FISCAL POLICY, INFLATION, AND INTEREST RATES: correlation and impacts of agents' intertemporal choice.

ABSTRACT

Economic policy instruments are conventionally organized into two main areas: fiscal policy and monetary policy. The first, under the responsibility of the Executive Branch, operates through taxation and public spending, conditioned by the budgetary process and legislative approval. The second is largely conducted by central banks – often endowed with institutional autonomy and explicit mandates – and involves not only liquidity control but, above all, the definition of the interest rate as an instrument for stabilizing inflation and the level of economic activity. This article focuses on fiscal policy, examining its effects on the dynamics of aggregate demand and inflation. It also analyzes the interaction between labor productivity, intertemporal decisions of economic agents, and the determination of the interest rate. From an empirical point of view, it investigates the correlation between interest rates and inflation using Pearson's coefficient. Finally, the work critically discusses the sometimes divergent interpretations of the Keynesian and New Keynesian traditions regarding these relationships.

Keywords: Fiscal Policy; Inflation; Interest Rates; Intertemporal Choice: Correlation.
JEL Classification: C10; E12; E31; E43; E62

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1.Introduction

The relationship between fiscal policy, consumers' intertemporal choice, inflation, and the interest rate is very close. Inflation and the interest rate are both cause and effect within this complex web of relationships, which becomes even more intricate once the implications of income and substitution effects on aggregate consumption are

added. To better contextualize the issue within the Brazilian economy, it is worth noting that during the six decades preceding the Real Plan, Brazil consistently lived with the problem of large positive price variation. Immediately after the 1929 crisis, the resulting depression caused deflation that lasted until 1933. From 1934 onward, however, prices began to rise again, reaching 9.4% in 1937 and entering double digits for most of the 1940s (with a peak of 20.6% in 1944), remaining high throughout the 1950s (peaking at 39.4% in 1959) and the 1960s (peaking at 92.1% in 1964).

The economic policy of the military regime (1964–1985) was based on external saving, that is, on indebtedness, which deteriorated the balance of payments and began to exert pressure on inflation. During the 1970s, structural changes took place in the world economy. Keynesian-oriented policies, based on expanding aggregate demand through public investment as an inducement to private investment, no longer responded to the economic challenges of the time after thirty years of robust growth. In reaction to U.S. support for Israel in the Yom Kippur War in 1973, the Organization of Petroleum Exporting Countries (OPEC) tripled the price of a barrel of oil. Brazil, which imported 80% of the oil it consumed, saw its trade balance thrown off balance.

On November 4, 1972, through Law No. 5,727, the government launched the First National Development Plan (I PND). The political context was one of war against democracy, which the military identified as a gateway to communism. Thus, everything associated with income distribution, support for the working class, and social protection policies in general was abhorred by the regime. The I PND was a plan for economic growth, not for development. Its measures aimed to accelerate capital accumulation through wage compression, since wages were treated as costs, very much in line with the intrinsic content of Say's Law. In the sphere of production, therefore, the incentive was directed toward durable consumer goods. This set of measures deepened the exclusion of the majority of the population from the so-called "Brazilian Miracle," which began in 1968 and lasted until 1973.

The situation of Brazilian workers worsened during this period due to the combination of rising inflation and lack of wage adjustment, which led to rapid devaluation of real wages. Meanwhile, at the other end of the social structure, wealth accumulated in extraordinary fashion. Inflation stood at 19.3% in 1970. In 1979, after the second oil shock, it reached 77.3% (the average inflation rate for the decade was 34% per month), paving the way for the hyperinflation of the following decade, which went down in history as the "lost decade."

The second oil shock exposed the fragility of the military regime's growth model, based on external saving. With the rise in international interest rates, the country's foreign debt exploded. Public debt as a whole increased sharply. The Second National Development Plan (II PND), launched in 1975 to complete Brazil's industrialization process, focused on energy, basic industrial inputs such as steel, aluminum, and oil, as well as capital goods. Its underlying objective was to expand exports in order to improve the balance of payments and cope with the growing debt. Although it had a positive impact on the maturation of the country's industrial process, it failed to reverse years of economic policy based on indebtedness. The result was that,

in the 1980s, inflation soared alongside economic stagnation, the worst possible scenario for any economy.

During the 1980s and the first half of the 1990s, the country went through several stabilization plans (Cruzado, 1986; Bresser, 1987; Verão, 1989; Collor, 1990), but in 1989 inflation reached 1,982.91% per year. This worsened social inequality in the country, while the contraction of investment resulting from uncertainty about the future increased unemployment. Meanwhile, the IMF dictated increasingly austere policies, aggravating the problem.

Between the mid-1970s and the mid-1990s, the Brazilian economy went through periods of slowdown and even continued recession, with high unemployment and wages losing value at rates approaching 100% per month. This increased monetary issuance, feeding the inflationary process and producing severe consequences in many aspects of Brazilian life, compounded by regressive taxation consolidated by the 1965–1966 tax reform (Lourenço Filho, 2025).

At the macro level, public accounts were suffocated by foreign debt, and the only feasible investment was financed by foreign firms. The measures taken by the government at the end of the II PND, in 1979, included currency devaluation to stimulate exports on the one hand, and the reduction of the population's purchasing power (restricting the domestic market) so that production would be directed mainly toward foreign markets (breaking the capital cycle) on the other, thereby aggravating the social crisis.

During this period, even though labor income remained fixed due to institutionally imposed wage rigidity, workers lost purchasing power because of the worsening inflationary process (income effect), which was accompanied by a substitution effect, with increased consumption of inferior goods.

2. The Importance of Monetary Stability for Fiscal Policy

With the Real Plan in 1994, inflation was brought under control, but the fixed exchange-rate policy adopted by the Fernando Henrique Cardoso administration led to a currency crisis and the sharp devaluation of the real in 1999. The Plan succeeded in defeating inflation, but everything has a cost. As the title of a collection of articles by Milton Friedman puts it, "There's No Such Thing as a Free Lunch" (FRIEDMAN, 1975). The architecture of the Plan, based on measures aimed at disinflation through recession, with high interest rates and low public investment, together with an almost fixed and overvalued exchange rate, undermined the export sector and worsened balance-of-payments problems. Inflation began to return and, in 2002, ended the year at around 12%, influenced by the rapid rise of the U.S. dollar. GDP growth only returned to an average level of 4% per year in the period from 2004 to 2011.

During this period, especially in the 2007–2011 subperiod (with average annual growth of 4.6%), the role of public investment in the growth of aggregate demand was decisive. This, in turn, influenced intertemporal consumption decisions.

With inflation under control and interest rates at a bearable level, it became possible to give up future consumption in exchange for present consumption. And this

intertemporal choice was made by millions of Brazilians, which helps explain the increase in demand during the period mentioned.

2.1 Effects of Intertemporal Preference on Fiscal Policy

In economics as theory, agents' consumption decisions affect overall economic activity, regardless of the time horizon considered (whether short or long run). Thus, the decision regarding what part of income will be consumed today and what part will be saved for future consumption is fundamental for defining certain macroeconomic indicators, such as the interest rate. In neoclassical analysis, the mediation between nominal and real interest rates is made by the inflation rate. Keynesian thought also considers price variation, but adds other determinants.

In the short run, the decision to consume in the present is fundamental in establishing a given level of aggregate demand. In the long run, the decision to save affects investment and the growth of future consumption. It represents how much a generation intends to set aside for its own future consumption and for the consumption of future generations. Revisiting the original Keynesian consumption function, we have:

$$\mathbf{C = a + bY_d}$$

Where **a** is autonomous consumption, **b** is the marginal propensity to consume, and **Yd** is disposable income. If autonomous consumption is disregarded, the average propensity to consume is the ratio between total consumption (**C**) and disposable income (**Yd**). Yet, in this model, as income rises, consumption falls proportionally, since the excess income is assumed to go into saving. This identity was heavily criticized from the moment *The General Theory* was published (KEYNES, 1996 [1936]), and post-Keynesian economists, based on empirical observations of the postwar economy, have found that income grew without a corresponding explosion in the propensity to save (DAVIDSON, 1996). That said, let us return to intertemporal choice.

The Keynesian consumption function is extremely simple. It relates disposable income to present consumption. But individuals may, by their own choice, save today in order to consume and/or invest in the future. The variable operating across both periods is the budget constraint, since it is intertemporal: it limits consumption today and will also limit consumption in the future. The interest rate, in turn, influences saving and investment decisions.

Irving Fisher's model (FISHER, 2012 [1930]) filled this gap. It shows how a supposedly rational consumer (a condition of the model) makes consumption decisions across different periods ($\mathbf{t_1}$ and $\mathbf{t_2}$). The budget constraint is intertemporal. Saving in period $\mathbf{t_1}$ is income minus consumption in that period. If the consumer spends more than income allows, borrowing becomes necessary, implying negative saving, which reduces consumption in period $\mathbf{t_2}$. If the consumer spends less than income in period $\mathbf{t_1}$, there is positive saving, equal to the amount saved times the real interest rate of the period. This is why the budget constraint operates across both periods, and the interest rate is the link between them.

The equation below shows the relationship between consumption in periods $\mathbf{t_1}$ and $\mathbf{t_2}$ and disposable income in those same periods. It demonstrates that the budget constraint is intertemporal through the relationship between present and future consumption and present and future income:

$$(1 + r)\, C_1 + C_2 = (1 + r)\, Y_1 + Y_2 \quad [1]$$

Rearranging equation 1 and dividing both sides by **(1 + r)**, we obtain:

$$C_1 + \frac{C2}{1+r} = Y1 + \frac{Y2}{1+r} \quad [2]$$

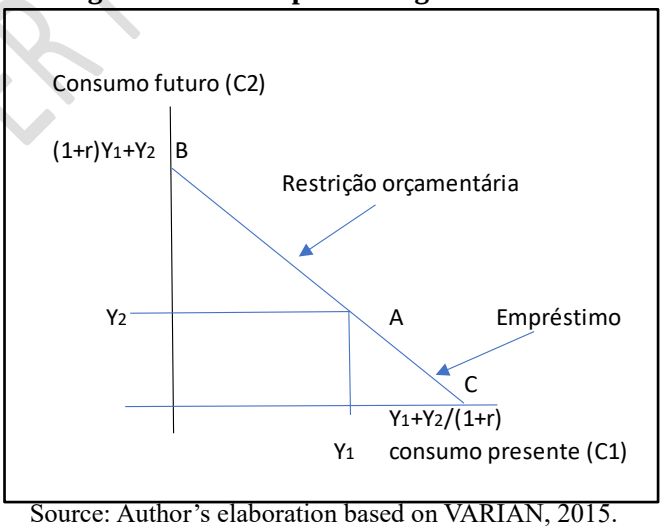
The expression **(1 + r)** represents the future equivalent of one current monetary unit and may be applied to both total consumption and total income. According to Varian (2015), "$1 today can become $(1 + r) next period simply by lending it to the bank at an interest rate r" (p. 272).

What differentiates consumption and income across the two periods is the interest rate (**r**). If it is zero, total consumption in $\mathbf{t_1}$ and $\mathbf{t_2}$ equals total income in $\mathbf{t_1}$ and $\mathbf{t_2}$. But if it is greater than zero, future consumption ($\mathbf{C_2}$) and future income ($\mathbf{Y_2}$) must be divided by the factor **(1 + r)**, which represents the absolute value of the slope of the intertemporal budget constraint, naturally preceded by a minus sign because the slope is negative.

The intertemporal budget constraint shows the importance of the interest rate for this type of choice, a fact somewhat neglected by Keynes, who considered income alone as the determinant of consumption, partly because he was concerned with macroeconomic aggregates rather than with consumers' intertemporal choice in microeconomics.

Figure 1 shows the budget constraint affecting consumption in the present (the horizontal intercept of the budget line) and in the future (the vertical intercept), as well as the role of the interest rate as the mediator of this intertemporal choice.

Figure 1. Intertemporal budget constraint



Source: Author's elaboration based on VARIAN, 2015.

Returning to figure1, it can be observed that the interest rate acts as the relative price between present and future consumption. In the savings region (to the left of the endowment point), foregoing one unit of present consumption allows for obtaining 1+ r units of consumption in the following period, reflecting intertemporal capitalization. In

the debt region (to the right of the endowment point), future consumption is discounted at the rate r, so that one unit of future consumption is equivalent to $\frac{1}{1+r}$units in the present. Thus, the interest rate does not operate directly on the income of each period, but defines the intertemporal transformation rate that guides the agent's optimal choice.

In current terms, in the savings region, current income, when not consumed, is capitalized at the interest rate, increasing future consumption. In the debt region, future consumption is brought to present value through discounting, reducing its current equivalent.

2.1.1 Productivity Growth: Effects on Expansionary Fiscal Policy

Once twentieth-century economic mainstream theory had demonstrated, within its own paradigm, the importance of the interest rate for intertemporal consumption choice in competitive markets, specialists turned their attention to the role of productivity – especially labor productivity, but also capital productivity – in mitigating the expansionary effect of fiscal policy. Expansionary fiscal policy increases the volume of money in circulation (through increased public spending or reduced taxation), which stimulates aggregate demand and tends to generate inflation. Yet there is a movement that mitigates this effect: expenditure on education, science, technology, and innovation. This type of expenditure increases labor and capital productivity, enabling society to produce more in less time, which tends to generate positive saving that will affect investment and increase consumption in $\mathbf{t_2}$ (future time). Paradoxically, in this case, an increase in public spending (on education, for instance) reduces or stabilizes aggregate demand in the short run, *ceteris paribus*. Considering that rational agents will not spend 100% of their income increase on consumption, the saved portion reduces the quantity of money in circulation, although this applies only to a specific portion of government expenditure.

In general, the impact of expansionary fiscal policy is strong in the short run. It increases supply (output), raises employment, and expands aggregate demand. If demand remains overheated for a long period, inflation may arise, requiring the adoption of restrictive fiscal measures. If inflation proves persistent, contractionary monetary policy measures should be adopted. The key point is that certain types of government expenditure, which raise productivity in the economy, mitigate the inflationary effects of expansionary fiscal policy through the intertemporal preference for saving rather than current consumption, while preserving the importance of the interest rate.

2.1.2 Interest Rates and Intertemporal Substitution in the Labor Market

Real business cycle theory from a New Keynesian perspective (MANKIW, 1989; ROMER, 1996) maintains that labor supply, both in the short and the long run, is a function of the wage incentives offered by firms. Higher wages generate more labor supply. Lower wages generate less interest in work. Very low wages lead part of the labor force into voluntary unemployment while they seek reallocation in the labor market when wages rise. This is the so-called intertemporal substitution of labor. Mankiw (1995) presents mathematically the ratio determining the intertemporal relative price of wages: given the first-period wage ($\mathbf{W_1}$), the real interest rate ($\mathbf{r}$), and the second-period wage ($\mathbf{W_2}$), the relative price across the two periods is:

$$\mathbf{Pr} = \frac{(\mathbf{1}+r)\boldsymbol{W1}}{\boldsymbol{W2}}$$

This equation means that the difference between $\mathbf{W_1}$ and $\mathbf{W_2}$ is determined by the real interest rate. If it is high, it is more advantageous to work in period $\mathbf{t_1}$ and invest (save) the excess income earned in that period, enjoying leisure in period $\mathbf{t_2}$. But it is not only the interest rate that governs this intertemporal substitution.

2.2 The Impact of Inflation on Intertemporal Choice and on the Interest Rate

Taking the economic policy adopted by the government in the 1990s as the starting point, one finds that from the Real Plan onward, the unprepared opening of the Brazilian economy, combined with an overvaluation of the real vis-à-vis globally convertible currencies, contributed to a situation in which much of local industry disappeared or significantly increased its idle capacity. These factors – monetary stability, currency overvaluation, and trade liberalization – led to growing imports, and negative balances in the trade balance and current account soon became troublesome. The result was an increase in the country's external vulnerability, with greater dependence on foreign capital inflows (SOUZA, 2007). In terms of output growth, the results from 1995 to 2003 were poor. Intertemporal choice was impaired during this period, since there was no income in $\mathbf{t_1}$ and no prospect of income in $\mathbf{t_2}$. With prohibitive interest rates, it was not possible for most of the Brazilian population even to accumulate negative saving. Positive saving was effectively "forbidden" by the reduction in household and corporate income.

High inflation (from double digits per year onward) affects intertemporal choice in several ways. The most important comes from monetary policy. The models of all central banks around the world indicate raising the interest rate as the main measure to confront inflation, that is, high inflation pulls interest rates upward. A high interest rate inhibits consumption, depresses aggregate demand, and restricts investment (LUCAS; SARGENT, 1969). The decision to take out a loan to consume today out of future income becomes very costly. And if inflation is accompanied by a loss in real wages, as occurred in the 1970s and 1980s, indebtedness may become catastrophic, especially when borrowing is used to pay debts incurred for household subsistence (current expenses). If an agent takes out a new loan to pay off a previous one (debt to pay debt), the newer loan tends to be more expensive than the previous one because of the upward movement of interest rates over time in situations of persistent inflation, as in the period under analysis.

2.2.1 The Relationship Between Inflation and the Interest Rate: Theoretical Analysis

The real interest rate is given by the difference between the nominal interest rate and the inflation rate: $\mathbf{r = i - \pi}$. Economist Irving Fisher (1977) derived the nominal interest rate from this equation: $\mathbf{i = r + \pi}$, showing that the nominal interest rate is the sum of the real interest rate and the inflation rate. Thus, he formulated what became known as the "Fisher effect": for every 1% increase in the inflation rate, there is a corresponding 1% increase in the nominal interest rate. In other words, there is a strong correlation between the nominal interest rate and current inflation. It should be noted

that the inflation rate determines both the real and the nominal interest rate. Within the narrow confines of this model, the problem of interest lies in inflation. For the Quantity Theory of Money, the monetary expansion rate determines the inflation rate. For Keynesian thought, when aggregate demand grows without a corresponding increase in supply, inflation intensifies. Now, according to the mainstream, the real interest rate adjusts to balance saving and investment (the real side of the economy). But if the real interest rate depends on inflation, the determinants of inflation, such as aggregate demand (also on the real side of the economy), must be taken into account. This is where fiscal policy assumes a prominent role. Because it influences inflation, it is one of the determinants of the interest rate, whether nominal or real. It is up to contemporary economists to deepen research in this field, especially regarding the impact of productivity growth on these variables.

2.2.2 The Relationship Between Inflation and the Interest Rate: Statistical Analysis

Theoretically, the relationship between the interest rate and inflation is generally inverse, since interest-rate variation is the monetary policy instrument used by the Central Bank to control inflation. If inflation rises, the Central Bank raises the interest rate in order to cool down the economy by making credit more expensive, thereby discouraging consumption and investment and, consequently, aggregate demand, causing inflation to fall. Conversely, when inflation is low, the Central Bank tends to reduce the interest rate in order to stimulate consumption and investment, in an expansionary policy aimed at encouraging economic growth.

There is, however, a mild paradox in this relationship that may go unnoticed in a superficial analysis. When inflation rises, the Central Bank tends to increase the interest rate. In that case, the relationship between the variables would be direct and positive. In practice, however, the Central Bank raises interest rates to reduce inflation, implying an inverse, negative relationship. This study carried out an empirical test before proceeding to a theoretical analysis. A 25-year historical series, from 1999 to 2023, was used to verify the linear correlation between the variables interest rate and inflation using Pearson's coefficient. The final analysis will be presented in the concluding remarks.

2.2.3 Data Selection and Collection

The data selection took into account the central variables of the article: inflation and the interest rate. Data were collected from official sources. The IPCA-IBGE is the inflation indicator adopted by the Central Bank and the Brazilian government. Annualized data were used here. The basic interest rate (Selic) is defined by the Monetary Policy Committee (COPOM) of the Central Bank, which every 45 days sets the "Selic target," the benchmark rate for the entire economy. The values used here are those from the last COPOM meeting of each year in the series.

Table 1. Historical Series: Selic Target and IPCA

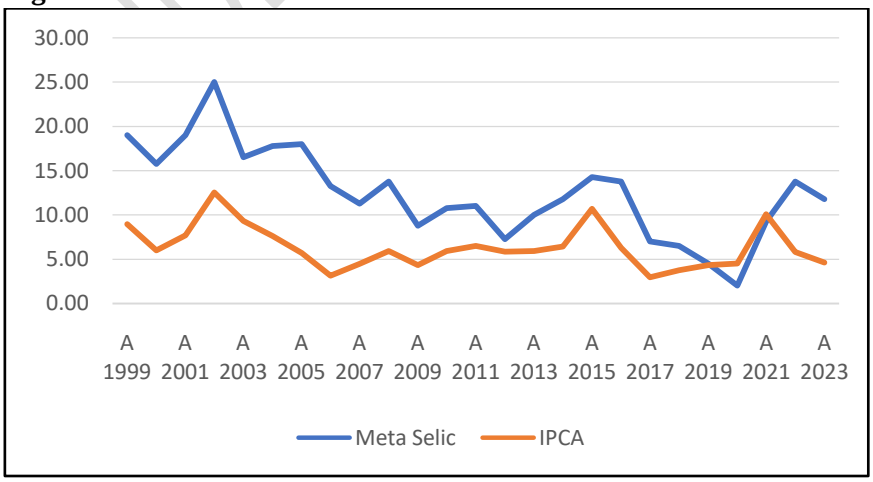
Year	Selic Target	IPCA
1999	19.00	8.94
2000	15.75	5.97
2001	19.00	7.67
2002	25.00	12.53

Year	Selic Target	IPCA
2003	16.50	9.30
2004	17.75	7.60
2005	18.00	5.69
2006	13.25	3.14
2007	11.25	4.46
2008	13.75	5.90
2009	8.75	4.31
2010	10.75	5.91
2011	11.00	6.50
2012	7.25	5.84
2013	10.00	5.91
2014	11.75	6.41
2015	14.25	10.67
2016	13.75	6.29
2017	7.00	2.95
2018	6.50	3.75
2019	4.50	4.31
2020	2.00	4.52
2021	9.25	10.06
2022	13.75	5.79
2023	11.75	4.62

Sources: Selic rate: https://www.bcb.gov.br/controleinflacao/historicotaxasjuros
Inflation (IPCA-IBGE): https://www.ibge.gov.br/estatisticas/economicas/precos-e-custos/9262-indice-nacional-de-precos-ao-consumidor-amplo-especial.html?=&t=downloads

Figure 2 presents the data from Table 1. It can be seen that the variables moved in a similar way throughout the historical series. Their upward and downward movements are common to both variables, indicating a positive relationship.

Figure 2. Variation in the Selic rate and IPCA: 1999–2023



Sources: original work based on BACEN; IBGE.

2.2.4 Pearson's Correlation Coefficient

Pearson's correlation coefficient (**r**) is an indicator from descriptive statistics, dimensionless in nature, also called the product-moment correlation coefficient. It can assume values in the interval from -1 to +1 and indicates both the intensity and the direction of a linear relationship on an interval scale. Intensity refers to the degree of association between two variables (in this case, inflation and the interest rate in Brazil from 1999 to 2023). Direction indicates whether the correlation is positive or negative.

For the interpretation of this coefficient, the following parameters are used: **ρ = 1** means a perfect positive correlation between the two variables; **ρ = -1** means a perfect negative correlation between the two variables, that is, if one increases, the other decreases in the same proportion; **ρ = 0** means that there is no linear dependence between the two variables, although there may be nonlinear dependence.

To interpret the meaning of coefficient **r**, several authors provide interval-based classifications of the strength of a given correlation (DANCEY; REIDY, 2006; TRIOLA, 2008). Broadly speaking, for a positive direction, if**0.10 < r < 0.30**, the linear correlation is weak; if **0.40 < r < 0.60**, it is moderate; if **0.70 < r < 1**, it is strong.

For the present analysis, two hypotheses were considered: $\mathbf{H_0}$ (null hypothesis) and $\mathbf{H_1}$ (alternative hypothesis), where $\mathbf{H_0}$ **= there is no linear correlation** and $\mathbf{H_1}$ **= there is a linear correlation**. From the collected data, the relationship between the two variables appears to be positive. From that point onward, the following parameters were defined: if **r = 0** (absence of linear correlation) or **0.10 < r < 0.30** (weak correlation), $\mathbf{H_0}$ is accepted and $\mathbf{H_1}$ rejected. If **0.40 < r < 0.60** (moderate linear correlation) or **0.70 < r < 1** (strong linear correlation), $\mathbf{H_0}$ is rejected and $\mathbf{H_1}$ accepted, that is, there is linear correlation.

Mathematically, Pearson's correlation coefficient (**r**) is calculated using the following formula:

$$\mathbf{r} = \frac{\sum_{k=1}^{n}(xi - \bar{x})(yi - \bar{y})}{\sqrt{\sum_{k=1}^{n}(xi - \bar{x})^2} \cdot \sqrt{\sum_{k=1}^{n}(yi - \bar{y})^2}}$$

Where **x1, x2, ... xn** and **y1, y2, ... yn** are the empirically measured values of the two variables, and $\bar{\mathbf{x}}$ and $\bar{\mathbf{y}}$ are their respective means. Using the data from Table 1 in the formula above yields **r = 0.6505**. The next step is the scatter plot.

2.2.5 Scatter Plot and Trend-Line Equation

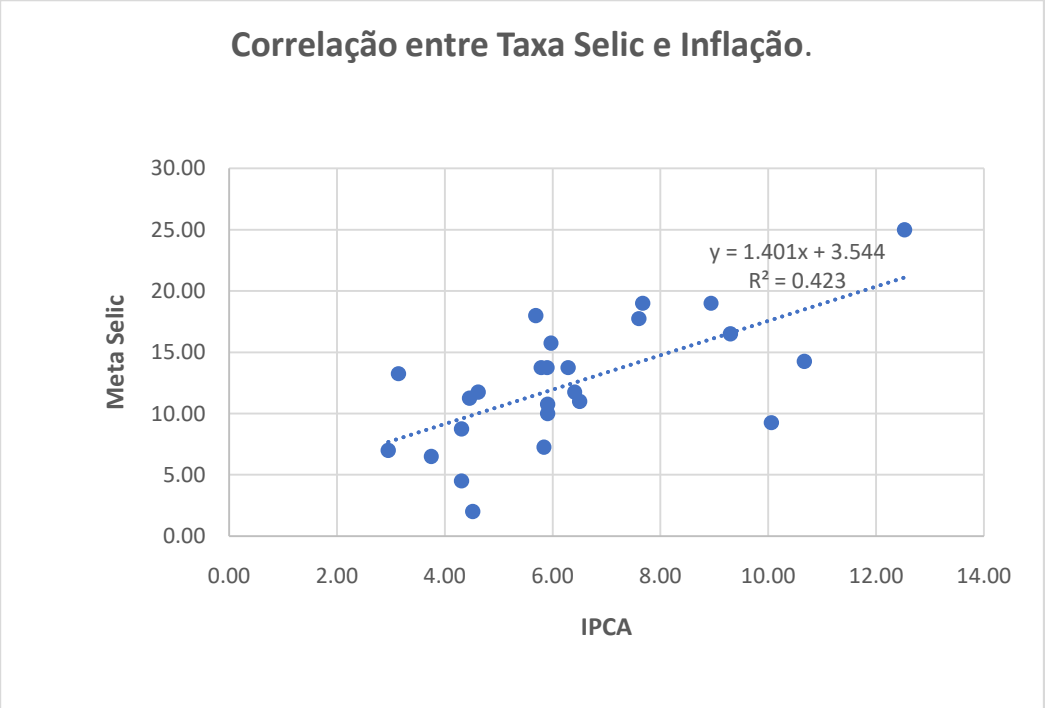
Since there are two thematic variables in this study, the literature recommends Pearson's coefficient for the analysis of linear correlation between them. The scatter plot is the best graphical means of visualizing the intensity and, especially, the direction of the relationship, showing whether it is direct or inverse.

The collected data display few outliers (discrepant values, points outside the pattern), which validates the use of Pearson's coefficient to measure the correlation. Based on the scatter plot, the trend line is defined along with its characteristic equation, and the value of the coefficient of determination ($\mathbf{R^2}$) is obtained. Pearson's coefficient (**r**) is then obtained by taking the square root of $\mathbf{R^2}$. The independent variable here is inflation (measured by the IPCA), since it is its variation that leads the Central Bank to

alter the interest rate (the dependent variable). In the plot, inflation is on the horizontal axis and the Selic target is on the vertical axis.

The slope of the line is positive, showing a direct relationship (considering a single period, without time lag between the collection of each variable). The derivative, which measures the degree of slope of the trend line, is equal to **1.4**, a moderate slope that coincides with the estimated value of **r (0.6505)**, corresponding to a correlation between moderate and strong.

Figure 3. Scatter plot: Selic rate and inflation (IPCA): 1999–2023



Source: original work based on research.

Since **R²** is a percentage value, **0.4232** may be represented as **42.32%**. **R²** indicates, in percentage terms, how much the variance of one variable explains the other, but the correlation coefficient is **r**, obtained either by the mathematical formula already mentioned or by taking the square root of **R²** (PUTH, 2014). The square root of **0.4232** is **0.6505**, confirming the value of **r** obtained from the formula. The result indicates that **0.60 < r < 0.70**, that is, it lies between a moderate and a strong correlation. The null hypothesis is therefore rejected. There is a correlation between the interest rate and inflation, and the direction is positive, as shown by the trend line in Figure 2 and the positive coefficient of **x** in the equation of that same line.

2.3 The Central Bank and Inflation Control

The New Keynesian three-equation model (CARLIN; SOSKICE, 2006), adopted by central banks in developed and developing countries, works with the IS curve, the long-run Phillips curve, and the Monetary Rule curve (which replaced the traditional LM curve in the IS-LM model). In this model, the long-run Phillips curve does not vary. The real side of the economy depends on real movements in investment and saving

associated with output variation. This leaves the Central Bank with the monetary rule, which is almost always reduced to the determination of the benchmark interest rate, since empirical evidence has shown that expanding or restricting the money supply beyond what is required by the level of activity only generates inflationary instability.

With demand close to supply, easing pressure on prices, the interest rate can be reduced. In this sense, monetary stability is fundamental so that the "rational agent" can make intertemporal choices (MUTH, 1961; LUCAS; SARGENT, 1981), whether regarding consumption or investment, while remaining aware of the possibility of cycles. Since such cycles are absent from the New Classical universe, the agent's "rationality" is thereby impaired.

2.3.1 Interest Rates and Investment: The Influence of Fiscal Policy

Returning to the roots, Keynes (1996) challenged neoclassical theory, according to which the investment market determines the interest rate through the relationship between the supply of saving and the demand for investment. If the volume of investment alone (which raises money demand through the demand for saving) determined the interest rate, then the interest rate itself would be the only determinant of investment volume, which is tautological reasoning. For Keynes (1996), the determinants of investment are exogenous to the capital market, such as aggregate demand and the marginal efficiency of capital, under the influence of uncertainty and liquidity preference during crises. Aggregate demand, however, has among its determinants government spending on the one hand, and intertemporal consumption and labor choices on the other.

3. Keynesianism and the Marginal Efficiency of Capital

For Keynes (1996), the relationship between the marginal efficiency of capital and private investment is very strong, recalling that before Keynes, Ricardo (1982) had already considered the rate of profit—one of the consequences of the marginal efficiency of capital—as a fundamental determinant of investment. For Marx (2008), it was not only the rate but above all the volume of profit that weighed most heavily in the investment decision. Bresser-Pereira (1973) addresses both the rate of profit and the interest rate as determinants of investment in the classical, neoclassical, and Keynesian schools.

> The classical tradition of giving primacy to the rate of profit was abandoned by neoclassical economists, who placed the interest rate at the center of their system. To the extent that, under perfect competition, the rate of profit tended to identify itself with "normal profit," which followed the interest rate, the latter became the core of the neoclassical macroeconomic system. Keynes restored, to a certain extent, the importance of the rate of profit through the concept of the marginal efficiency of capital. He also had the merit of emphasizing that what matters is not the current rate of profit, but the expected rate of profit on investments. Nevertheless, his neoclassical training probably prevented him from fully criticizing the theory that placed the interest rate at the base of the investment function (BRESSER-PEREIRA, 1973, p. 3).

In Chapter 11 of *The General Theory*, Keynes deals with the marginal efficiency of capital, a concept taken from marginalism which, in his theoretical system, required an enriched meaning beyond simply "producing more in less time." Objectively, for Keynes, this productivity is the relationship between the annuity expected by the investor and the historical result yielded by the investment.

> When a person buys an investment or capital-asset, he purchases the right to the series of prospective returns, which he expects to obtain from selling its output, after deducting the running expenses of obtaining that output, during the life of the asset. It is convenient to call this series of annuities Q1, Q2 ... Qn the prospective yield of the investment. (KEYNES, 1996, p. 149).

Next, the author of *The General Theory* explains that "in contrast with the prospective yield of the investment" stands the supply price of the capital asset, by which he means not the market price at which such an asset can actually be purchased at that moment, but the price which would just induce a manufacturer to produce an additional unit of such capital (p. 149). Keynes calls this the "replacement cost." He then presents his definition of the subject of Chapter 11:

> The relation between the prospective yield of a capital-asset and its supply price or replacement cost, i.e. the relation between the prospective yield of one more unit of that type of capital and the cost of producing that unit, furnishes us with the marginal efficiency of capital of that type. More precisely, I define the marginal efficiency of capital as being equal to that rate of discount which would make the present value of the series of annuities given by the returns expected from the capital-asset during its life just equal to its supply price. This gives us the marginal efficiencies of particular types of capital-asset. (KEYNES, 1996, p. 149).

Still in Chapter 11 of *The General Theory*, Keynes shows the coincidence between his concept and Fisher's concept of the marginal efficiency of capital. We thus have, in effect, two quotations in one, reflecting the thought of two major twentieth-century economists on a subject so central to the mainstream.

> Professor Irving Fisher has given in his *Theory of Interest* (1930) a definition of what he calls "the rate of return over cost," which is identical with my definition of the marginal efficiency of capital, though he does not call it by that name. "The rate of return over cost," he writes, "is that rate which, employed in computing the present worth of all the costs and all the returns, will make these two equal." Professor Fisher explains that the extent of investment in any direction will depend on a comparison between the rate of return over cost and the rate of interest. To induce new investment "the rate of return over cost must exceed the rate of interest." "This new magnitude (or factor) plays the central role on the investment-opportunity side of the interest theory." Thus Professor Fisher uses his "rate of return over cost" in the same sense and for precisely the same purpose as I use "marginal efficiency of capital." (KEYNES, 1936, p. 153).

The conclusion is that, to obtain the marginal efficiency of capital (**MEC**), it is first necessary to transform the series of future investment returns (**Q1, Q2, Q3, … Qn**) into present value (**PVQ**). The **MEC** can then be determined as the rate that equates this present value (**PVQ**) to the supply price (**SP**) of the capital asset, and, by the definition given by Keynes in Chapter 11 of *The General Theory*, we have **PVQ = SP · MEC**. Thus, the equalizing rate is given by:

$$\mathbf{MEC = PVQ / SP}$$

The subject leads us back to Ricardo and Marx regarding the possibility of economic stagnation caused by the end of investment. According to Ricardo (1986), this is a theoretical possibility, due to the tendency—historically grounded, in his view—of the rate of profit to fall, based on the law of diminishing returns. Marx (2008) adopted the general line of this tendency, but gave prominence to the volume of profit, derived from the absolute volume of surplus value, a terrain absent from Ricardo's work. Neoclassical theory sought to escape the importance of profit for investment, among other reasons because of the moral issue. Profit can easily be associated with exploitation, and this social reality was not welcome in a theory that, in essence, seeks to justify capital accumulation by means of simple comparative-static demonstrations. For that type of approach, it is preferable to prioritize the cold and impersonal interest rate as the determinant of investment. It is important, but it cannot be treated as the only determinant, or even as the most important one, through an *a priori* choice that does not discuss other determinants and nevertheless seeks to rank them.

There is no denying Ricardo's influence, both on the right and on the left of the ideological spectrum. The idea of diminishing returns is a strong example. It appears both in Marx's Law of the Tendency of the Rate of Profit to Fall and in the Keynesian notion that, as investment increases, the marginal efficiency of capital decreases. On page 150 of *The General Theory*, Keynes (1996) states: "It follows that the incentive to invest depends partly on the investment-demand schedule and partly on the rate of interest." At this point in his work, he does not explicitly address the rate of profit, but it is to some extent implicit in the broader context of aggregate demand, affected by variations in the marginal efficiency of capital.

In economic practice, the role of the interest rate is as visible as that of aggregate demand when investment decisions are concerned. A rational and well-informed entrepreneur will only decide to invest in a machine if its marginal efficiency exceeds the prevailing interest rate. Broadly speaking, the entrepreneur invests if he believes that the return on production generated by the investment will exceed what could be obtained by investing in a government bond or lending to a financial institution. In short, for Keynes (1996), investment will grow up to the point of intersection – on the investment-demand curve – between the marginal efficiency of capital and the prevailing market interest rate.

3.1 The Productivity Issue from a New Keynesian Perspective

What is the relationship between productivity in competitive markets and the factors that influence intertemporal choice, such as investment (derived from saving) and the interest rate (the premium paid for renouncing consumption in period $\mathbf{t_1}$)?

One may begin to answer this by examining the effects of an increase in labor productivity. In a competitive market, an agent seeks to improve his or her position in the labor market in order to raise income. To do so, the agent must increase productivity (produce more in the same or less time). This requires more advanced technical knowledge. The agent therefore invests in his or her own technical education.

As educational attainment increases, the agent produces more in the same or less time. The additional income thus obtained can be consumed in the present or saved for future consumption. By not consuming in the present, the agent contributes to reducing aggregate demand in the short run, which puts downward pressure on inflation and tends to lower the interest rate. With a lower interest rate, borrowing for present consumption becomes possible. The increase in demand for money capital raises its price in the market, resulting in a higher interest rate, which discourages current consumption and encourages saving for future consumption.

Public investment aimed at improving the educational and technical level of the labor force contributes to an overall increase in productivity. The same applies to investments in science, technology, and innovation. This type of public expenditure may put pressure on the balance of public accounts, increasing risk in the market and tending to raise the interest rate, which is a recessionary measure; but, by increasing productivity, it may also raise workers' saving and investment, contributing to an expansionary movement in the economy. This is an important contribution of New Keynesian thought.

4. Fiscal Policy and Uncertainty: Keynes versus Neoclassicals and New Keynesians

The crucial difference between Keynes and the neoclassical school (and its modern version, the New Classical school) is that, for Keynes, uncertainty is a set of non-measurable probabilities; that is, it is genuine uncertainty, subjectivity. For the latter, uncertainty does not exist in the Keynesian sense of the term. It is merely risk, something measurable through careful analysis of the past and rational expectations regarding the future. In practice, risk for the neoclassical school (and its descendants) can be forecast through mathematical regressions based on past situations combined with probability distributions for future scenarios.

The consequences of this difference in thinking are considerable. If an agent must make a decision about future investment under conditions of total uncertainty, the possibility of liquidity preference arises—in other words, hoarding—which breaks both the maxim of Say's Law (every supply creates its own demand) and the neoclassical paradigm that saving equals investment. Uncertainty is therefore a central element of *The General Theory*, because through liquidity preference it explains fluctuations in investment and output (TOBIN, 1997).

The New Keynesian school, because it understands its theory as applying only to the short run, does not deny but rather neglects the importance of uncertainty. In doing so, it does not confront rational expectations theory. For original Keynesianism, uncertainty cannot be modeled—that would mean predicting the future through mathematical models—and this opens the possibility of crises, creating a theoretical toolkit to study them alongside the active role of fiscal and monetary policies. Beyond its differences with Keynes, New Keynesianism also differs in important ways from neoclassical economics. It rejects the neoclassical assumption that the market, by itself

(through a supposed "invisible hand"), would achieve Pareto efficiency. Moreover, by defending the existence of market failures, New Keynesianism admits some degree of state regulation, however limited, thereby opening space for a certain protagonism of economic policy.

In Joseph Stiglitz's view (2012), it is the interest rate—not the money supply—that is primarily responsible for variations in the price level. And the fact that, in practice, there is low intertemporal substitution of labor for leisure does not reduce the importance of the interest rate in the decision-making process of economic agents. For Stiglitz (2012), empirical evidence does not demonstrate that aggregate unemployment is involuntary, after all. Since there is no "free lunch," the key question here is: who would pay for the "lunch" if most of the labor force voluntarily chose leisure over work? This thesis of involuntary unemployment is an abstraction as subjective as that of supposed perfect information. There is also controversy over short-run price rigidity and its institutional determination (HALL; TAYLOR, 1989; BALL; MANKIW, 1994).

For neoclassical theory, an increase in public investment reduces private investment, and the final result for the economy, in terms of raising activity levels, is zero, aggravated by the burden of contributing to the public deficit, the antechamber of fiscal crisis. New Keynesian theory preserved the importance of aggregate demand, which admits some relevance for public spending, but by accepting agents' rationality it diminished the weight of uncertainty in future investment decisions. This is because it accepted that Keynesian thought applies only to the short run; in the long run, neoclassical theory would prevail. These developments brought New Keynesianism closer to neoclassical microeconomics (consumer theory and firm theory), giving it a certain predictability absent from original Keynesianism, for which the economy is not ergodic, as Marcelo Mallet and Túlio Chiarini argue:

> An ergodic economy is one in which the underlying fundamental structure of the economy is constant and therefore timeless. But the world in which we live is not ergodic, because uncertainty about the economic future requires that the system be generated by a stochastic process for which no probability distribution can be calculated. (MALLET; CHIARINI, 2014, p. 305)

The mantle of supposed agents' rationality seeks to conceal the fragilities of a theory that works only in markets of perfect (ideal) competition. At bottom, all these theoretical lines are children of Say's Law, which gave total priority to supply and against which Keynes rose, pointing to demand as the determinant of investment and, therefore, of economic growth.

According to Fernandes (2020), New Classical theory, by neglecting the importance of uncertainty in exchange for the acceptance of full agents' rationality, ends up moving toward tautology. Uncertainty becomes probabilistic risk and crises become mere punctual imbalances between supply and demand, quickly solvable by the market's own mechanisms. The U.S. government's trillion-dollar spending during the 2008–2009 crisis shows otherwise. New Keynesianism does not fully embrace this line, but by assigning greater importance to rationality (combined with perfect information) than to uncertainty, it distances itself from the "revolution" Keynes dared to launch within capitalist economics. The New Keynesian school has faced criticism not only from the New Classical side, but also from Keynesians, who regard it as an appendage

of neoclassical theory for the short run. As Cláudio Gontijo argues in *Critical Notes on New Keynesian Macroeconomics* (2009):

> New Keynesian macroeconomics seems to face many difficulties, beginning with the ad hoc character of many of the hypotheses it employs, which prevents it from being conceived as a systematic totality. In particular, although observable, the rigidity of prices and wages seems to rest on difficult foundations, while the derivation of the IS and LM curves from neoclassical theory also seems problematic. Furthermore, the connections between the short and long run, involving the relationships among interest rates, money, and output, do not seem clear, and the contradictions between the proposed models and traditional neoclassical theory are noteworthy. Thus, even disregarding the omission of Joan Robinson's and Sraffa's criticisms of the foundations of neoclassical theory, it seems that the New Keynesian promise of explaining reality through a systematic construction that, starting from neoclassical microeconomic theory, accounts for real-world phenomena, is far from having been satisfactorily fulfilled. (GONTIJO, 2009, p. 296)

5. Keynes and the New Keynesian School: Convergences and Divergences

Soon after the publication of Keynes's *The General Theory* in 1936, Keynesian thought began to be "domesticated" by segments of a heterogeneous movement generally grouped under the broad definition of "post-Keynesianism." Part of that movement sought to bring Keynesianism closer to neoclassical thought, stripping it of its character as a denunciation of neoclassical inconsistencies and presenting it as merely a subset of the then dominant theory, valid only for short-run analysis. This seems to have reached its most significant stage with the emergence of the New Keynesian school.

It is important to begin with areas of agreement. New Keynesianism agrees with "old" Keynes regarding the possibility of economic equilibrium below full-employment output and regarding the importance of aggregate demand for macroeconomics. After this convergence, differences begin to emerge (GORDON, 1990). New Keynesians agree with neoclassical theory on the following postulates: in the long run, all markets clear through price and wage vectors. The supply curve becomes inelastic, and involuntary unemployment completes the equation (MANKIW; ROMER, 1991; MANKIW, 1985). They recognize, by implication, that Keynesian theory is useless in the long run (there, for those still alive, there will be no involuntary unemployment or business cycles). Thus, the New Keynesian critique of neoclassical macroeconomics is only that it lacks tools for short-run analysis. To illustrate the degree of controversy among those who claim the Keynesian label, the post-Keynesian Paul Davidson (1994; 2003), one of the major critics of the New Keynesian school, argues that this new school reduced Keynes's theory to a special case of neoclassical economics, which would then, ironically, become the general theory.

It is very difficult, if not impossible, to define what the post-Keynesian school is, given the great diversity of ideas – some of them divergent – circulating within it. The literature generally identifies three main groups: (a) North American post-Keynesians, also called fundamentalists, who start from the *Treatise on Money* to discuss *The*

General Theory (Davidson and Minsky); (b) neo-Ricardians, who interpret Keynes through the lens of classical theory, especially Ricardo and his labor-value framework (Sraffa, Garegnani); and (c) the tradition linked to Kalecki and Joan Robinson, which dialogues with the Marxist tradition (CARVALHO, 1992; DAVIDSON, 2003). It is evident that the New Keynesian school does not fit into any of these three lines.

For a synthesis, let us turn to the landmarks defined by Paul Davidson in his critique of rational expectations, published in the *Journal of Post Keynesian Economics* in 1982. According to him, the essential points of post-Keynesian thought are:

I.Recognition of and respect for historical time;
II. Uncertainty (not ergodicity) as a characteristic of decision-makers;
III. Institutional determination of prices and wages;
IV. Central importance of the distribution of socially produced wealth;
V. Income effects dominate substitution effects.

Consulting the literature, it becomes evident that even this small number of points is insufficient to establish a unitary post-Keynesian doctrine. In a broad sense (rejected by Davidson), everything that came after the publication of *The General Theory* and that recognizes, at minimum, the supremacy of aggregate demand over supply falls within the category of "post-Keynesian thought."

Concretely, in 1937 the economist John Hicks (2011 [1937]) presented the IS-LM model, giving rise to what Paul Samuelson (1997), a critic of Milton Friedman's liberalism, called the Neoclassical Synthesis, an approach that dominated the world economy throughout the postwar period and marked the beginning of the subordination of *The General Theory* to neoclassical theory. The New Keynesian movement is a far more homogeneous school than the post-Keynesian cluster (ROMER, 1996); yet this homogeneity derives from its grounding in Walrasian microeconomics, which distances this current significantly from the economist whose name it bears.

6. Final Remarks

Fiscal policy, abhorred by liberal economists but responsible for the growth of the now dominant economies of the United States and Western Europe during the "Thirty Glorious Years," affects not only the short run but also the long run, among other reasons because of the phenomenon of hysteresis. Without entering into that issue, the degree of importance attributed to the long run by Neoclassical and New Classical theories is comparable only to the importance of the doctrine of free will in theology. If we consider only the industrial phase (beginning in the mid-eighteenth century), capitalism has existed for more than 270 years, and equilibrium in the markets for goods, services, labor, and capital has never been achieved. When one asks about full-employment equilibrium of the factors, the answer is always: "it is just around the corner, in the long run."

The level of employment, which is linked to society's level of well-being, depends on investment. For the classics, investment depends on the rate of profit (RICARDO, 1986). For Marx (2008), it depends on the absolute volume of profit derived from surplus value. For neoclassicals, investment depends only on saving and

the interest rate. For Keynes (1996) and his followers, it depends on aggregate demand, saving, the interest rate, and the rate of profit. For all these theorists, to a greater or lesser extent, the efficiency (marginal or otherwise) of capital also belongs in this set of determinants.

All of these determinants are important. No rigid hierarchy is appropriate; however, in a monetary production economy, the interest rate occupies a prominent place, also because it is the most visible factor and the one most directly linked to intertemporal choice. When one analyzes the issue of productivity growth, which may generate a surplus of saving (the mass from which investment is extracted), it becomes clear that the agent faces choices between present and future, and the decision to be made depends primarily on the real interest rate.

Beyond all of this, there is one determinant that escapes both neoclassical theory and Keynesian theory (and their descendants): the role of the degree of surplus-value extraction in the formation of the mass of profit in the economy. There lies the most significant determinant of investment, with all the derived implications for employment, disposable income, inflation, and interest rates.

This article sought to identify the level of correlation between inflation and the interest rate in Brazil through a 25-year historical series of these variables. The result was **r = 0.6505** (an intensity between moderate and strong). Superficially, this seems to contradict the theory that points to a decline in inflation because of higher interest rates. A more accurate analysis, however, must consider that the Central Bank treats inflation prospectively when guiding its decisions regarding the Selic target, since there is a time lag before the effect of the interest rate appears in inflation.

The study of the lag effect between a change in the interest rate and the moment when it begins to affect price variation is indispensable for understanding the result of the empirical observation. Thus, what Figures 1 and 2 show is the behavior of the variables within the same period of time. If the lag is extended to 12 months or more, the correlation decreases and, with larger lags, becomes negative, as theory indicates. The research demonstrated the existence of a considerable degree of positive correlation using Pearson's coefficient, but this is due to the fact that the two variables were measured in the same period.

In light of everything discussed, it is evident that a simple analysis of the correlation between inflation and the interest rate in the same period is insufficient to understand the economic movements arising from changes in these variables. Public spending increases aggregate demand. If it does not rise to the point of aggravating the fiscal deficit, it will stimulate the growth of output and employment. If coordination failures occur, imbalances between supply and demand may lead to undesirable price variation. Monetary policy then comes into play, through changes in the interest rate according to the desired objective – cooling or heating the economy – indicating a considerable correlation between the variables considered, which was clearly demonstrated by the empirical evidence, notwithstanding the need for a deeper analysis of its direction.

Thus, one may conclude that fiscal policy geared toward investment (increased public spending and tax restraint), agents' uncertainty regarding their future income, and households' intertemporal choices (all influenced by the degree of surplus-value extraction), mediated by inflation, are determinant factors in the definition of the interest rate. With the exception of the surplus-value variable, this conclusion fits within

the scope of Keynesian thought and its descendants, together with other elements such as productivity, hysteresis, and animal spirits.

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