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Monetary policy, growth, debt, and the stock market in the United States 2000-2020: Lessons for the post-pandemic Covid-19 era

Política monetaria, crecimiento, deuda y mercado de valores en Estados Unidos 2000-2020: lecciones para la era post-pandemia Covid-19

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> After the rate of interest has fallen to a certain level, liquidity-preference may become virtually absolute […] In this event, the monetary authority would have lost effective control over the rate of interest […] owing to the unwillingness of most monetary authorities to deal boldly in debts of long term, there has not been much opportunity for a test. Moreover, if such a situation were to arise, it would mean that the public authority itself could borrow through the banking system on an unlimited scale at a nominal rate of interest. J.M. Keynes (1936 [1964], p. 207).

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Abstract

The aim of this paper is look at the relationship between the Fed's monetary policy, the USA's debt, and the stock market over the period 2000-2020. Reaction functions to assess the effect of debt variations on the stock market, GDP, price stability and the rate of interest are elaborated. By way of hypothesis, it is argued that the main effect, associated with debt expansion, goes to the stock market as its main index is significantly elastic to public debt increments. This result is consistent with the Fed interventions to improve liquidity with a view to stabilize the financial system after both the 2007/2008 financial crisis and the economic impact of the Covid-19 pandemic.

JEL Code: E31, E52, H63, N12
Keywords: inflation; growth; debt; stock market; United States

Resumen

El objetivo de este artículo es analizar la relación entre la política monetaria de la Fed, la deuda pública de Estados Unidos y el mercado de valores durante el periodo 2000-2020. Estimamos funciones de reacción ante variaciones de la deuda para evaluar: el efecto sobre el desempeño bursátil; el impacto sobre la dinámica del PIB; el efecto sobre la estabilidad de precios y las implicaciones para la tasa de interés. Nuestra hipótesis es que el principal efecto, asociado a la expansión de la deuda, es sobre el mercado de valores, la respuesta del índice bursátil ante un incremento de la deuda pública es significativamente elástica. Este resultado es consistente con la hipótesis de que la compra de títulos del gobierno que realiza la Fed (incrementos en la hoja de balance) tiene como principal objetivo aumentar la liquidez para morigerar la inestabilidad del sistema financiero resultante de las crisis de 2008 y 2020.

Código JEL: E31, E52, H63, N12
Palabras clave: inflación; crecimiento; deuda; mercado de valores; Estados Unidos

Introduction

The issue of the risk of inflation or deflation and a weak and slow economic recovery associated with the burden of corporate and government debt in the post-pandemic era is, once again, at the core of the monetary policy debate of several central banks, including the U.S. Federal Reserve (Fed), the Bank of England, and the European Central Bank (Blanchard, 2020, Miles, & Scott, 2020; Goodhart & Pradhan, 2020; Becker, Hege, & Mella-Barral, 2020).

Goodhart and Pradhan (2020:2) state that "the coronavirus pandemic and the supply shock it has induced will mark the dividing line between the deflationary forces of the past 30 to 40 years and the resurgent inflation of the coming decades." This scenario, complex in itself, becomes even more complicated if it is considered that the Fed and other central banks have had severe difficulties in achieving the inflation target (in other words, before the Covid19 pandemic, to increase the inflation rate despite large injections of liquidity and, in 2021, to reduce it from 5% to 2%) and that the effectiveness of

monetary policy is constrained by the very low level of interest rates. Lilley and Rogoff (2020) argue that there is a persistent global downward trend in real interest rates and that, given the ineffectiveness of quasi-fiscal instruments when the interest rate is at the zero bound, the world is moving inexorably toward a negative interest rate scenario.

In this article, the Fed's monetary policy during the period 2000-2020 is analyzed. The objective is to study the relation between the Fed's monetary policy, the debt overhang, and the stock market, for which reaction functions of gross domestic product (GDP), inflation, stock market activity, and interest rate to changes in debt are formulated. Four reaction functions to changes in debt are estimated: the effect on stock market performance; the impact on GDP dynamics; the effect on price stability; and to measure the implications for the interest rate.

The hypothesis is that stock market dynamics generate the main effect associated with debt expansion: the response of the stock market index to an increase in public debt is significantly elastic. This result is consistent with the hypothesis that the Fed's purchase of government bonds (increases in the balance sheet) is primarily aimed at increasing liquidity to mitigate the financial system's instability resulting from the 2008 and 2020 crises rather than to stabilize the real economy. In the medium and long term, the low-interest rate observed since the subprime crisis has induced a greater preference for riskier assets, which has driven an inflationary process in financial assets.

The article's structure is as follows: in the next section, a discussion of the main theories of inflation that have informed the Fed's monetary policy since the Great Moderation will follow. The third section presents an empirical analysis of the role of debt and the stock market in the Fed's monetary policy; next, the econometric estimation and the results are presented; the last section summarizes and concludes.

Review of the literature on inflation and monetary policy

The Phillips curve

The Federal Reserve System (Fed) was founded in 1913 by an act of the U.S. Congress, with the original mission to "provide an elastic currency," in other words, an elastic supply of liquidity. As a consequence of the Great Depression of the 1930s, the government assigned the Fed the responsibility of pursuing macroeconomic stabilization through monetary policy.

Thus, since the 1940s, the Fed has operated with a dual mandate of full employment and price stability, objectives that it has pursued throughout history to the present through a variety of instruments, namely: monetary aggregate targets, interest rate targets, open market operations, creation of monetary

reserves (Hetzel, 2008) and, more recently, quantitative easing, massive purchases of financial assets, and balance sheet movements.

The determination of the inflation rate is often presented in terms of the quantitative theory of money:

$$\dot{p} = \dot{m} - g \tag{1}$$

Where $\dot{p}$, $\dot{m}$, and g denote the inflation rate, money supply growth, and real output growth. Modern inflation analysis is usually formulated with some form of the Phillips Curve, of which exist the Keynesian (Samuelson & Solow, 1960; Lipsey, 1960), monetarist (Friedman, 1968, 1977; Phelps, 1967, 1968) and Neo-Keynesian versions. Phillips (1958) estimated the long-run relation between the unemployment rate (u) and the dynamics or rate of change of nominal wages ($\dot{w}n$). The main results of Phillips (1958:283), in summary, were that the structural and institutional conditions of the labor market influence the dynamics of nominal wages, and there is an inverse (non-linear) relation between the two variables:

$$\dot{w}_n = -\alpha(u - \bar{u}) \tag{2}$$

$\bar{u}$ represents the average unemployment rate over the business cycle; Phillips did not consider it the equilibrium unemployment or full employment rate.

Lipsey (1960) reformulated the Phillips Curve by proposing that nominal wage growth depends on excess labor demand, and Friedman (1968, 1977) introduced adaptive expectations and established a causal relation in which economic policy generates surprise inflation, alters wage expectations, and induces changes in the unemployment rate that eventually translate into inflation:

$$\dot{w}_n = -\alpha(u* - u) + \dot{p}_{t-1} \tag{3}$$

Where u* is the natural rate of unemployment, and $\dot{p}_{t-1}$ are lagged expectations. Expansionary monetary policy will maintain $u < u*$ as long as workers—consumption maximizers—perceive that the nominal wage increase is equivalent to an increase in their real wage (w_r); in other words, as long as they experience monetary illusion and move along their short-run labor supply curve. Capitalists interpret the monetary shock as meaning a lower w_r. When workers and capitalists realize that the real wage did not increase because the monetary expansion resulted in a higher inflation rate, the unemployment rate will return to the level before the monetary shock. Successive surprise monetary shocks will be required to

keep u below u*. However, this will only accelerate inflation without increasing output or employment. Friedman assumes that the relevant labor market adjustment variable is the real wage, not the nominal wage and that there is full indexation of nominal wage increases to inflation:

$$\dot{w}_n - \dot{p}_{t-1} = \dot{w}_r = -\alpha(u* - u), \qquad u* = u \tag{4}$$

Therefore, in the long run, the economy will tend to equilibrium, in other words, to the equilibrium unemployment rate u* consistent with no acceleration of inflation.

Lucas (1972) extended Friedman's model, replacing the adaptive expectations hypothesis with the rational expectations hypothesis, based on his proposition of economic policy ineffectiveness (PEPI).This proposition assumes that money is absolutely neutral because monetary policy does not affect products or employment in the short or long term. Lucas proposes a supply curve in which economic agents have no monetary illusion; they form their expectations "correctly," and they correctly anticipate the effect of monetary policy on expected inflation (p^E). Workers' supply decisions are based on the ex-ante knowledge that monetary shocks do not change relative prices and can be expressed as follows:

$$u_t = u^* - (\frac{p_t - p^E}{\alpha}) \tag{5}$$

Given the rational expectations rule, there is a continuous equilibrium in the labor market, $u_t = u*$, money is neutral, and active monetary policy is ineffective, causing only inflation. Lucas' PEPI assumes not only full indexation of nominal wage changes to prices but also immediate indexation.

Samuelson and Solow (1960) suggested that the Fed could exploit the trade-off implicit in the Phillips Curve to reduce unemployment at the cost of a higher inflation rate. Indeed, the U.S. unemployment rate fell from 5.5% to less than 4% between 1964 and 1970, and inflation rose from less than 2% to more than 5%. However, after 1970, inflation accelerated dramatically to almost 11% in 1975, as Friedman argues. During the decade of the 1970s, the relation between inflation and unemployment was positive. The U.S. economy experienced a crisis of stagnation with inflation in the decade of the 1970s, characterized by double-digit unemployment and inflation rates. The stagflation crisis had as one of its premises the rigidity of real wages and a partially elastic reaction of the nominal GDP growth rate (Gordon, 1984).

Between 1979 and 1982, Paul Volcker put Milton Friedman's hypothesis into practice, thus verifying the so-called monetarist experiment. After 1979, the structural change in the monetary policy

regime, supply shocks, and financial innovation implied ruptures in the relation between the money supply, nominal income, and the interest rate.

Inflation decreased from 10% in 1981 to 3% in 1986. This resulted from a combination of factors: high-interest rates and monetary tightening; a rapid decline in hydrocarbon prices between 1981 and 1986; appreciation of the dollar; rising unemployment; and declining labor costs. In the 1990s, inflation remained low and stable, and the unemployment rate fell from 7% to less than 4% in 2000. In fact, inflation remained low and stable, fluctuating around 2% and 4% between 1981 and 2007. Between the second half of the 1980s and 2007, U.S. inflation and output growth volatility, as measured by standard deviation, declined sharply. This period of low macroeconomic fluctuations is known as the Great Moderation. The assumed benefits of lower volatility include lower transaction costs, greater certainty for consumption and investment, and increased productive employment.

The great moderation

What was the cause of the Great Moderation (G.M.) that occurred during 1984-2007? Kim and Nelson (1999), McConnell and Perez-Quiros (2000) and Kim et al. (2003) claim that in the decades of the Great Moderation, there was a notable decrease in the volatility of output. Warnock and Warnock (2000) further state that employment volatility has also declined. Indeed, in the 1990s, the United States experienced the longest sustained expansion without recessions in its modern history, and the 1980s also saw an increase among the most vigorous. Blanchard and Simon (2001) comment that inflation and output volatility have reduced by 50% and 66% since the G.M. began.

Ahmed et al. (2002) discuss three possible hypotheses that combine to explain the Great Moderation. The first is the "good luck hypothesis," which is that in the G.M. years economic shocks were few and not very significant, so it is not that the U.S. economy has become more stable per se (Stock & Watson, 2003). The second hypothesis states that the G.M. is due to structural changes that have occurred during the period, which have resulted in greater macroeconomic flexibility and more benign cyclical fluctuations, for example, greater efficiency in inventory management, technological progress in the media and cybernetics, institutional changes such as industrial deregulation, financial innovation, the productive transition, and the change in the composition of output toward a lower share of manufacturing and a greater relative weight of services, trade, and financial liberalization. The third hypothesis is the implementation of a more effective monetary policy framework that reacts more to inflation volatility than output volatility and views expectations as a mechanism to reduce macroeconomic volatility. This monetary policy framework is known as the Taylor curve, which establishes the efficient policy possibility

frontier. The objective is a low and stable inflation rate, and the instrument of monetary policy is the interest rate which reacts to output and inflation gaps with a forward-looking monetary policy rule.

$$i_f = \alpha(p - p*) - \beta(y - y*), (\alpha, \beta \geq 0); \quad \alpha + \beta = 1 \tag{6}$$

Where y, y*, i_f, p and p* are observed output, potential output, the federal funds interest rate, the observed inflation rate, and the inflation target, respectively.

Unconventional monetary policy

The Great Financial Crisis of 2007-2008 was a watershed in the practice of monetary policy based on the Taylor rule (1993, 1999). At the outbreak of the crisis, the Fed slashed i_f to 0.25% and kept it at the zero bound between 2009 and 2015, although in 2016 it increased it to 0.5% as a sign of a cautious return to normalcy and then to 2.5% in 2019.

The financial crisis, whose epiphenomenon -but not cause- was the subprime mortgage market debacle, led the U.S. economy into the liquidity trap (Keynes, 1936), an area in which monetary policy focused on the short-term interest rate (the well-known Taylor rule) is practically ineffective because it no longer influences aggregate demand. The process that determined this liquidity trap scenario is complex, including the expansion of household and corporate debt accumulated during the long period of cheap money, depressed real wages and growing inequality, financial speculation -particularly in the derivatives market-, overvaluation of the dollar, and disinflation caused by the contraction of productive investment and manufacturing GDP.

In 2008-2009 the U.S. economy was facing the imminent probability of a profound crisis caused by the combination of deflation and debt, similar to the Great Depression of 1929-1933 (cf. Fisher, 1933). The Fed abandoned the Taylor rule and embraced a non-conventional monetary policy (NCMP). The instruments of this strategy are the expansion of the central bank's balance sheet through massive purchases of financial assets and the influence on expectations through forward guidance initiatives. In addition to the objectives of the Taylor rule (price stability and financial stability), the NCMP aimed to reduce long-term interest rates, increase the prices of long-term bonds, lower their returns and the risk premium on longer-term bonds, reduce expectations of volatility in short-term interest rates, lower the risk of default and increase liquidity, and accelerate economic recovery (cf. Bernanke, 2013, 2015).

As a consequence of the NCMP, the Fed bought huge amounts of toxic assets, devalued private debt (Mortgage Backed Securities, MBS), and longer-term Treasury bonds. This was intended to reduce the cost of credit (Bernanke, 2015) and the yield on these debt bonds and increase the price of other assets.

New money had to be created through the three quantitative easing (Q.E.) operations to achieve this. (Bernanke prefers to call them Credit Easing). Thus, the balance sheet (and monetary supply and base) increased unprecedentedly in the Fed's history between 2008 and 2015 to bail out "too big to fail" financial institutions such as AIG, Citi, Bank of America, and Lehman Brothers (see Figures 1 and 2).

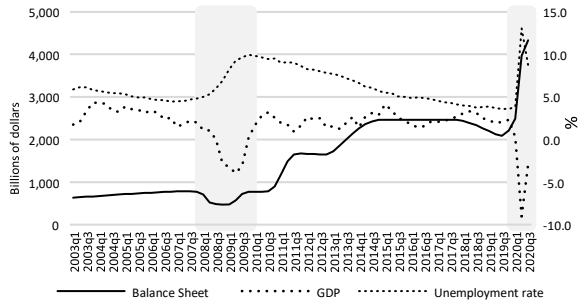

Figure 1. Economic activity, unemployment and debt
Source: Authors´elaboration with FED data

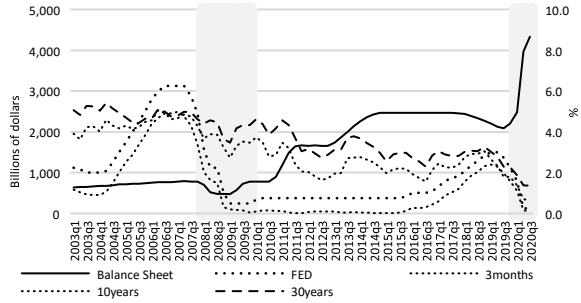

Figure 2. Interest rate in the NCMP framework
Source: Authors´elaboration with FED data

The record liquidity injection did not trigger a hyperinflationary spike, as the canon of quantity theory predicts. The explanation for this is that this feverish liquidity did not flow into consumers' coffers but into those of the banks. Moreover, the banks recycled it back to the Fed as excess reserve holdings that generate a safe interest rate on reserves. On the face of it, government debt equals Fed money. Nevertheless, the issue is more complex. This concerns whether Q.E. operations revived the economy and the apparent conundrum of the absence of an inflationary spiral induced by the Fed's bloated balance sheet. As mentioned above, the economy remained sluggish until 2016-2017 and liquidity was retained in the bank-Fed circuit.

Nevertheless, the NCMP served to avoid deflation (in 2009, the inflation rate was negative). This also increased private debt, especially that of non-financial corporations, so that when the Covid-19 pandemic emerged and hit the economy, the Fed had to lower its interest rate to the zero lower bound in 2020. Thus, it can be stated that the first major lesson is that the Fed's monetary policy to combat the Covid-19 pandemic has been the NCMP and that everything seems to indicate that this policy will continue post-pandemic.

Monetary rule, debt, and stock market dynamics

Macroeconomic, monetary, and financial dynamics: some stylized facts

The recent changes in U.S. economic policy are undoubtedly a watershed. Contrary to the axioms of the New Macroeconomic Consensus and the measures taken by most emerging economies, the Treasury Department and the Federal Reserve have implemented an unconventional policy to cushion the negative effects on the real economy and the financial system associated with the external shocks generated by the dot.com crisis of 2000/2001, the subprime crisis of 2007/2008, and those induced by the Covid-19 pandemic in 2020.

Indeed, monetary expansion (bank reserves) constitutes the operating mechanism of the quantitative easing (Q.E.) process through the purchase of debt securities and private bonds (backed by mortgages), as well as by the swap in open market operations of short-term debt for long-term liabilities (Perrotini, 2015).

In practice, the results seem dissimilar to the objectives expected with the operation of the unconventional monetary policy. In terms of economic activity, the process of convergence of the Gross Domestic Product (GDP) to its equilibrium path has been slow, placing the mean growth rate below the average rate observed during the nineties (see Table 1). In this context, the injection of liquidity had a marginal capacity to significantly boost aggregate demand (consumption and investment) and, with it, the recovery of production and employment until 2020. However, in the first half of 2021, there are signs of a reactivation of GDP and employment with a rebound in inflation (around 5%).

Table 1
USA: Economic and financial performance

Indicator	1990-2000	2000-2010	2010-2020
Interest Rate /3	4.9	2.5	0.5
Consumer Prices /1	2.8	2.4	1.7
GDP /1	3.4	1.7	1.7
Unemployment Rate /3	5.6	5.9	6.4
Exchange Rate /1	1.2	-2.6	1.6
Trade Balance /2	-1.4	-3.6	-2.4
Debt /2	61.0	64.4	102.2
NASDAQ Index /1	24.9	-4.7	15.8
S&P 500 Index /1	15.6	-2.3	11.0
Tax Balance Sheet /2	-3.7	-5.8	-6.8
Savings Rate /2	19.1	19.3	22.9
Capital Formation /1	3.6	-0.9	3.2

/1 = average annual growth rate
/2 = as a proportion of GDP
/3 = average of the indicator

Source: Authors´elaboration with data from the Federal Reserve Bank.

Similarly, the response of the unemployment rate to the 2007/2008 subprime shock, to converge to its equilibrium path, was gradual and slow, with a new inflection point during the close of 2020. A natural discussion, in this context, would be to define the effects and effectiveness of the Fed's current policy on the distribution of income and the expansion of the real economy.

Indeed, the combination of slow price growth, the downward control of the benchmark interest rate and, in general, the Q.E. implemented since 2009 represent the context of the gradual adjustment of long-term interest rates, a condition that has significantly closed the gap between short- and long-term returns. This has led to a process of reconfiguration of the structure of investment portfolios and their returns, which has created an environment of high indebtedness and overvaluation of assets.

The prospects of a rapid recovery in economic activity, rising inflationary expectations, and the fiscal package projected by the Treasury Department to address the economic effects of the Covid-19 pandemic have induced a rise in returns of long-term government bonds (5, 10, and 30 years), which has slowed down the dynamics of the stock markets. The U.S. primary fiscal balance in 2020 was negative -16.69% of GDP (the highest since World War II), and public debt is estimated to amount to over 120% of GDP (MFI, 2020; Fed, 2020; Vázquez et al. 2021). All this resulted from programs to alleviate the economic effects of the Covid-19 pandemic. In particular, the Coronavirus Aid, Relief, and Economic Security (CARES) Act of 2020 comprises: a) food and health assistance, cash transfers, unemployment

insurance, pension payments, and tax discounts and deferrals for households; b) credit facilities, subsidies, and temporary tax suspension for private corporations; and c) education funds and various assistance mechanisms for local governments.

In the United States, the Covid-19 pandemic dramatically increased the unemployment rate, particularly among African Americans and low-wage women in the service sector (Holder & Masterson, 2020). It is estimated that the unemployment rate was 50% higher than during the Great Recession of 2007-2009. This does not include those who are in non-formal work or are looking for work and do not participate in the labor force.

Given the severity of the pandemic's impact, even conservative authors have suggested unorthodox policies. Gali (2020) proposed using "helicopter money" as an alternative measure of money creation or credit linked to the central bank account, namely, generating credit on behalf of the government. This money would be dispersed through additional, non-refundable transfers from the government. Due to low-interest rates, helicopter money would not impact the central bank's capital account. These unconventional monetary measures can be applied temporarily through fiscal interventions in emergencies such as the economic crisis caused by COVID-19.

The combination of low-interest rates and pandemic-generated stagnation is the new normal (Krugman, 2020). The above can be understood as another lesson from the post-Covid-19 era: the new normal of the U.S. macroeconomy is characterized by a liquidity trap (low-interest rates and high debt levels) plus unconventional long-term monetary policy. Fiscal stimulus is, for the time being, the remedy to alleviate urgent health problems, unemployment, and slowing aggregate demand. However, in the face of a long-term fiscal stimulus, there is concern about the impact on the debt. The current low-interest rates do not seem to have an adverse effect, but everything changes when the debt-to-GDP ratio is considered. Due to the current low growth rates, the increase in the above ratio may rise and cause a debt spiral. An increase in fiscal stimulus does not cause an increase in interest rates, but as Krugman (2020) suggests, it should be channeled to public investment or productive programs.

As for the stock market response to the expansion of debt (balance sheet), the effects have been markedly positive, as the stock market has been able to effectively capitalize on the injection of liquidity provided by the monetary authority in the wake of quantitative easing (see Figure 3). Likewise, the operation of unconventional monetary policy constitutes a Fed mechanism for offsetting the price deceleration and thus ensuring the achievement of the inflation target (see Figure 4).

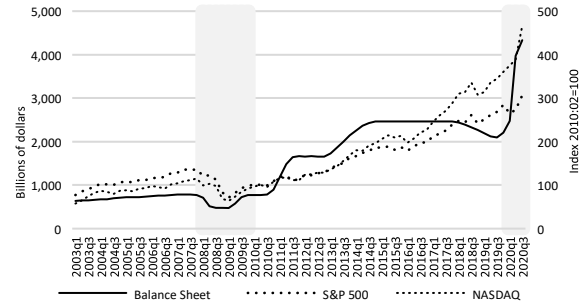

Figure 3. Effect of debt on the stock market
Source: Authors´elaboration with FED data.

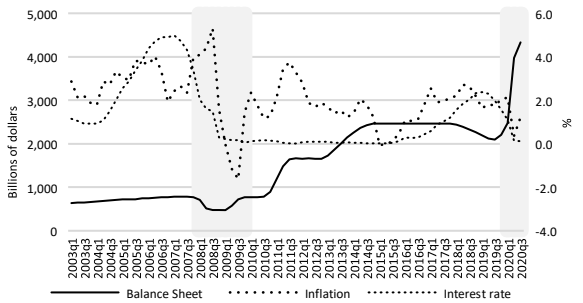

Figure 4. Inflation adjustment and NCMP
Source: Authors´elaboration with FED data.

A dynamic model of the monetary rule: Methodological aspects

The aim is to empirically test that, in an unconventional monetary policy regime (such as the one applied by the Fed to alleviate both the financial crisis of 2007-2009 and the effects of the Covid-19 pandemic), an increase in debt and low-interest rates (income from supply and/or demand shocks) generates greater economic and financial fragility. Minsky's (1982, 1991) financial instability hypothesis or "Wall Street paradigm" is based on Keynes' (1936) liquidity preference theory and Fisher's (1933) debt-deflation theory of great depressions.

Minsky's model focuses on the relations between finance, capital asset values, and investment. The main message of his theory is that the capitalist economy is inherently unstable, that disequilibrium and unemployment are its normal circumstances, and that the cause of instability lies in the financial system, in the role of debt and credit: the excessive leverage of corporations generates destabilizing effects.

Following Minsky's theory, Delli Gatti *et al*. (1994) have analyzed the growing indebtedness of U.S. corporations during the 1980s. Their analysis shows that when the financing of economic activity and financial speculation increasingly depend on debt, a cyclical pattern tends to occur whereby the economy moves from a financially robust expansion (where income increases and debt decreases) to a phase of fragile growth (where income and debt increase), then to a stage of fragile recession (debt increases and income decreases) and, finally, to a phase of robust recession (debt decreases and income decreases). Delli Gatti *et al*. thus express Minsky's taxonomy (1982, p. 105-111) of Hedge, Speculative, and Ponzi financial structures.

Next, reaction functions for output, inflation, stock market activity, and the interest rate to changes in debt based on the theoretical foundations of Lucas (1972), Ahmed *et al*. (2002), Hetzel (2008), and Taylor (1999) are specified.

Given the above, the empirical study is based on an Autoregressive with Distributed Lag (ARDL) model, for which, in generic form, the following stochastic function is assumed:

$$\tau_t = \sum_{j=1}^{p} \theta_j i_{t-j} + \sum_{j=0}^{q-1} \psi_j^{'} \Gamma_{t-j} + \varepsilon_t \tag{7}$$

Where τ_t represents the reaction variable of each specification (gross domestic product, prices, interest rate, and stock market index), while Γ_t constitutes a column vector of explanatory variables (productivity, capital stock, prices, gross domestic product, money supply, nominal exchange rate, debt, and stock market index); while θ_j and $\psi_j^{'}$ are coefficient vectors and ε_t is a column vector of random disturbances with zero mean and constant variance.

If the series of expression (7) is integrated of order I(d) and the error term is a stationary stochastic process in levels, then an error correction equation should be incorporated into the autoregressive model to capture the short-term deviations of the variables from the equilibrium path. Therefore, the corresponding reaction function will be defined as:

$$\Delta\tau_t = \beta_0 + \beta' \Gamma_t + \alpha i_{t-1} + \sum_{j=1}^{p} \theta_j \Delta i_{t-j} + \sum_{j=0}^{q-1} \psi_j^{'} \Delta \Gamma_{t-j} + u_t \tag{8}$$

In this equation, τ_t represents the reaction variable of each specification, Γ_t constitutes a column vector of explanatory variables; β' is a vector of kx1 long-run estimators, while the vectors θ_j and $\tau_j^{'}$ contain

the short-run coefficients. Meanwhile, α, u_t and Δ constitute, respectively, the adjustment speed coefficient, the system error term, and the first difference operator (Pesaran *et al.* 2001).

It is expected that an increase in debt will first induce an increase in prices, which would support the conjecture that the Fed's balance sheet expansion has been a mechanism to reverse the deflationary process in the United States, especially since the 2008 subprime crisis. Second, a significant impact on capital market dynamics, which would support the perspective that the expansion of the federal debt (and thus of the balance sheet) would be aimed at containing the misalignments of the financial system (providing liquidity and dampening volatility); however, this condition could also generate a stock market overvaluation and, therefore, an abrupt correction of the stock market.

Some of the advantages[1] of using the ARDL methodology in multivariate time series analysis are i) it allows the combination of variables with different orders of composition in the system, thus avoiding the problem associated with standard cointegration analysis; ii) it produces unbiased estimates of the long-run coefficients, although the system variables are endogenous; iii) the estimators are efficient and consistent even with small samples (Pesaran *et al.* 2001).

Monetary policy and debt: Analysis and interpretation of results

The study uses quarterly U.S. data from 2000-2020 on labor productivity, capital stock, interest rate, consumer price index, Gross Domestic Product, debt, money supply (M1 aggregate), stock market index, and exchange rate. The information can be found in the statistical repositories of the Federal Reserve and the Organization for Economic Cooperation and Development (OECD).

Following Equation (2), four reaction functions to debt variations are estimated: the first, columns (A) and (B), assesses the effect on stock market performance; the second, columns (C) and (D), corresponds to the impact on GDP dynamics; the third, columns (E) and (F), captures the effect on price stability; the fourth, columns (G) and (H), measures the implications on the interest rate.

The test of the present paper's hypothesis begins with studying the stochastic properties of the series included in each system, using the Augmented Dickey-Fuller (ADF) and Phillips-Perron (P.P.) unit root tests. The results suggest that the variables are integrated of order one in levels and stationary

[1]In contrast with other methodologies, such as Autoregressive Vectors with Error Correction, which, from the structural point of view, uses little a priori information on the relation between the variables and proposes an endogenous system in which there will be as many equations as variables included in the model and a significant block of lags, which generates a relevant loss of degrees of freedom, given the excessive loading of parameters in the estimation and the loss of robustness of the variance-covariance matrix in small samples. In addition, its operation requires that the incorporated series be integrated of the same order, which causes a significant restriction in its use and estimation.

stochastic processes in first differences. Having determined the order of composition, the next step is to identify whether an equilibrium relation persists between the variables. Following the procedure of Pesaran *et al*. (2001), a long-run co-movement in the regressions is confirmed (see appendixes A1 and A2). Although the econometric diagnosis did not reveal problems of autocorrelation (Breusch-Godfrey) or heteroscedasticity (White), evidence suggests that the residuals do not follow a normal distribution (Royston), see appendixes A3, A4 and A5.

In general, the estimates show that the most notable effect associated with debt expansion is the one on stock market dynamics since the response of the stock market index to an increase in government liabilities is significantly elastic. This outcome is consistent with the conjecture that the Fed's purchase of government bonds (increase in the balance sheet) is mainly aimed at injecting liquidity to cushion the instability of the financial system caused by the shocks of 2008 and 2020, against the backdrop of the impact generated on the performance of the real economy (see Table 2). Nonetheless, in the medium and long term, the low-interest rate policy, implemented since the subprime crisis, has created a greater preference for riskier assets due to the loss of profitability in commercial banking, which drives a systematic inflationary process of financial assets, with an inflection point at the moment of normalization of the Fed's monetary policy.

Table 2
United States: Economic Performance, Stock Market Dynamics, and Debt (2000-2020)

Variable	Model A dlnib	Model B dlnib	Model C Dlny	Model D dlny	Model E dlnp	Model F dlnp	Model F Dlni	Model H dlni
Constant	-29.1987 [0.000]	-17.4498 [0.000]	-0.5075 [0.441]	-0.3622 [0.590]	-3.3679 [0.088]	-3.9043 [0.006]	0.1043 [0.003]	-0.0152 [0.710]
P	-	-	-	-	-	-	0.3221 [0.062]	0.5823 [0.023]
Y	-	2.8471 [0.017]	-	-	0.6784 [0.000]	0.5363 [0.000]	0.0409 [0.003]	0.0458 [0.001]
Debt	2.0963 [0.000]	1.6218 [0.009]	-0.1528 [0.000]	-0.1784 [0.000]	0.2560 [0.000]	0.1402 [0.000]	-0.0200 [0.000]	-0.0154 [0.001]
Ib	-	-	-	0.0181 [0.057]	0.0596 [0.030]	0.0515 [0.008]	0.0022 [0.225]	-
M	-	-	-	-	-0.1746 [0.000]	-0.0248 [0.528]	-	-
E	0.9945 [0.035]	1.1004 [0.011]	-	-	-	-0.1709 [0.001]	-	0.0087 [0.071]
I	13.7414 [0.001]	10.9601 [0.044]	-0.1513 [0.491]	-0.1798 [0.358]	-0.4787 [0.140]	-0.4643 [0.044]	-	-
K	-	-	0.6664 [0.000]	0.6542 [0.000]	-	-	-	-
Pl	-	-	0.6119 [0.014]	0.5834 [0.033]	-	-	-	-
Adjustment coefficient	-0.1673 [0.000]	-0.1830 [0.004]	-0.3734 [0.001]	-0.5026 [0.003]	-0.2204 [0.000]	-0.2821 [0.000]	-0.2036 [0.000]	-0.1640 [0.000]

Source: Authors´elaboration with data from the U.S. Federal Reserve.

On the other hand, estimates show that debt expansion seems to be emerging as a price adjustment mechanism in the United States. Indeed, the outbreak of the 2008 crisis represented not only a financial and economic turning point but also a deflationary phase for the U.S. economy, which has been offset by the implementation of a set of unconventional measures to ensure the profitability (balance sheets) of financial and non-financial corporations through monetary stimulus programs (Q.E.). In this way, the significant purchase of Treasury and mortgage bonds by the Fed (unconventional expansionary monetary policy), in the face of the shocks of 2008 and 2020, is aimed at stabilizing the value of goods and services to reverse the deflationary process that both disruptive economic episodes have induced; this conjecture is confirmed by the effect of the increase in debt and money supply on the evolution of prices (see Table 2).

Although the monetary stimulus implemented by the Treasury Department and the Fed is the main measure to cushion the recession and guide the economic recovery, according to the estimates the increase in debt does not seem to generate a significant stimulus to productive activity (depressed aggregate demand), which confirms the presence of biases in the distribution of income. A consequence on the horizon would be the risks of future shocks in terms of a fiscal crisis, due to the excessive increase in the size and cost of debt, in addition to those associated with the overvaluation of stock portfolios.

Conclusions

This paper studies the relation between Fed monetary policy, U.S. government debt, and the stock market from 2000 to 2020. The Fed has pragmatically used various instruments to achieve its dual mandate of price stability and full employment, from the Phillips Curve (1960s) to monetary aggregates and Friedman's natural rate of unemployment hypothesis (1979-1982), the Taylor Curve (1984-2007), and unconventional monetary policy (2009-2020).

After discussing the theoretical elements and the various empirical results in the literature, the next step was an econometric analysis. This suggests that the main effect of using debt as a stabilization instrument during the 2007 financial crisis and the COVID-19 public health emergency has been on the stock market. An elastic relation is observed between the response of the stock market index and the increase in public debt.

Indeed, the Fed's massive purchase of government bonds by increasing its balance sheet has been aimed at stabilizing the financial system. However, its impact on the real economy appears marginal; although the operation of unconventional monetary policy has allowed the U.S. economy to avoid the risk of deflation, it has not generated an acceleration in output growth or employment. Rather, it has created significant pressure on corporate indebtedness. Thus, the results suggest that productivity and capital

formation are the determinants of output expansion, while the impact of debt on GDP dynamics and the interest rate is negative; likewise, the evidence confirms that quantitative easing plays a relevant role as a compensatory mechanism for the deflationary pressures facing the U.S. economy.

Undoubtedly, a key topic associated with the excess supply of liquidity is the increase in the prices of financial assets due to short-term expectations about the depth of the impact that this could cause when the Fed normalizes its monetary policy; the systematic growth of the stock and credit market, derived from the operation of the unconventional monetary policy, could be driving an asset bubble in a phase of inflection for the functioning of world markets.

Future research will evaluate the transmission effect of quantitative easing by the United States on macroeconomic and exchange rate dynamics in emerging markets. Therefore, it is necessary to analyze the adequacy of the current monetary policy to cushion supply and demand shocks in the post-pandemic period.

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Appendix

Table A1
Unit root test

Variable	Dickey-Fuller Augmented			Phillips-Perron			Backlog	Order of integration
	Without I and T	With I	With I and T	Without I and T	With I	With I and T		
lnipc	-1.334	-3.201 [0.0199]	-3.750 [0.0192]	-1.682	-3.207 [0.0196]	-3.368 [0.0558]	6	I(1)
lny	2.427	-1.286 [0.6358]	-1.905 [0.6521]	3.152	-0.996 [0.7547]	-2.674 [0.2469]	2	I(1)
Debt	4.668	0.001 [0.9586]	-1.733 [0.7360]	5.957	0.051 [0.9625]	-1.667 [0.7650]	1	I(1)
lnib	1.429	0.600 [0.9876]	-3.051 [0.1185]	1.426	0.768 [0.9911]	-3.470 [0.0427]	2	I(1)
lnm	2.556	1.598 [0.9979]	-0.837 [0.9624]	3.741	2.047 [0.9987]	-0.669 [0.9751]	2	I(1)
lne	-0.595	-1.966 [0.3018]	-1.633 [0.7793]	-0.538	-1.899 [0.3324]	-1.596 [0.7938]	3	I(1)
lni	-2.967	-3.520 [0.0075]	-3.814 [0.0159]	-2.825	-2.937 [0.0413]	-2.813 [0.1923]	4	I(1)
lnk	2.346	-2.101 [0.2442]	-1.487 [0.8337]	14.365	-2.335 [0.1610]	-2.658 [0.2539]	3	I(1)
lnpl	4.122	-0.210	-2.377	4.541	-0.214	-2.419	1	I(1)

		[0.9373]	[0.3919]		[0.9368]	[0.3697]		
dlnipc	-4.262	-4.247 [0.0005]	-4.221 [0.0042]	-7.408	-7.348 [0.0000]	-7.279 [0.0000]	5	I(0)
dlny	-3.787	-4.598 [0.0001]	-4.605 [0.0010]	-9.300	-10.349 [0.0000]	-10.336 [0.0000]	1	I(0)
dlndebt	-1.416	-3.241 [0.0177]	-3.225 [0.0795]	-5.995	-8.136 [0.0000]	-8.092 [0.0000]	3	I(0)
dlnib	-5.380	-5.555 [0.0000]	-6.034 [0.0000]	-5.809	-5.944 [0.0000]	-6.301 [0.0000]	1	I(0)
dlnm	-2.261	-3.355 [0.0126]	-3.878 [0.0130]	-4.772	-5.791 [0.0000]	-6.254 [0.0000]	1	I(0)
dlne	-5.065	-5.060 [0.0000]	-5.268 [0.0001]	-6.045	-6.025 [0.0000]	-6.113 [0.0000]	2	I(0)
dlni	-3.497	-3.573 [0.0063]	-3.699 [0.0224]	-4.275	-4.381 [0.0003]	-4.515 [0.0014]	5	I(0)
dlnk	-1.855	-3.022 [0.0329]	-3.625 [0.0278]	-2.362	-3.360 [0.0124]	-3.287 [0.0684]	2	I(0)
dlnpl	-7.346	-9.058 [0.0000]	-9.001 [0.0000]	-7.346	-9.058 [0.0000]	-9.001 [0.0000]	0	I(0)

p: consumer price index; y: gross domestic product; debt: federal debt; ib: NASDAQ stock index; e: exchange rate (basket); i: interest rate; k: capital stock; pl: labor productivity; m: money supply. Estimated p-value in brackets
Source: Authors´elaboration.

Table A2
Pesaran, Shin, and Smith Cointegration Test

Specification	Statistic	10%		5%		1%	
		I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
Model A	F = 4.199	2.435	3.303	2.880	3.828	3.877	4.984
	t = -2.979	-2.549	-3.424	-2.867	-3.774	-3.492	-4.448
Model B	F = 3.469	2.276	3.222	2.673	3.706	3.561	4.768
	t = -2.950	-2.543	-3.641	-2.863	-4.001	-3.494	-4.695
Model C	F = 8.858	2.255	3.234	2.652	3.725	3.544	4.808
	t = -3.317	-2.525	-3.617	-2.848	-3.982	-3.486	-4.687
Model D	F = 10.079	2.090	3.206	2.453	3.685	3.275	4.753
	t = -3.112	-2.468	-3.749	-2.803	-4.137	-3.464	-4.891
Model E	F = 15.422	2.255	3.234	2.652	3.725	3.544	4.808
	t = -3.767	-2.525	-3.617	-2.848	-3.982	-3.486	-4.687
Model F	F = 27.981	2.128	3.182	2.492	3.648	3.308	4.677
	t = -5.363	-2.505	-3.801	-2.833	-4.179	-3.481	-4.911
Model F	F = 5.534	2.248	3.238	2.645	3.731	3.538	4.821
	t = -5.080	-2.519	-3.610	-2.843	-3.976	-3.483	-4.684
Model H	F = 6.622	2.248	3.238	2.645	3.731	3.538	4.821
	t = -4.991	-2.519	-3.610	-2.843	-3.976	-3.483	-4.684

Estimated p-value in brackets; Ho: No long-term relation exists
Source: Authors´elaboration.

Table A3
LM Test (Breusch-Godfrey statistic)

Specification	Backlog (p)				
	1	2	3	4	5
Model A	[0.4096]	[0.3995]	[0.5863]	[0.7026]	[0.6427]
Model B	[0.6524]	[0.6196]	[0.7564]	[0.8325]	[0.7083]
Model C	[0.5435]	[0.3776]	[0.4249]	[0.2944]	[0.3817]
Model D	[0.7160]	[0.7250]	[0.1122]	[0.1217]	[0.0341]
Model E	[0.6363]	[0.8786]	[0.9672]	[0.7612]	[0.8411]
Model F	[0.8220]	[0.8074]	[0.8006]	[0.3364]	[0.4136]
Model F	[0.5380]	[0.3224]	[0.1725]	[0.2749]	[0.0687]
Model H	[0.9320]	[0.8197]	[0.8486]	[0.7295]	[0.2774]

Estimated p-value in brackets; Ho: No autocorrelation exists
Source: Authors´elaboration.

Table A4
Heteroscedasticity test (White's statistic)

Specification	Model A	Model B	Model C	Model D	Model E	Model F	Model F	Model H
Prob > chi2	[0.0426]	[0.0852]	[0.0712]	[0.0558]	[0.4471]	[0.4471]	[0.4471]	[0.4471]

Estimated p-values in brackets; Ho: Residuals are homoscedastic
Source: Authors´elaboration.

Table A5
Normality Test (Royston's statistic)

Specification	Model A	Model B	Model C	Model D	Model E	Model F	Model F	Model H
Prob > chi2	[0.0022]	[0.0024]	[0.0000]	[0.0000]	[0.2588]	[0.0001]	[0.0014]	[0.0003]

Estimated p-value in brackets; Ho: Errors are normally distributed
Source: Authors´elaboration.