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Functional Distribution of Income, Floating Exchange Rates and Inflation Targets in a Macrodynamic Model

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Abstract

This article presents a post-Keynesian macrodynamic model for a small open economy, with floating exchange rates and inflation targeting regime. It models, mathematically, an economy with distributive conflict, technological progress and labor supply as endogenous from different theoretical strands. Moreover, investment decisions are based on the differential between the rate of profit and the interest rate. The effects of opening the capital account on the inflation rate, the interest rate and the employment growth rate depend on the income distribution prevailing in the economy. In the long run, the model presents multiple equilibrium in two different accumulation regimes: 1) *profit led* and 2) *wage led*.

Keywords

Functional Income Distribution, Macroeconomic Policies, Post-Keynesian Macrodynamics

1. Introduction

This article aims to study the influence of monetary and fiscal policies on economic activity and the processes of capital accumulation and functional income distribution in a small open economy. For this, a model of the post-Keynesian theoretical tradition was developed whose prices, in the short term, are rigid; there are distributive conflicts between capitalists and workers; technological progress and the supply of labor are both endogenous; and economic policy is based on the floating exchange rate regime and the inflation targeting system.

The discussion of accumulation regimes as in Rowthorn (1981), Marglin and

Bhaduri (1990), Bhaduri and Marglin (1990), Lima (1999) and Bhaduri (2007) has generally given attention to elements that we could define as structural issues, such as the process of technological innovation, the way in which income is distributed between capitalists and workers, and capital accumulation decisions. However, for the most part, these works do not consider the effects that economic policies can generate on these (and other) variables. An exception is You and Dutt (1996), who discuss the role of fiscal policy in accumulation regimes.

Likewise, the works that seek to analyze the possible impacts of economic policies on the economic system, such as Le Heron (2008), disregard the influence that distributive conflict—and, consequently, the way in which the distribution of income is divided between capitalists and workers—has on these policies. When such an analysis is considered, as in Lima and Setterfield (2014), the interaction between the interest rate and the exchange rate is not addressed in the context of a rule based on inflation targets for the first variable and exchange rate flexibility for the second.

More recently, Porcile, Spinola and Yajima (2021) presented a set of growth and distribution models in developing countries which reflect distinct political economy regimes. These regimes give rise to different institutional frameworks that affect macroeconomic outcomes. They focused on three cases: 1) a pure development a list state, 2) conflicting claims between workers and the government, and 3) financialization under a neoliberal coalition. However, the main focus of the present article is concerning the different claims between workers and capitalists, which can give rise to distinct political economy regimes.

As will be seen later, the interactions that exist among the exchange rate, the monetary policy rule and distributive conflict (the transmission channel) generate a series of overlapping effects that fundamentally condition the short- and long-term behavior of the economic system. One way to understand these interactions is through the change in the domestic interest rate, which depends on an inflation target. Differently, Dvoskin, Feldman and Ianni (2020) examine the transmission channels of the political economy affecting the real exchange rate undervaluation to output growth because productive structure depends on income distribution.

The widening of the difference between domestic and foreign interest rates intensifies the inflow of foreign capital and, consequently, appreciates the exchange rate. This appreciation affects net exports and, through this channel, the degree of utilization of productive capacity, which, in turn, causes distributive conflicts between capitalists and workers. Ultimately, this distributive conflict affects the inflation rate and the functional distribution of income, which engenders changes in the nominal interest rate and the exchange rate. This creates several feedback effects that greatly increase the complexity of the dynamics of the economic system under study.

In addition to this brief introduction, the article is divided into six more sections. In the second section, the structure of the model is presented. Then, in the third section, the short-term equilibrium conditions are established so that, in the fourth section, three exercises of comparative statics are presented to analyze the influence of economic policies on inflation, domestic interest rates, changes in nominal wages and unemployment. In the fifth section, the behavior of the model in the long run is presented based on the following variables: stock of capital-efficient labor supply and share of wages in income. In the sixth section, the analysis of multiple equilibria is performed. Finally, in the seventh and final section, the main conclusions are presented.

2. The Structure of the Model

2.1. The General Structure, the Profit Share and Investment

Consider an open, government-run economy where oligopolistic firms produce a single usable good for both consumption and investment. The production of this good is carried out through only two homogeneous factors of production—labor and capital—through a production technology of fixed coefficients. This can be seen from the following Leontief function:

$$Q = \min\left[L/a; K \cdot u_K\right] \tag{1}$$

where Q: is the level of production, L: is the level of employment, a: is the work-product relationship, K: is the capital stock[1] and u_k: is the potential output-capital ratio ($\bar{Q}/K$).

The adoption of a fixed coefficients function implies that the elasticity of substitution between these two production factors is null, which can be explained by a technological rigidity that makes each production factor unique, at least in the short term[2].

The economy is assumed to operate with excess capital such that it never reaches its potential output, therefore keeping a certain idle margin of its productive capacity[3]. Furthermore, it is assumed that there are no long-term contracts and no costs of firing, hiring and training the workforce. In such a setting, firms demand workers in the exact measure of their needs, dictated by the demand for their product and by the labor-product relationship. The latter is supposed to be constant in the short term.

Therefore, the level of employment can be presented as follows:

$$L = aQ \tag{2}$$

The determination of the price level by oligopolistic firms is made from the application of a *markup rate* on the unit production costs, that is, from the following pricing function[4]:

[1]For simplicity, it is assumed that capital does not depreciate over time.

[2]Several works, such as those by David (1975), Nelson and Winter (1982), Dosi (1984) and Lima (1999), argue that in the short term the production structure tends to be rigid, because technological progress can be characterized by learning gains and/or by specific paths for each firm.

[3]According to Steindl (1952), oligopolistic firms maintain some idle production capacity to provide an effective and credible barrier to entry into the market in which they operate, for technical reasons of divisibility and durability of capital, or to respond to increases in unexpected demand.

$$P = (1 + Z) \cdot W \cdot a \tag{3}$$

where *P*: is the price level, *W*: is the nominal wage and *Z*: is the assumed positive and constant *markup rate*.

The inflation rate is modeled here as depending on the distributive conflict present in society, as the means by which the economic system adjusts *ex post* to distributive demands that were *ex ante incompatible*. More specifically[5], we have:

$$\hat{P} = \rho(\sigma - \sigma_f);\ 0 < \rho < 1 \tag{4}$$

where $\hat{P}$: is the rate of price change $(\mathrm{d}P/\mathrm{d}t)(1/P)$; σ: is the effective salary share; σ_f: is the salary share determined by the desired *markup*; ρ: is a parameter of sensitivity of the price adjustment with respect to the differences between the actual and desired salary share.

The salary share implied by the desired *markup* depends inversely on the degree of use of productive capacity (u), so that the more heated the goods market is, the lower the salary share implied by the desired *markup will be.* Thus, we have:

$$\sigma_f = \phi_0 - \phi_1 \cdot u;\ \phi_0 < 1; \phi_1 < \phi_0 \text{ and } 1 - \phi_0 < \phi_1 \tag{5}$$

where ϕ_0 and ϕ_1 are positive parameters.

The rate of profit in this economy is the product of the share of profits in income and the degree of utilization of productive capacity, as shown below:

$$r = m \cdot u \tag{6}$$

where *r*: is the rate of profit defined as the cash flow of profits divided by the stock of capital valued by the price level of the product.

As in Taylor (1991), the rate of profit in this open economy depends only on the share of profits in income and the degree of utilization of productive capacity.

Defining the share of wages in income (σ) as follows and remembering that the division of income between workers and capitalists must be equal to unity, we have:

$$\sigma = (W/P) \cdot a;\ 0 < \sigma < 1 \tag{7}$$

$$m = 1 - \sigma \tag{8}$$

where *m*: is the share of profits in income.

The capital stock in an efficient labor supply unit is defined as the product of

[4]Arguments for pricing based on a *markup* on primary production costs can be found in Kalecki (1971). Furthermore, the justification for nonmaximizing behavior on the part of firms, that is, for only satisfactory behavior, can be strongly based on the works of Simon (1959, 1980).

[5]This way of modeling the inflation rate through the distributive conflict between capitalists and workers can be better understood if we remember that the labor-product ratio, *a*, is constant in the short run and that there is an inverse relationship between the *markup* and the salary installment (see Equation 7). Therefore, the gap between the *markup* desired by firms and the effective *markup* can be represented by the difference between the effective salary share and the salary share determined by the desired *markup.*

the capital stock with respect to the ratio between the labor-output ratio and the labor supply. As demonstrated below:

$$k \equiv K \cdot (a/N) \tag{9}$$

where k: is the stock of labor supply capital in efficiency units and N: is the labor supply.

The desired investment of firms depends, following Keynes (1936), on the differential between the rate of profit and the rate of interest. In this way, the aim is to capture the opportunity cost of the investment, which will occur only if the rate of profit is higher than the interest rate, that is, if the expected return on the investment is greater than the cost of carrying it out[6]:

$$g^d = \beta \cdot (r - i);\; 0 < \beta < s_C \tag{10}$$

where g^d is the investment rate, β is the average propensity to invest, and i is the interest rate.

Private saving is the share of the capitalists' profit saved and is therefore defined by the Cambridge equation, as follows:

$$g^S = s_C \cdot r;\; 0 < s_C < 1 \tag{11}$$

where g^S: is the private saving rate and s_C is the average propensity to save of capitalists.

Government savings are nothing more than the difference between the volume of taxes and government spending, both in proportion to the capital stock.

$$g^G = T - G \tag{12}$$

where g^G is government savings, T: is the tax burden as a proportion of the capital stock and G: is government spending as a proportion of the capital stock.

2.2. The External Sector, Wage Share and Technological Innovation

Foreign saving rate (g^{NX}) is the difference between imports (M) and exports (X), both as a proportion of the capital stock:

$$g^{NX} = M - X \tag{13}$$

It is also assumed, for simplicity, that the tax burden and government spending are exogenous.

$$G = \overline{G} \tag{14}$$

$$T = \overline{T} \tag{15}$$

Exports and imports as a proportion of the capital stock are assumed in this model to depend on only the nominal exchange rate. Both are duly weighted,

[6]Dutt (1984) and Lima and Meirellles (2003) assume that the investment function depends on the real interest rate as a measure of the cost of financial capital. The formalization of the investment decision through the differential between the profit rate and the interest rate follows the work of Guerberoff and Oreiro (2006) and Carvalho and Oreiro (2008).

respectively, by the coefficients of sensitivity of exports and imports in relation to exchange rate variations, as follows:

$$X = \chi \cdot e;\ 0 < \chi < 1 \tag{16}$$

$$M = -\mu \cdot e;\ 0 < \mu < 1 \tag{17}$$

where e is the exchange rate, χ is a coefficient of sensitivity of exports with respect to changes in the nominal exchange rate, and μ: is a coefficient of sensitivity of imports with respect to changes in the nominal exchange rate.

The nominal exchange rate is an inverse function of the differential between the domestic interest rate and the international interest rate. The difference between interest rates generates an impact on the nominal exchange rate according to the sensitivity parameter θ_1, which can be seen as a parameter that measures the *degree of openness of the capital account*. In particular, if $\theta_1 = 1$, there is a perfect mobility of the capital account in the sense of Mundell (1968) and Fleming (1962). Therefore, it follows that:

$$e = \theta_0 - \theta_1 \left(i - i^*\right) \tag{18}$$

where $\left(i - i^*\right)$: is the differential between the domestic interest rate and the international interest rate; θ_0: is an autonomous (positive) parameter that captures all the variables that affect the nominal exchange rate and that are not explained in the above equation; and θ_1:, as mentioned, is a sensitivity coefficient of ($0 \le \theta_1 \le 1$), the domestic and international interest rate differential.

The inflation targeting regime is formalized in the equation below.[7] Whenever the rate of change in prices (effective inflation rate) is greater than the inflation target established by the monetary authority, the interest rate increases.[8]

Therefore, we have:

$$i = \varphi \cdot \left(\hat{P} - \pi_M\right);\ 0 < \varphi < 1 \tag{19}$$

where $\left(\hat{P} - \pi_M\right)$ is the difference between the effective inflation rate and the inflation ($\hat{P}$) target (π_M), and φ is the monetary policy sensitivity coefficient.

Nominal wages in the short run are fixed, but it is reasonable to assume that in the long run, they will vary according to the degree of production and the bargaining power of workers. Thus, the rate of change in nominal wages depends on the difference between the wage share desired by workers and the actual wage share, as shown in the equation below:

$$\hat{W} = \varepsilon_1 \left(\sigma_W - \sigma\right);\ 0 < \varepsilon_1 < 1 \tag{20}$$

where σ_W: is the wage share desired by workers, σ: is the effective wage share and ε_1: is the sensitivity coefficient of the differential between the desired and

[7]According to Haldane and Salmon (1995: p. 176), a monetary policy rule function formalized in this way presents less freedom of reaction for the action of *policymakers,* since it considers only the observed inflation instead of taking into account the inflation expectations by the central bank.

[8]Here it is assumed that the objective function of the monetary authority is to keep the inflation rate as close to the inflation target as possible and that the only monetary policy instrument available to the Central Bank to achieve this objective is the control of the nominal interest rate.

effective wage share (thus capturing the bargaining power of workers).

The share of wages in the income desired by workers will be higher when the labor market presents the employment rate high. Formally, we have:

$$\sigma_W = \varepsilon_0 \cdot E;\ 0 < \varepsilon_0 < 1 \tag{21}$$

where E: is the employment rate, understood as the fraction of employed workers (L) in relation to the workforce (N), that is, $E \equiv L/N$ and ε_0: is a sensitivity coefficient that measures the increase in the desired wage share when there is an increase in the employment rate.

The employment rate depends on the capital product ratio in efficient labor units and the heating state of the goods market, measured by the degree of utilization of productive capacity. Therefore, we have:

$$E = u \cdot k;\ 0 < E \le 1 \tag{22}$$

Following Keynes (1936), workers decide to supply more work according to the nominal wage growth rate. Thus, the proportional growth rate of the labor force is assumed to be dependent on the growth rate of nominal wages. Indeed, whenever nominal wages rise, there will be a less than proportionate increase in the growth of the labor supply.

$$\hat{N} = \eta \cdot \hat{W};\ 0 < \eta < 1 \tag{23}$$

where $\hat{N}$: is the growth rate of the labor supply $(\mathrm{d}N/\mathrm{d}t)(1/N)$ and η: is a coefficient ($0 < \eta < 1$) that describes the sensitivity of the growth rate of the labor supply to the growth rate of nominal wages.

It is assumed that as the share of wages in income increases and, therefore, as profits in income decrease, capitalists have more incentives to introduce technological innovations as a means of protecting themselves from the decrease of their income in the national product.[9] Indeed, the rate of technological innovation can be modeled as positively depending on the share of wages in income, as shown below.

$$\hat{\Gamma} = \psi \cdot \sigma \tag{24}$$

where $\hat{\Gamma}$: is the labor-saving rate of technological innovation and ψ: is a parameter of sensitivity ($0 < \psi < 1$) of the innovation rate with respect to the wage share.

In the short term, it has been said that the labor-output ratio is fixed; however, in the long term, it will decrease whenever the rate of technological innovation increases. Therefore, we have:

$$\hat{a} = -\psi\sigma \tag{25}$$

where $\hat{a}$: is the growth rate of the labor-output ratio $(\mathrm{d}a/\mathrm{d}t)(1/a)$.

3. The Behavior of the Model in the Short Term

In the short-run equilibrium, the desired investment must be equal to the sum of

[9]Since the capital-output ratio, u_K, is assumed to be constant and the innovation rate is neutral in the Harrod sense.

private, government and foreign savings, that is, that $g^d = g^S + g^G + g^{NX}$. By substituting Equations (10), (11), (12), (13), (14), (15), (16) and (17) into the above equilibrium condition, we have:

$$u^e = \frac{\lambda_0 - \lambda_1 \sigma}{\lambda_2 - \lambda_3 \sigma} \tag{26}$$

where the parameters are defined as follows:

$$\lambda_0 \equiv (\mu + \chi)(\theta_0 + \theta_1 i^* + \theta_1 \varphi \pi_M + \theta_1 \varphi \rho \phi_0) + \beta \varphi (\pi_M + \rho \phi_0) - G^* > 0$$
$$\lambda_1 \equiv \beta \varphi \rho + (\mu + \chi) \theta_1 \varphi \rho > 0$$
$$\lambda_2 \equiv (\mu + \chi) \theta_1 \varphi \rho \phi_1 + (s_C - \beta) + \beta \varphi \rho \phi_1 > 0$$
$$\lambda_3 \equiv s_C - \beta > 0$$

Equation (26) describes the degree of utilization of productive capacity, compatible with short-term equilibrium, as a function of the share of wages in income. It can be seen from it that the degree of utilization starts from a positive intercept λ_0/λ_2. In turn, the shape of the curve for the degree of utilization of productive capacity can be deduced from the equation below.

$$\frac{\partial u^e}{\partial \sigma} = \frac{\lambda_0 \lambda_3 - \lambda_1 \lambda_2}{(\lambda_2 - \lambda_3 \sigma)^2} > 0 \tag{27}$$

The denominator of the partial derivative above is positive for any wage share. The numerator, in turn, will be positive if and only if $\lambda_0 \lambda_3 > \lambda_1 \lambda_2$[10]. Such a condition will have a greater probability of being true if it is assumed, among other possibilities, that the Marshall-Lerner effect is *greater* than *one* and that the differential between the average propensity to save and to invest is *greater* than the product of the sensitivity of the monetary policy with the ability to set prices by capitalists. Furthermore, as the wage share is a number between zero and one and as it is squared, we have that the degree of utilization grows at increasing rates as the share of wages in income rises.

Once the relationship between the degree of utilization and the wage share compatible with short-term equilibrium has been defined, in the next section, a series of comparative statics exercises will be carried out based on the following economic policy variables: 1) government, *G*; 2) inflation target, π_M and 3) degree of openness of the capital account, θ_1.

4. Comparative Static Analysis

This section analyzes the model in terms of the impact of an expansionist fiscal policy on the degree of capacity utilization (Section 4.1) and on key macrovariables also considering an expansionary monetary policy (Section 4.2), via relaxation of the inflation target, and, finally, the opening of the capital account on the inflation rate, the domestic interest rate, the unemployment rate and the nominal wage growth rate.

[10]See the first condition of the Annex at the end of this essay.

4.1. Influence of an Expansionist Fiscal Policy on the Degree of Use

Deriving Equation (26) with respect to government savings as a proportion of the capital stock and remembering that government savings belongs to λ_0 and that $G^* \equiv T - G$, we have:

$$\frac{\partial u^e}{\partial G} = \frac{1}{\lambda_2 - \lambda_3 \sigma} > 0 \tag{28}$$

The effect of government spending on the degree of utilization will be positive if and only if $\lambda_2 > \lambda_3 \sigma$. Such a relationship, as shown in the third condition of Annex I, is always true. It follows, therefore, that an expansionary fiscal policy raises the degree of equilibrium utilization in the magnitude dictated by $\partial u^e / \partial G = 1/\lambda_2 - \lambda_3 \sigma > 0$.

4.2. Influence of the Increase in the Inflation Target on the Degree of Utilization

Since the inflation target belongs only to the parameter λ_0, it follows that the softening of the inflation target, that is, an expansionary monetary policy, causes the degree of utilization to increase according to the equation described below:

$$\frac{\partial u^e}{\partial \pi_M} = \frac{\beta\varphi + (\mu + \chi)\theta_1 \varphi}{\lambda_2 - \lambda_3 \sigma} > 0 \tag{29}$$

Thus, the influence of the inflation target on the degree of capacity utilization will always be positive, and its magnitude will depend on the weights of the propensity to invest, the Marshall-Lerner effect, the degree of openness of the capital account and the sensitivity of the monetary policy to deviations of current inflation from the established inflation target[11]. Indeed, a relaxation of the inflation target established by the monetary authority has the effect of increasing the degree of capacity utilization.

4.3. Influence of Capital Account Opening on Capacity Utilization

As stated earlier, the coefficient θ_1, between zero and one, can be seen as the degree of openness of the capital account. Thus, the closer this coefficient is to 0 (zero), the greater (lesser) the control (openness) over capital flows will be. Conversely, the closer the value of this coefficient is to 1 (one), the greater (smaller) the opening of the capital account (control over capital flows) will be.

Bearing in mind that the capital account opening coefficient belongs to the parameters λ_0, λ_1 and λ_2, it follows that its variation affects both its intercept and its slope, as shown in the following equation:

$$\frac{\partial u^e}{\partial \theta_1} = \frac{\Theta_0 - \Theta_1 \sigma + \Theta_2 \sigma^2}{(\lambda_2 - \lambda_3 \sigma)^2} \tag{30}$$

[11] See the fourth condition in the Annex.

The parameters are defined as follows:

$$\Theta_0 \equiv (\mu+\chi)\left(i^* + \varphi\pi_M + \varphi\rho\phi_0 - \varphi\rho\phi_1\lambda_0\right) > 0$$

$$\Theta_1 \equiv \beta\varphi\rho\lambda_2 + (\mu+\chi)\cdot\lambda_3\left(i^* + \varphi\pi_M + \varphi\rho\phi_0\right) > 0$$

$$\Theta_2 \equiv \beta\varphi\rho\lambda_3 > 0$$

The analysis of these parameters shows that only Θ_0 has an ambiguous signal. However, if we assume, for example, a high Marshall–Lerner effect, then there is a greater probability that $\Theta_0 > 0$. In addition, as the numerator of this partial derivative is quadratic, it follows that for low levels of the wage share, the degree of utilization tends to *decrease* as capital account opening increases. For high levels of wage share, the degree of utilization tends to *increase* with the increase in the share of salaries in income.

4.4. Influence of Economic Policies on Some Key Macrovariables

Aiming to analyze the influences of an expansionary fiscal policy, via an increase in government spending, of an expansionary monetary policy, via relaxation of the inflation target, and, finally, the opening of the capital account on 1) the inflation rate, 2) the domestic interest rate, 3) the unemployment rate and 4) the nominal wage growth rate, it is necessary to first determine the equilibrium values of these variables.

Substituting Equation (5) into Equation (4), it is possible to determine the short-run equilibrium inflation rate:

$$\hat{P} = -\rho(\phi_0 - \sigma) + \rho\phi_1 \cdot u^e \tag{31}$$

Deriving the inflation rate with respect to the degree of equilibrium utilization, we have:

$$\frac{\partial \hat{P}}{\partial u^e} = \rho\phi_1 > 0 \tag{32}$$

The influence of economic policies is then the following:

$$\frac{\partial \hat{P}}{\partial \bar{G}} = \underbrace{\left(\frac{\partial \hat{P}}{\partial u^e}\right)}_{+}\underbrace{\left(\frac{\partial u^e}{\partial \bar{G}}\right)}_{+} > 0 \tag{31-a}$$

$$\frac{\partial \hat{P}}{\partial \pi_M} = \underbrace{\left(\frac{\partial \hat{P}}{\partial u^e}\right)}_{+}\underbrace{\left(\frac{\partial u^e}{\partial \pi_M}\right)}_{+} > 0 \tag{31-b}$$

$$\frac{\partial \hat{P}}{\partial \theta_1} = \underbrace{\left(\frac{\partial \hat{P}}{\partial u^e}\right)}_{+}\underbrace{\left(\frac{\partial u^e}{\partial \theta_1}\right)}_{\pm} < ou > 0 \tag{31-c}$$

Since Equation (32) is positive, the effect of economic policies on the inflation rate will depend on their effect on the degree of capacity utilization, that is, on the level of effective demand in the economy. The partial derivatives above show that both the increase in government spending and the relaxation (increase) of the inflation target provoke the intensification of the inflation rate. In turn, the opening of the capital account has an ambiguous effect on the inflation rate. If most of the economy's income flows to capitalists via profits, then opening the capital account will have the power to reduce the rate of inflation. However, if the opposite occurs, that is, if income flows mostly to workers via wages, then opening the capital account will raise the rate of inflation.

The analysis of the effects of economic policies on the domestic interest rate can be started by substituting Equations (4) and (5) into Equation (19). In doing so, we have:

$$i = \varphi\left(\rho\sigma - \pi_M - \rho\phi_0\right) + \left(\varphi\rho\phi_1\right)u^e \tag{33}$$

The partial derivative of the interest rate with respect to the equilibrium utilization degree is then[12]:

$$\frac{\partial i}{\partial u^e} = \varphi\rho\phi_1 > 0 \tag{34}$$

The effect of monetary policies on the interest rate is then:

$$\frac{\partial i}{\partial \bar{G}} = \underbrace{\left(\frac{\partial i}{\partial u^e}\right)}_{+}\underbrace{\left(\frac{\partial u^e}{\partial \bar{G}}\right)}_{+} > 0 \tag{33-a}$$

$$\frac{\partial i}{\partial \pi_M} = \underbrace{\left(\frac{\partial i}{\partial u^e}\right)}_{+}\underbrace{\left(\frac{\partial u^e}{\partial \pi_M}\right)}_{+} > 0 \tag{33-b}$$

$$\frac{\partial i}{\partial \theta_1} = \underbrace{\left(\frac{\partial i}{\partial u^e}\right)}_{+}\underbrace{\left(\frac{\partial u^e}{\partial \theta_1}\right)}_{\pm} < ou > 0 \tag{33-c}$$

Once again, the effects of government spending and the inflation target are unambiguously determined, and both have a positive relationship with the domestic interest rate. However, the influence of capital account opening is not entirely clear. If the economy has a high-income distribution in favor of workers, then opening the capital account has the effect of raising the interest rate. Conversely, if the economy has a high-income distribution in favor of capitalists, it follows that opening the capital account will have the effect of lowering the domestic interest rate.

The equilibrium rate of change of nominal wages can be determined by substituting Equation (22) into Equation (21) and substituting this substitution into Equation (20). By doing so, we have:

$$\hat{W} = \left(\varepsilon_2 k\right)u^e - \varepsilon_1\sigma;\ \ \varepsilon_2 \equiv \varepsilon_0\varepsilon_1 \tag{35}$$

Deriving Equation (35) with respect to the degree of utilization of the equilibrium capacity, we have the partial derivative shown below:

$$\frac{\partial \hat{W}}{\partial u^e} = \varepsilon_2 k > 0 \tag{36}$$

It follows, therefore, that increasing the degree of capacity utilization raises

[12]For more details, see the fifth condition of the Annex.

the rate of nominal wage growth. Indeed, in this economy, increasing the degree of capacity utilization has the effect of raising real wages if and only if $\varepsilon_2 k > \rho\phi_1$, that is, if the economy has a high bargaining power of workers and a high capital-labor supply ratio in productivity units vis-à-vis the power of capitalists to impose a price level that guarantees them a high share of profits in the income.

Furthermore, the effects of economic policies on the nominal wage rate of change are:

$$\frac{\partial \hat{W}}{\partial \bar{G}} = \underbrace{\left(\frac{\partial \hat{W}}{\partial u^e}\right)}_{+}\underbrace{\left(\frac{\partial u^e}{\partial \bar{G}}\right)}_{+} > 0 \tag{35-a}$$

$$\frac{\partial \hat{W}}{\partial \pi_M} = \underbrace{\left(\frac{\partial \hat{W}}{\partial u^e}\right)}_{+}\underbrace{\left(\frac{\partial u^e}{\partial \pi_M}\right)}_{+} > 0 \tag{35-b}$$

$$\frac{\partial \hat{W}}{\partial \theta_1} = \underbrace{\left(\frac{\partial \hat{W}}{\partial u^e}\right)}_{+}\underbrace{\left(\frac{\partial u^e}{\partial \theta_1}\right)}_{\pm} < ou > 0 \tag{35-c}$$

Thus, it follows that increases in government spending and the inflation target unambiguously raise the nominal wage. In turn, the opening of the capital account will depend on the level of income distribution in force in the economy. If workers receive the greater (less) part of the income, the effect of opening the capital account will be to raise (reduce) the rate of growth of nominal wages.

Finally, the unemployment rate (D) compatible with short-term equilibrium can be obtained by subtracting 1 (one) from Equation (22). After performing this subtraction, we arrive at:

$$D \equiv 1 - E = (1-k)u^e;\ 0 < k < 1 \tag{37}$$

The variation of the unemployment rate in relation to the degree of utilization of productive capacity is:

$$\frac{\partial D}{\partial u^e} = -k < 0 \tag{38}$$

The effects of the economic policies under study on the unemployment rate will be:

$$\frac{\partial D}{\partial \bar{G}} = \underbrace{\left(\frac{\partial D}{\partial u^e}\right)}_{-}\underbrace{\left(\frac{\partial u^e}{\partial \bar{G}}\right)}_{+} < 0 \tag{37-a}$$

$$\frac{\partial D}{\partial \pi_M} = \underbrace{\left(\frac{\partial D}{\partial u^e}\right)}_{-}\underbrace{\left(\frac{\partial u^e}{\partial \pi_M}\right)}_{+} < 0 \tag{37-b}$$

$$\frac{\partial D}{\partial \theta_1} = \underbrace{\left(\frac{\partial D}{\partial u^e}\right)}_{-}\underbrace{\left(\frac{\partial u^e}{\partial \theta_1}\right)}_{\pm} > ou < 0 \tag{37-c}$$

Thus, the increase in government spending as well as the inflation target raises the degree of capacity utilization and, consequently, reduces the unemployment rate. Opening the capital account will increase (reduce) the unemployment rate if income distribution is concentrated in the hands of capitalists (workers).[13]

5. The Behavior of the Model in the Long Term

The dynamics of the economy in the long run are based on changes in the capital stock, in the price level, in the labor-product ratio, in the nominal wage and in the labor supply, with the equilibrium condition always being satisfied through adjustments in the degree of utilization of productive capacity.

One way of monitoring the dynamic behavior of the system is by analyzing the behavior over time of the following state variables: 1) the stock of capital-efficient labor supply, *k*, and 2) the share of wages in income, σ. For this, it is enough to linearize and derive Equations (22) and (7) with respect to time.

$$\hat{k} = \hat{K} - \hat{N} + \hat{a} \tag{39}$$

$$\hat{\sigma} = \hat{W} - \hat{P} + \hat{a} \tag{40}$$

Explaining the parameters and variables that determine the behavior of Equation (39), we have:

$$\hat{k} = \frac{\Omega_0 - \Omega_1\sigma - \Omega_2\sigma^2 - (\Omega_3 - \Omega_4\sigma)k}{\lambda_2 - \lambda_3\sigma} \tag{41}$$

where the above parameters are defined as follows:[14]

$$\Omega_0 \equiv (\varphi\pi_M + \varphi\rho\phi_0 - \psi)\lambda_2 + (1 - \varphi\rho\phi_1)\lambda_0 > 0$$
$$\Omega_1 \equiv -(\eta\varepsilon_1\lambda_2 + \psi\lambda_3) + (\varphi\pi_M\lambda_3 + \varphi\rho\phi_0\lambda_3 + \lambda_1 + \varphi\rho\lambda_2) > 0$$
$$\Omega_2 \equiv -\varphi\rho\lambda_3 + (\lambda_0 + \eta\varepsilon_1\lambda_3) > 0$$
$$\Omega_3 \equiv \eta\varepsilon_2\lambda_0 > 0$$
$$\Omega_4 \equiv \eta\varepsilon_1\lambda_1 > 0$$

All parameter signs except for parameters Ω_3 and Ω_4 are ambiguous. Thus, it is necessary to make some preassumptions regarding the weights of the parameters. In this way, it will be more likely that $\Omega_0 > 0$, $\Omega_1 > 0$ and $\Omega_2 > 0$ if the following assumptions are assumed, as was done: that the ratio between the sensitivity of labor productivity to the share of wages in income, ψ, and the sensitivity of monetary policy, φ, is sufficiently *lower* than the sum of the value of the inflation target and the product of the pricing power of the capitalists, ρ, with the value of the autonomous parameter of the wage share implied by the *markup* desired by the firms, ϕ_0. Furthermore, a high propensity to invest and a high Marshall-Lerner effect contribute to the positive value of these parameters.

Equation (41) describes the rate of change of the capital stock in an efficient

[13]For a more in-depth look at this issue, see the sixth condition of the Annex.

[14]See the seventh condition of the Annex.

labor supply unit. Thus, the functional relationship that describes all combinations of the capital stock in the efficient labor unit and the share of wages in income for which the rate of change of the capital stock is zero are:

$$k = \frac{\Omega_0 - \Omega_1\sigma - \Omega_2\sigma^2}{\Omega_3 - \Omega_4\sigma} \tag{42}$$

Equation (42) above describes the locus $\hat{k} = 0$. By deriving it with respect to the wage share, it is possible to determine the slope of the locus $\hat{k} = 0$, as follows:

$$\frac{\partial k}{\partial \sigma} = \frac{\left(\Omega_0\Omega_4 - \Omega_1\Omega_3\right) - \left(2\Omega_2\Omega_3\right)\sigma + \left(\Omega_2\Omega_4\right)\sigma^2}{\left(\Omega_3 - \Omega_4\sigma\right)^2} \tag{43}$$

The slope of the locus $\hat{k} = 0$ is shown by Equation (43) above. It can be seen from it that the denominator is always positive for any value of the salary portion. The numerator of this equation, in turn, is a quadratic function whose concavity is facing upward. Furthermore, if we suppose that $\Omega_0\Omega_4 > \Omega_1\Omega_3$ and we adopt, just by way of illustration, that the minimum point of this function corresponds to $\sigma = 1/2$, it follows that the locus $\hat{k} = 0$ has a negative slope up to $\sigma = 1/2$, when it then becomes a positive slope.[15]

The growth rate of the wage share can be obtained by explaining the parameters of Equation (40). After doing this, we arrive at the following equation:

$$\hat{\sigma} = \frac{-\Lambda_0 - \Lambda_1\sigma + \Lambda_2\sigma^2 + \left(\Lambda_3 + \Lambda_4\sigma\right)k}{\lambda_2 - \lambda_3\sigma} \tag{44}$$

where the parameters are defined as follows:

$$\Lambda_0 \equiv \rho\phi_1\lambda_0 - \lambda_2\rho\phi_0 > 0$$
$$\Lambda_1 \equiv \rho\phi_0\lambda_3 + \lambda_2\left(\varepsilon_1 + \psi + \rho\right) - \rho\phi_1\lambda_1 > 0$$
$$\Lambda_2 \equiv \left(\varepsilon_1 + \psi + \rho\right)\lambda_3 > 0$$
$$\Lambda_3 \equiv \varepsilon_2\lambda_0 > 0$$
$$\Lambda_4 \equiv \rho\phi_1\lambda_1 > 0$$

Except for the first two parameters defined above, all the others are clearly positive. The parameter Λ_0 is positive since 1) $\phi_1 > \phi_0$, a condition that is necessary to guarantee that the wage share implied by the desired *markup* of the firms is between zero and one, and 2) $(\mu + \chi) > (s_C - \beta)$, since the presence of the Marshall-Lerner effect is assumed and $(s_C - \beta) < 1$.

In turn, the parameter Λ_1 is also positive because parameters ε_1 and ψ are both positive.[16]

The equation describing the locus $\hat{\sigma} = 0$ is therefore:

$$k = \frac{\Lambda_0 + \Lambda_1\sigma - \Lambda_2\sigma^2}{\Lambda_3 + \Lambda_4\sigma} \tag{45}$$

[15]This is because it is assumed that $\Omega_0\Omega_4 > \Omega_1\Omega_3$. For this inequality to be true, it is necessary to suppose that $\varepsilon_0 + \varphi\rho\phi_1 < 1$, $\varphi\rho > \eta\varepsilon_1$ and $(\varphi\rho - \eta\varepsilon_1)\lambda_2 + (1/\varepsilon_0)\lambda_1\lambda_2 > \lambda_0\lambda_3$.

[16]For more details, see the eighth condition of the Annex.

It is easy to see that if the wage share assumes a value equal to zero, we will have a positive intercept. The slope of the locus $\hat{\sigma}=0$ can best be analyzed using the following equation:

$$\frac{\partial k}{\partial \sigma}=\frac{\left(\Lambda_1\Lambda_3-\Lambda_0\Lambda_4\right)-\left(2\Lambda_2\Lambda_3\right)\sigma-\left(\Lambda_2\Lambda_4\right)\sigma^2}{\left(\Lambda_3+\Lambda_4\sigma\right)^2} \tag{46}$$

From Equation (46), we have that the slope of locus $\hat{\sigma}=0$ can vary from positive to negative as the wage share rises. Furthermore, as $\Lambda_1\Lambda_3>\Lambda_0\Lambda_4$, the slope of locus $\hat{\sigma}=0$ will be positive when the wage share tends to zero.[17] By way of illustration, if we suppose that the maximum point of this function occurs exactly when $\sigma=1/2$, then the locus $\hat{\sigma}=0$ will be a symmetrical parabola with the concavity facing downward.[18]

Once the format of the two loci has been defined and remembering that the space (k-σ) is divided by a separatrix that marks the point where the system passes from a region whose growth is driven by profits (*profit-led growth*) to another region whose growth is driven by wages (*wage-led growth*), we can now begin the analysis of the dynamic properties of this system.

6. Multiple Equilibrium Analysis

As we saw earlier, both locus $\hat{k}=0$ and locus $\hat{\sigma}=0$ exhibit nonlinearity. Thus, it is necessary to analyze the conditions for the existence and definition of the nature of the existing equilibrium in space (k-σ). The two-dimensional system can be rewritten as follows:

$$\hat{k}=\left[\beta(1-\sigma)-\beta\varphi\rho\phi_1-\eta\varepsilon_2 k\right]\cdot u^e+\left(\eta\varepsilon_1-\psi-\beta\varphi\rho\right)\sigma+\beta\varphi\left(\pi_M+\rho\phi_0\right) \tag{47}$$

$$\hat{\sigma}=\rho\phi_0-\left(\varepsilon_1+\psi+\rho\right)\sigma+\left(\varepsilon_2 k-\rho\phi_1\right)\cdot u^e \tag{48}$$

Bearing in mind in the subsequent analysis that in the entire economically relevant domain we have $\partial u^e/\partial\sigma>0$ and $\partial u^e/\partial k=0$, it follows that the Jacobian matrix of this nonlinear system is:

$$J_{11}=\frac{\partial\hat{k}}{\partial k}=-\eta\varepsilon_2 u^e<0 \tag{49}$$

$$J_{12}=\frac{\partial\hat{k}}{\partial\sigma}=\eta\varepsilon_1-\left[\left(\beta u^e+\psi+\beta\varphi\rho\right)+\left(\beta\varphi\rho\phi_1+\eta\varepsilon_2 k\right)\frac{\partial u^e}{\partial\sigma}\right]<0 \tag{50}$$

$$J_{21}=\frac{\partial\hat{\sigma}}{\partial k}=\varepsilon_2 u^e>0 \tag{51}$$

$$J_{22}=\frac{\partial\hat{\sigma}}{\partial\sigma}=\left(\varepsilon_2 k-\rho\phi_1\right)\frac{\partial u^e}{\partial\sigma}-\left(\varepsilon_1+\psi+\rho\right)>ou<0 \tag{52}$$

The first element of this Jacobian matrix is clearly *negative*, since all its parameters and the degree of equilibrium utilization have positive values. The second

[17]Since it is assumed that $\phi_0\lambda_3+\phi_0^2\lambda_2+\varepsilon_2\left(\varepsilon_1+\psi+\rho\right)\left(\lambda_2/\lambda_1\right)>\varphi_1\lambda_1+\phi_1^2\lambda_0$.

[18]The condition for the locus maximum point to $\hat{\sigma}=0$ match $\sigma=1/2$ is $\Lambda_1\Lambda_3+0.25\cdot\Lambda_2\Lambda_4=\Lambda_2\Lambda_3+\Lambda_0\Lambda_4$.

element, in turn, initially presents an ambiguous signal. However, as long as the following inequality is true, $\beta u^e + \psi + \beta\varphi\rho > \eta\varepsilon_1$, that is, as long as one assumes, among other possibilities, a high combination between the marginal propensity to invest and the intensity of the effect of technological innovation in relation to the growth rate of labor supply and the bargaining power of workers, it follows that the element J_{12} will be *negative* for each and every level of the wage share.

The third element is clearly *positive* for any value of the capital stock in units of efficient labor supply. Finally, the fourth element has an ambiguous sign. If we assume that $\varepsilon_2 k > \rho\phi_1$, that is, that the bargaining power of workers as well as the stock of capital in efficient labor units are both high relative to the power of capitalists to impose prices, then there is the possibility of changing the sign of this element of the Jacobian matrix. Otherwise, the element J_{22} would have a negative sign for both regions under study.

The shape of the productive capacity utilization curve ensures that the slope is very low but positive when the wage share is small (PL region). Indeed, it is reasonable to assume that in this region, when the wage share is between zero and a half, the element J_{22} has a *negative* sign. Conversely, in the WL region, when the share of wages in income is high, the slope of the degree of utilization is very high. Thus, it can be said that in this region, when the wage share is between half and one, the element J_{22} will be *positive*.

In this way, stability in both regions will be governed by the following matrices of differential equations.

$$J_{PL} = \begin{vmatrix} J_{11} < 0 & J_{12} < 0 \\ J_{21} > 0 & J_{22} < 0 \end{vmatrix} \tag{53}$$

$$J_{WL} = \begin{vmatrix} J_{11} < 0 & J_{12} < 0 \\ J_{21} > 0 & J_{22} > 0 \end{vmatrix} \tag{54}$$

It can be seen that in the region whose wage share is between zero and a half ($0 < \sigma^* < 1/2$), region PL, we have that the trace of this matrix is clearly negative, $Tr|J_{PL}| < 0$, and its determinant is undoubtedly positive, $Det|J_{PL}| > 0$, which denotes that the equilibrium point E_1 presents *stable dynamics characterized by damped spirals*.

In the WL region, whose share of wages in income is between half and one ($1/2 < \sigma^{**} < 1$), we have that the trace of this matrix can be positive or negative. Thus, if J_{22} is greater than J_{11}, the trace of this matrix will be positive. If J_{22} is less than J_{11}, then the trace will be negative $Tr|J_{WL}| < 0$. The determinant, in turn, also apparently presents ambiguous signs. However, a more detailed analysis[19] tells us that $J_{11}J_{22} > J_{12}J_{21}$; therefore, the determinant of the Jacobian matrix will be negative, $Det|J_{WL}| < 0$.

Thus, if the supposed difference between the product of workers' bargaining power and the capital-supply ratio of efficient labor with respect to the power to impose prices by capitalists is sufficiently large, then $J_{11} < J_{22}$ and the Jacobian matrix trace will be positive, which implies an unstable saddle point equilibrium

[19]See the ninth condition of the Annex.

in this region. If the opposite occurs, the matrix trace in this region will be negative, and the point E_2 will not show equilibrium. It is interesting to note that the difference between the bargaining power of workers vis-à-vis that of capitalists is the determining factor to guarantee an unstable equilibrium or not in this region, whose dynamics are strongly influenced by the greater distribution of income in favor of workers.

Having analyzed above all the possibilities of equilibrium (and its absence) in the two regions under study, we saw that the PL region presents as the only possibility the existence of a stable equilibrium around E_1. In the WL region, in turn, it was found that there are two possibilities: the existence of a complete absence of equilibrium and the existence of an unstable saddle point equilibrium.

Figure 1 shows a system with two equilibria, E_1 and E_2, each in one of the two regions defined above, the *profit-led* (PL) and *wage-led* (WL) regions. In the PL (WL) region, whose income mostly flows to capitalists (workers), a stable equilibrium characterized by damped spirals (unstable saddle point type) is shown.

First, one can notice a subset in the phase space in which the economy will not leave if it is in it. This subset will be called the stability zone and its complement the instability zone. Both zones are divided by the trajectory that leaves Point A, referring to the saddle point unstable equilibrium. Second, if the economy is in the stable zone, for example, at Point B, its trajectory will take the form of smoothed cyclic fluctuations until it settles into the stable focus E_1. Thus, if the system suffers small shocks, in such a way that the loci positions are not too disturbed, the system will be able to present endogenous and self-sustained fluctuations in its main variables.

7. Conclusion

This article developed a macrodynamic model with the objective of studying the influence of monetary and fiscal policies on economic activity, capital accumulation and the functional distribution of income. The main characteristics of this model of the post-Keynesian theoretical tradition are 1) the existence of distributive conflicts between capitalists and workers, 2) endogenous technological progress and labor supply, and 3) economic policy based on the floating exchange rate regime and the inflation targeting system.

The effects of opening the capital account on the inflation rate, the interest rate and the employment growth rate proved to be quite sensitive to the income distribution prevailing in the economy. If income flows mostly to capitalists, we have that the increase in the capital account reduces (raises) these three variables. Conversely, if workers receive most of the economy's income, it follows that the increase in the capital account raises (reduces) the variables in question. Finally, we have seen that for a low (high) wage share, an increase in the opening of the capital account can reduce (raise) unemployment.

The long-term analysis showed that the locus $\hat{k} = 0$ will be a parabola with the concavity facing upward, provided that the parameters that govern the

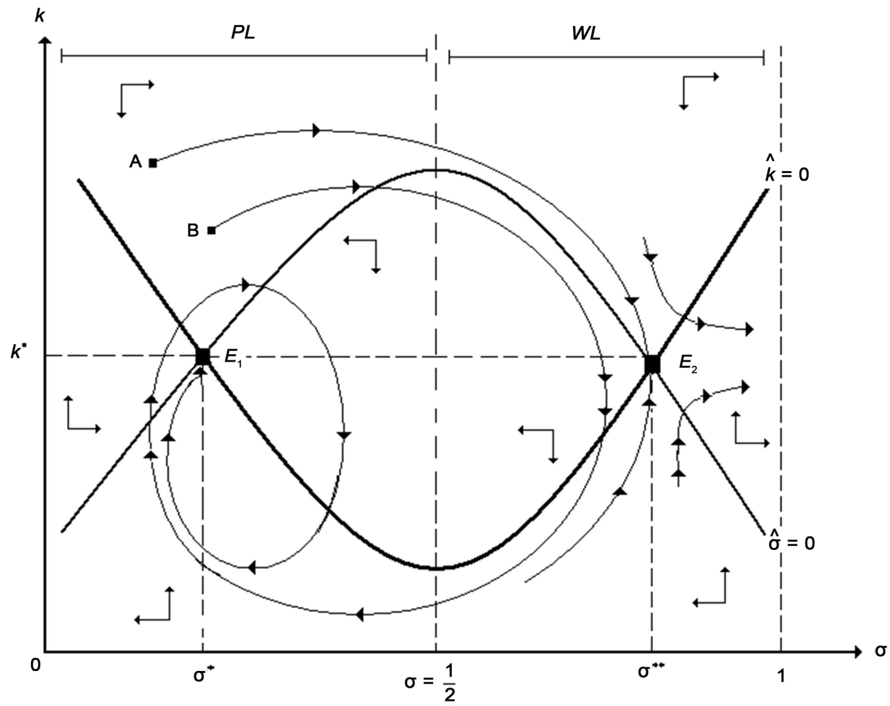

Figure 1. Multiple equilibrium (*k*-*σ*). Source: Authors' own.

nominal exchange rate and that define the average propensity to invest are assumed to be relatively high vis-à-vis the power of capitalists to impose prices. With respect to the locus $\hat{\sigma} = 0$, this is also a parabola, but with the concavity facing downward. By way of illustration, the economically relevant region was divided by a separatrix that cut the loci at their minimum or maximum points. In the first region, whose accumulation regime is of the *profit-led type*, the existence of a stable equilibrium characterized by damped spirals was shown, and in the second region, whose accumulation regime is of the *wage-led type*, the possibility of the existence of unstable saddle point equilibrium was shown. The system shows that there is a critical level of the wage share that, when exceeded, has the potential to destabilize the economic system.

As demonstrated in this article, an expansionary fiscal (or monetary) policy has the potential to raise the capital-supply ratio of efficient labor while keeping the share of wages in income relatively stable. In other words, a policy of this nature can generate an increase in economic growth with stability in the functional distribution of income.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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Annex

► **FIRST CONDITION:** The intercept will assume values less than one if and only if $\lambda_0 < \lambda_1$. The condition for this inequality to be true is:

1) $\lambda_0 < \lambda_1 \Leftrightarrow \frac{\theta_0}{\theta_1} + i^* + 2\varphi\pi_M + 2\varphi\rho\phi_0 < 2\varphi\rho\phi_1 + \frac{s_C - \beta}{\beta}$. This will be true if:

a) $s_C > 2\beta$;

b) $\phi_1 > \phi_0$;

c) $\theta_1 > \theta_0$.

► **SECOND CONDITION:** The condition for the equilibrium utilization degree curve with respect to the wage share to increase is that $\lambda_0\lambda_3 > \lambda_1\lambda_2$. For this to be true, it is necessary that

1) $A + B > C$, where:

$$A \equiv (\beta/\rho)\pi_M + \beta\phi_0 + (G^*/\varphi\rho) + \beta\theta_1\varphi\rho\phi_1$$

$$B \equiv \left[(s_C - \beta)/\rho\varphi\right]\cdot\left(\theta_0 + \theta_1 i^* + \theta_1\varphi\pi_M + \theta_1\rho\phi_0\right) + \beta\theta_1 + 2\varphi\rho\phi + (\mu + \chi)$$

$$C \equiv 2 + \theta_1\phi_1 + \varphi\rho\phi_1$$

This condition is satisfied, since it is assumed that:

a) $(s_C - \beta) > \rho\varphi$;

b) $(\mu + \chi) > 1$.

► **THIRD CONDITION:** The condition for government spending to have a direct influence on the degree of utilization of productive capacity, that is, for which $\partial u^e/\partial G > 0$, is that $\lambda_2 > \lambda_3\sigma$, which implies the following condition: $\frac{1 + \sigma + \beta\varphi\rho\phi_1 + (\mu + \chi)(\theta_1\varphi\rho\phi_1)}{1 + \sigma} > s_C$. It is easy to see that this condition is always true, since the expression on the left is clearly greater than one.

Proposition 1: The increase in government spending will increase the degree of utilization of productive capacity for any and all parameter values, as long as they are nonnegative and the marginal propensity to save is between zero and one.

► **FOURTH CONDITION:** The effect of the relaxation (increase) of the inflation target on the degree of equilibrium utilization is positive and occurs according to the following partial derivative: $\frac{\partial u^e}{\partial \pi_M} = \frac{\beta\varphi + (\mu + \chi)\theta_1\varphi}{\lambda_2 - \lambda_3\sigma} > 0$. As in the third condition, the denominator of this derivative is clearly positive, so that the relaxation of the inflation target unambiguously affects the degree of utilization of productive capacity.

Proposition 2: There is a direct relationship between the degree of utilization of productive capacity and the inflation target, which tends to be higher the greater the share of wages in income.

Proposition 3: The increase (relaxation) of the inflation target will have a greater influence on the degree of utilization of productive capacity vis-à-vis the increase in government spending on this same variable if and only if $\beta\varphi + (\mu + \chi)\theta_1\varphi > 1$.

► **FIFTH CONDITION:** The influence of the degree of utilization on the inflation rate is greater than on the interest rate, since:

$$\frac{\partial \hat{P}}{\partial u^e} = \rho\phi_1 > \frac{\partial i}{\partial u^e} = \varphi\rho\phi_1 > 0;\quad \forall(0<\varphi<1).$$

Proposition 4: The effect of the degree of utilization on the equilibrium inflation rate is always greater than the effect of the degree of utilization on the domestic interest rate, except for the situation in which the monetary policy reaction coefficient with respect to deviations between current inflation and the inflation target is equal to one ($\varphi=1$).

► **SIXTH CONDITION:** The rate of change of the real salary is defined by $\frac{\partial \hat{V}}{\partial u^e} = \frac{\partial \hat{W}}{\partial u^e} - \frac{\partial \hat{P}}{\partial u^e}$, where $V \equiv W/P$. It appears that the real wage will increase as a result of the increase in the degree of utilization of productive capacity if and only if $\varepsilon_2 k > \rho\phi_1$.

Proposition 5: If the product of the parameters that measure the bargaining power of workers and the capital-efficient labor supply ratio is greater than the product of the parameters that measure the pricing power of capitalists, it follows that the increase in the degree of utilization of productive capacity will always raise the real wage.

► **SEVENTH CONDITION:** The signal conditions of the parameters that form Equation (41) are:

1) $\Omega_0 > 0 \Leftrightarrow (\varphi\pi_M + \varphi\rho\phi_0 - \psi)\lambda_2 + (1-\varphi\rho\phi_1)\lambda_0 > 0$

It follows, therefore, that this inequality will be true if:

1) $\pi_M + \rho\phi_0 > \psi/\varphi$;

a) $\rho\varphi\phi_1 < 1$

2) $\Omega_1 > 0 \Leftrightarrow \varphi\pi_M\lambda_3 + \varphi\rho\phi_0\lambda_3 + \lambda_1 + \varphi\rho\lambda_2 > \eta\varepsilon_1\lambda_2 + \psi\lambda_3$

Thus, this condition will be true if, for example:

a) $\lambda_1 + \varphi(\rho + \pi_M + \phi_0) > \eta\varepsilon_1 + \psi$

3) $\Omega_2 > 0 \Leftrightarrow \eta\varepsilon_1(s_C - \beta) + \lambda_0 > \varphi\rho(s_C - \beta)$.

It follows that this condition will be true if and only if:

a) $\frac{\lambda_0}{s_c - \beta} + \eta\varepsilon_1 > \rho\varphi$, which is supposed to be true

► **EIGHTH CONDITION:** The parametric conditions for the growth rate of the wage share over time to be as specified in Equation (44) are as follows:

1) $\Lambda_0 > 0 \Leftrightarrow \lambda_0\phi_1 > \lambda_2\phi_0$

The above condition is true because:

1) $\phi_1(\mu+\chi)(\theta_0 + \theta_1 i^* + \theta_1\varphi\pi_M) + \beta\varphi\pi_M > \phi_0(s_C - \beta)$

2) $\begin{matrix}(\mu+\chi)(\varepsilon_1+\psi+\rho)(\theta_1\varphi\rho\phi_1)+(\beta\varphi\rho\phi_1)(\varepsilon_1+\psi+\rho)\\ +(\rho\phi_0+\varepsilon_1+\psi+\rho)(s_C-\beta) > (\mu+\chi)(\rho^2\phi_1\theta_1\varphi)+\beta\varphi\rho^2\phi_1\end{matrix}$. This is true since $\varepsilon_1 + \psi > 0$.

► **NINTH CONDITION:** The condition for the determinant of the Jacobian matrix, referring to the PL region, to be less than zero is:

1) $Det|J_{WL}| < 0 \Leftrightarrow J_{11}J_{22} > J_{12}J_{21}$

The above condition is accepted without additional assumptions since:

1) $\left(\psi+\rho\right)\left(1+\eta\right)+\beta\left(1+u^{e}\right)+\rho\phi_{1}\left(1+\beta\varphi\right)\underbrace{\frac{\partial u^{e}}{\partial\sigma}}_{+}>0$

Proposition 6: If the bargaining power of workers, weighted by the capital-supply ratio of efficient labor, is greater than the power to impose prices on the part of capitalists, the system will present an unstable equilibrium when the distribution of income flows in mostly for the workers.