitiveness in order to maintain a sufficient level of j^c to keep stability among the workers, avoiding an excessive reduction in labor costs which may lead to strikes. Fiscal deficits will tend to be high and unsustainable, as long as the brown tax goal and

public investment required of green actors show a growing gap. Moreover, the current account may experience a moderate deficit, and the private sector will tend to show a surplus of savings over investment. Since red actors are out of power, decreasing labor cost could correct the external deficit. Nevertheless, this pressure on workers can lead to social discontent.

Table 1. Political Economy and Patterns of Growth

Coalition	Parameters	Outcomes
GR	$w^R, j^R, g^G, Z^G, \theta^G, t^* < t^c$	Sustainable and inclusive growth.
GB	$w^B, j^B, t^B, g^G, j^* < j^c$	Sustainable but not inclusive growth.
RB	$w^R, j^R, g^B, \theta^B, t^B$	Inclusive but not sustainable.

Source: Own elaboration

Lastly, in RB scenario, stability depends on the demand and price of fossil exports. High deficits in the public sector match with high deficits in current account. The green-red alliance will be recurrently challenged as problems of external competitiveness result in external crises that give rise to a push to compress the wage share.

5. USING THE MODEL: IS A GREEN-RED COALITION VIABLE IN MEXICO?

In this section, we provide an application of the model to the Mexican economy. First, we need to develop an explicit relationship between Z and CO_2 emissions in order to answer the question: What level of Z is consistent with a desired level of emission reduction, CO_2^{obj}? Therefore, we start with Kaya's identity:

$$CO_2 = Y * \frac{E}{Y} * \frac{CO_2}{E} \tag{31}$$

Where, CO_2 is the level of emissions and where E is energy consumption. We can define Z as:

$$Z = \frac{E_r}{E_r + E_f} = \frac{E_r}{E} \tag{32}$$

where E_r and E_f is energy consumption from renewable and fossil sources respectively, therefore $E = E_r + E_f$.

To relate Z and CO_2, we start with the following identity:

$$CO_2 = E_r * e_r + E_f * e_f \tag{33}$$

Where, emissions are equal to energy multiplied by their technical emissions factor. Renewable energy has a zero-emission factor: $e_r = 0$. Thus, the emission levels of an economy could be calculated as a weighted average of the product between energy consumption from source i and its emission factor:

$$CO_2 = \sum E_{fi} * e_{fi} \tag{34}$$

Average emission factor from fossil fuels is:

$$e_f = \frac{CO_2}{E_f} \tag{35}$$

From equation (33) we have:

$$\frac{CO_2}{E} = \frac{E_f * e_f}{E} = (1 - Z) * e_f \tag{36}$$

And

$$CO_2 = E * (1 - Z) * e_f \quad (37)$$

For a target emission level, $CO_2 = CO_2^{obj}$, there is a $Z = Z^{obj}$ defined by:

$$Z^{obj} = 1 - \frac{CO_2^{obj}}{e_f} * \frac{1}{E} \quad (38)$$

Mexico has established in its NDC a reduction in emissions between 35 and 40 percent by 2030. For this exercise, it is assumed that emissions from different sources are reduced by the same amount.

In 2022, $Z = 0.11$ and $CO_2 = 394$ million tons.[14] Using (38[37]) we have:

Table 2. Mexico: GDP, Energy, and Emissions

Variable	Unit	2022	2030
GDP	Billion $2015 dollars	1,285	1,566
Energy	Thousand of Tera Joules	7,768	9,465
Fossil	Thousand of Tera Joules	6,895	
Non-Fossil	Thousand of Tera Joules	873	
CO_2 Emission BAU	Million tons	394	479
Emission target 2030	Million Tons	-	312 (=479*(1-0.35))
Z	Percentage	11	42

Note: GDP and Energy for 2030 is projected to growth by 2.5 percent each year. And CO_2 emissions is projected using Kaya's identity.

Source: Author's calculations and World Development Indicators.

To fulfill Mexico's emission reduction pledges, the share of renewables would need to increase from 11 to 42 percent.

[14] International Energy Agency.

Investment requirements can be estimated using the calculation of costs done by the Mexican government,[15] which found that emission reduction would cost $83 per ton. A 35 percent reduction by 2030 implies a reduction of 167 (=479-312) million tons, at a $83 dollars per ton gives a total investment of $62 billion dollars, from 2023 to 2030 equivalent to, on average, 0.5 percent of GDP per year.

We can estimate the current average tax rate using the identity of government income. In 2022, tax revenues amounted to 13.4 percent of GDP, $t(1-\theta g^G)(1-w^R) = 13.4\%$. and $\theta * g^G = Z = 0.11$. Finally, we use the estimate done by Ibarra and Ros (2019) of the share of wages in GDP $w^R = 0.28$. Thus,

$$t = \frac{0.134}{\left(1-0.11\right)} * \left(1-0.28\right) = 0.21$$

ECLAC (2020) estimated that j^R should be 3 percent of GDP each year to eradicate poverty by 2030 in LAC, we impose that it is the same case in Mexico. Suppose that investment implied by g^G and j^R is additional and, keeping $t^f x_f$ constant, the only way to finance the additional investment without increasing the deficit is by increasing t.

In 2022, Mexico presents a deficit of 3.4 percent of GDP, $t^f * x_f$, estimated by the state's oil revenues, reached 5.2 percent of GDP in the same year.[16] Government income was of 23 percent of GDP, whereas government expenditure amounted to 26 percent of GDP, showing a deficit of 3.4 percent.

Using the differential of equation (23), we have, from the expenses side:

$$\Delta g^G + \Delta j^R = 0.005 + 0.03 = 0.035$$

[15] Sourced from INECC (2018)

[16] Sourced from Sánchez, Calderón & De Jesús (2023)

From the income side:

$$(1 - Z) * (1 - w) * \Delta t - t * (1 - \mathrm{w}) * \Delta Z - t * (1 - Z) * \Delta w + t^f * \Delta x_f + \Delta t^f * x_f$$

with: $\Delta\omega = 0$, $\Delta t^f = 0$ and $\Delta x_f = 0$ and matching the necessary increase in spending, we would have:

$$0.035 = (1 - Z) * (1 - w) * \Delta t - t * (1 - \mathrm{w}) * \Delta Z$$

and, clearing for Δt,

$$\Delta t = \frac{0.035 + 0.21 * (1 - 0.28) * (0.42 - 0.11)}{(1 - 0.11) * (1 - 0.28)} = 0.1277$$

$\Delta t = t^* - t$ is equal to 0.1277:

$$t^* = t + \Delta t = 0.21 + 0.1277 = 0.3377$$

Raising an additional 3.5 percent of GDP to cover new spending requires raising the tax rate from 21 to 34 percent. Such a raise in government revenues would merely place Mexico on par with the OECD´s average. However, needless to say, an increase of 13 points of GDP is politically unthinkable and not feasibly in any short- to medium-term horizon. In fact, for decades, efforts to implement any significant tax reform in the country have been weakened or blocked. The most successful was put in place more than ten years, in the administration of Peña Nieto (2012–18), and managed to raise government revenue a bit less than 3 points of GDP. Looking at it from a complimentary perspective, the figure derived in our simulations—of an acute raise in Mexico´s tax rate—also indicates the nation´s urgent need to increase the rate of economic expansion. We must double it from its currently long-standing average of 2 percent per year to more than 4 percent per year. As the standard formula shows, debt sustainability depends, both on the behavior of the

numerator (net-indebtedness) and of the denominator (the average rate of growth of GDP or national income). For this growth stimulus cum major fiscal reform to take form in Mexico, a new social covenant is needed.

6. CONCLUDING REMARKS

Gaps models are useful tools for discussing economic development as they help to identify key asymmetries and constraints that limit this process. Initially, gap models have focused on the scarcity of savings as the binding constraint to growth, to which were subsequently added the scarcity of foreign exchange and rising fiscal imbalances. However, this view became increasingly insufficient as new challenges emerged for the global economy and, especially, for the periphery. The concept of sustainable development aims to respond to these challenges. It claims that growth must be sustainable not only in economic terms, but also from a social and environmental perspective. Social (with its political implications) and environmental crises represent major threats to development in the long run, beyond the traditional concern with economic growth and capital accumulation.

At the social level, the rise of inequality has already led to a globalization backlash and growing political and geopolitical instability. On the environmental side, besides the alarming signals of the loss of diversity and destruction of the global commons, climate change might potentially give rise to a catastrophic scenario for the planet. As a result, gaps models began to address asymmetries in a much broader sense, to focus on the set of conditions that could place growth on a path consistent with economic, social, and environmental sustainability. It can be said that the concept of sustainable development incorporates key negative externalities of the prevailing growth path that had received much less attention in previous decades.

This paper defined sustainable development using a simple Kaleckian model and discussed different growth paths emerging from the combination of the parameters of the model. A specific combination therein is identified as the necessary condition for having sustainable

development. At the same time, each combination of parameters is the result of a process of bargaining between different actors (the educated bourgeoisie, the brown bourgeoisie, and the workers) with their own objectives, which are, in some cases, contradictory and in other cases complementary. How these actors align their interests and their relative power gives rise to different political coalitions and different growth paths. We claim that a coalition between the educated bourgeoisie and workers may be consistent with sustainable development, as their interests may overlap and reinforce each other, especially when international specialization is based in non-price competitiveness. However, nothing is spontaneous or automatic in the political economy of sustainable development. In particular, growing external and fiscal deficits during the transition to a greener economy may create political and economic tensions which could lead to the dismissal of the alliance between those concerned with the environment and those mainly concerned with equality.

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