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Abstract

I develop flexible- and sticky-price general equilibrium models that embody endogenous corporate financing decisions affecting firm value due to distortionary taxes. Nominal interest-rate variations impact the costs of debt and equity capital asymmetrically and thereby induce firms to modify the financial structure, altering the gap between the optimization-based weighted average cost of capital and the real interest rate. Under these circumstances, I characterize conditions under which rules-based monetary policies that set the nominal interest rate as an increasing function of the inflation rate induce aggregate stability in the form of a unique stable equilibrium. In contrast to what is commonly argued, I demonstrate that both passive interest rate policies, which underreact to inflation, and mildly active interest rate policies, which overreact to inflation but below a threshold reflecting both tax and capital structures, ensure determinacy of equilibrium. Conversely, excessively aggressive inflation-fighting monetary actions are destabilizing in the presence of price stickiness by generating either multiple equilibria or the nonexistence of stable equilibria. Under the stabilizing monetary regimes, I prove that macroeconomic dynamics following either interest rate normalization or temporary monetary tightening critically depend upon the tax code and the steady-state debt-equity ratio.

JEL Classification: E52; E31; G32; H24; H25.

Keywords: Corporate Finance; Firm Financial Structure; Weighted Average Cost of Capital; Distortionary Taxation; Interest Rate Policy; Equilibrium Dynamics; Monetary Policy Shocks.

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1 Introduction

The modern monetary theory that scrutinizes the nexus between the conduct of interest rate policy and aggregate stability (e.g., Taylor, 1999; Benhabib, Schmitt-Grohé and Uribe, 2001; Dupor, 2001; Bullard and Mitra, 2002; Woodford, 2003; Galí, 2015; Walsh, 2017; Bordo, Cochrane and Taylor, 2024) employ models that typically abstract from the modes of corporate finance and the associated optimal financial policies. The first contribution of the present paper is to set forth flexible- and sticky-price general equilibrium models that embody endogenous corporate financing decisions affecting firm value due to distortionary taxes. Allowing for the presence of corporate and personal taxes engenders deviations from the Modigliani-Miller capital structure irrelevance theorem that are central in the traditional theory of corporate finance (e.g., Copeland, Weston and Shastri, 2013) but unexplored in the theory of monetary policy rules. A key feature of the framework I develop here is the emergence of an endogenous gap between the optimization-based weighted average cost of capital and the real interest rate. Importantly for my purposes, this gap is crucially dependent upon monetary policy behavior, for nominal interest-rate variations impact the costs of debt and equity capital asymmetrically, inducing firms to modify the debt-equity mix to finance investment plans. The pass-through from the nominal interest rate to the wedge between the equilibrium cost of capital and the real interest rate reveals to be a critical channel through which monetary policy transmission impinges on both the demand- and supply-side of the economy.

I use the resulting theoretical setup to examine fundamental issues for monetary policy design. Specifically, my second contribution is to analytically characterize the dynamic properties of interest-rate feedback policy rules—that is, rules in which the nominal interest rate is set by monetary authorities as an increasing function of the inflation rate. A robust result that emerges from my analysis is that either passive monetary policies, which underreact to inflation, or mildly active monetary policies, which overreact to inflation but below a certain threshold, ensure aggregate stability by inducing real determinacy of equilibrium. In the presence of price stickiness, excessively aggressive inflation-fighting actions by monetary policymakers are shown to open the door to aggregate instability in the form of either multiple equilibria or nonexistence of a stable equilibrium. Thus, the famous Taylor's principle (Taylor, 1993, 1999)—that is, the prescription that the central bank should raise the nominal interest rate by more than one-for-one with increases in inflation—is neither a necessary nor a sufficient condition in order to protect the real side of the economy from embarking on expectations-driven fluctuations.

The reason why either a passive or a moderately active stance of monetary policy serves the purpose of guaranteeing macroeconomic stability in the presence of endogenous corporate financial policies can be laid out in two steps. The first step concerns the pass-through from the nominal interest rate to the weighted average cost of capital. The second step concerns the consequences of the pass-through for macroeconomic dynamics.

To be as transparent as possible, consider the limiting case in which the central bank responds to an increase in inflation by means of a "neutral" monetary policy stance, that is, raising the nominal interest rate one-for-one with the inflation rate. Consequently, the real interest rate remains unchanged. However, the financial structure employed by optimizing firms does modify, for the impact on the costs of debt and equity capital is, in general, unequal. The real cost of debt capital unambiguously falls, due to nominal interest-deductibility from the corporate income tax base. The real cost of equity capital may increase or decrease, depending on whether the tax rate on capital gains is higher or lower than the tax rate on personal income. The key point is that the endogenous switch toward the lowest-priced mode of corporate finance proves to induce a decline the weighted average cost of capital in real terms for any empirically plausible tax code and steady-state capital structure. The extension of this argument is straightforward. The equilibrium cost of capital unambiguously decreases for any passive monetary policy stance. And it may even fall under an active monetary policy stance, provided that the policy feedback to inflation is below a certain threshold. Such a threshold precisely depends on the steady-state financial structure and the tax code.

Now, in a macroeconomic environment in which both demand- and supply-side channels of monetary policy transmission are operative due to above optimal corporate financing choices, a passive or moderately active interest rate policy—which gets passed through into reductions in both the weighted average cost of capital and the after-tax real interest rate following inflationary pressures—turns to be stabilizing. Under both flexible and sticky prices, there typically exists a positively sloped saddle path in the capital stock-inflation space converging to the steady state. The underlying economic mechanism is as follows. Suppose that the initial stock of capital is higher than its steady-state value. The initial overshooting in the inflation rate brings about a decline in the real cost of capital, thereby inducing firms to reduce their recourse to labor. The resulting rise in leisure must be associated with a fall in the marginal utility of wealth and an increase in private consumption when leisure and consumption are normal goods. Two consequences arise. First, the increase in consumption crowds out corporate investment, thereby making the stock of capital converge toward the steady state via the law of motion of capital. Second, expectations of future increases in the marginal utility of wealth toward the steady state require reductions in the after-tax real interest rate via the Euler equation, which precisely apply when the stance of monetary policy is passive or mildly active.

Under the monetary regimes that deliver equilibrium determinacy, I then characterize equilibrium dynamics following either permanent or temporary monetary policy shocks. Specifically, my third contribution is to examine the dynamic consequences of interest rate normalization in the form of a permanent, exogenous shock entering the policy rule and increasing the long-run equilibrium rate of nominal interest one-for-one, along the lines proposed by Schmitt-Grohé and Uribe (2022). Notably, the implications of interest rate normalization after a prolonged period—since the Great Recession—of below-target inflation in conjunction with the nominal interest rate constrained at the lower bound constitute a focal issue in the current monetary policy debate. A central insight that comes from my investigation is that macroeconomic dynamics as a consequence of interest rate normalization critically depend upon the tax structure and the steady-state debt-equity ratio.

In a forward-looking optimizing environment, the transitional adjustment of macroeconomic variables following interest rate normalization is determined in part by the agents' expectations of the steady-state equilibrium. The key point here is that corporate financing decisions in the presence of tax incentives make a permanent, exogenous shift in the nominal interest rate—which drive up long-run inflation via the Fisher effect—non-superneutral. For such a shift gets passed through into long-run variations in the wedge between the weighted average cost of capital and the after-tax real interest rate—the latter pinned down by the rate of time preference, with the result of affecting the steady-state capital-labor ratio via the "modified golden rule" prevailing in the present framework. The non-superneutrality of monetary policy turns to engender a non-trivial transitional dynamics. When the steady-state debt-equity ratio and the tax rate on corporate income are relatively low—implying a relatively moderate "tax shield" due to the interest-deductibility of debt, the gap between the long-run real cost of capital and the rate of time preference increases following interest rate normalization, causing the long-run capital stock to decline. As a result, short-run investment falls, with inflation that on impact may overshoot or undershoot its higher long-run rate depending on whether the monetary policy stance is relatively inactive or sufficiently active. Conversely, when the steady-state debt-equity ratio and the tax rate on corporate income are relatively high—implying a relatively pronounced tax shield, the gap between the long-run real cost of capital and the rate of time preferences decreases following interest rate normalization, causing the long-run capital stock to raise. As opposed to the previous case, short-run investment now increases, with inflation that on impact always undershoots its higher long-run rate, irrespectively of the monetary policy stance.

The analysis of the macroeconomic effects driven by temporary monetary tightening—the final contribution of the present study—gives further robustness to the foregoing paper's message: the financial structure employed by firms in the steady-state equilibrium and the tax code are critical in determining not only quantitatively but also qualitatively the dynamic behavior of macroeconomic variables in response to monetary shocks. Following a transitory, exogenous hike in the nominal interest rate, the saddle path shifts temporarily, returning to the initial position when the shock vanishes. In this case, macroeconomic variables embark on a temporarily unstable equilibrium trajectory, reaching the initial saddle path when the monetary shock dissipates. Three consequences emerge. First, the impact effects on the macroeconomic variables are in general lower with respect to the case of a permanent monetary shock. Second, whether or not the inflation response to temporary monetary tightening exhibits a "price puzzle" (Sims, 1992; Eichenbaum, 1992) hinges precisely on both capital and tax structures—an aspect uninvestigated by the price-puzzle literature (see, e.g., Rabanal, 2007). Third, nonmonotonic dynamics may arise. For example, if monetary policy is sufficiently active, the tax shield is relatively low, and the intertemporal capital decumulation effect prevails on the Fisher effect, inflation decreases on impact and typically follow, thereafter, a non-monotonic dynamics overshooting the target rate before converging to the steady-state equilibrium.

The general equilibrium framework set forth in this paper and the results derived from the present analysis contribute to the literature on the design of stabilizing monetary policy rules. In particular, the paper is closely connected to the seminal works by Benhabib, Schmitt-Grohé and Uribe (2001) and Dupor (2001). Both emphasize the importance of the supply-side channel for the transmission of nominal interest-rate variations, which is arguably overlooked by standard New Keynesian setups of the type developed by Woodford (2003) and Galí (2015).[1] I lay out a general equilibrium framework in which the supply-side channel of monetary policy internalizes endogenous adjustments in the corporate financial structure and, in this context, convey new results on the dynamic effects generated by interest-rate feedback policy rules of the Taylor-type. In his influential sticky-price model with endogenous investment, Dupor (2001) demonstrates that active monetary policies are always destabilizing. When departures from the Modigliani-Miller neutrality theorem are operative in the economy because of distortionary taxes, I show that active monetary policies are typically stabilizing under flexible prices and may be feasible for equilibrium determinacy even under sticky prices, provided that the degree of aggressiveness in fighting inflationary pressures remains below a given threshold, reflecting both tax and financial structures. Dupor (2001)

[1]See, e.g., Barth and Ramey (2001), Christiano, Eichenbaum and Evans (2005), Rabanal (2007), and Gilchrist and Zakrajšek (2015) for the empirical relevance of the supply-side effects of monetary policy.

also establishes that a temporary, exogenous increase in the nominal interest rate under a passive monetary policy stance is inflationary. I demonstrate that when the tax shield is relatively high and the intertemporal capital accumulation effect prevails on the Fisher effect, a temporary, exogenous nominal interest-rate hike under a passive monetary policy stance is, on the other hand, disinflationary. Taking stock, the theoretical results derived in this paper give analytical foundations to the argument that considering explicitly optimal corporate financial policies within general equilibrium monetary models may be essential for a comprehensive characterization of the dynamic properties of alternative monetary policy rules.

The paper is further related to the studies intended to place corporate finance within a macroeconomic environment. De Fiore and Uhlig (2011, 2015), in particular, build a general equilibrium setup incorporating firms' optimal choices about alternative instruments of external finance in the presence of private information on a productivity factor (Carlstrom and Fuerst, 1997, 1998; Bernanke, Gertler, and Gilchrist 1999). Their framework is capable of accounting for the long-run differences in corporate finance between the United States and the euro area, as well as explaining the observed shift over the financial crisis of 2008-2009 from bank finance to bond finance. On the other hand, in the context of the New Monetarist literature discussed by Lagos, Rocheteau, and Wright (2017) and Rocheteau and Nosal (2017), Rocheteau, Wright and Zhand (2018) construct a general equilibrium model where firms finance investment opportunities using trade credit, bank-issued assets, or currency. Their framework gives rise to an endogenous pass-through from the nominal interest rates to real lending rates depending on market microstructure, monetary policy in the form of money growth or open market operations, and firm characteristics. The present analysis differs from these works in two relevant dimensions. First, I develop flexible- and sticky-price general equilibrium models in which the pass-through from the nominal interest rate to the weighted average cost of capital in real terms emerges endogenously as a result of corporate financing choices that affect firm value due to differential, distortionary tax treatments of alternative financial instruments. Deviations from the Modigliani-Miller capital structure irrelevance theorem arising from the presence of corporate and personal taxes, which are crucial in the conventional theory of corporate finance, appear to have been overlooked by both the New Keynesian and the New Monetarist literature. Second, my primary objective in this paper is to employ the resulting model to study the link between feedback monetary policy rules of the Taylor-style and macroeconomic stability, as well as the dynamic effects of permanent and temporary monetary policy shocks.

The remainder of the paper is organized in five sections. Section 2 develops the baseline model with flexible prices and analyzes equilibrium dynamics generated by interest-rate feedback rules. Section 3 extends the investigation to a macroeconomic environment with sticky prices. Sections 4 and 5 examine transitional dynamics in the presence of price stickiness following monetary policy shocks in the form of interest rate normalization and temporary monetary tightening, respectively. Section 6 summarizes the main conclusions.

2 A Flexible-Price Model

In this section, I present analytically tractable flexible-price model encompassing optimal corporate financial policies in the presence of distinct tax treatments of alternative securities. In this environment, which turns to exhibit non-neutrality of monetary policy and corporate capital structure on the behavior of real macroeconomic variables, I characterize conditions under which interest-rate feedback policies reacting to inflation stabilize the real side of the economy by guaranteeing the existence of a unique stable equilibrium.

2.1 Household Sector

The economy is populated by a large number of identical infinitely lived households with preferences defined over consumption and labor. The representative household's lifetime utility function is of the form

$$U(0) = \int_0^\infty e^{-rt} u(c,h) dt, \tag{1}$$

where $r > 0$ denotes the rate of time preference, c consumption, and h labor supply. The instant utility function $u(\cdot,\cdot)$ is twice continuously differentiable and satisfies $u_c > 0$, $u_h < 0$, $u_{cc}, u_{hh} < 0$, $u_{ch} < 0$, and $u_{cc}u_{hh} - u_{ch}^2 > 0$. The household accumulates assets in the form of nominal government bonds, B_g, which pay the nominal interest rate R_g, nominal corporate bonds, B_p, which pay the nominal interest rate R_p, and nominal equities, QE, where E is the number of shares outstanding and Q the share price. Letting P denote the price level, $\pi \equiv \dot{P}/P$ the inflation rate, $b_g \equiv B_g/P$ real government bonds, $b_p \equiv B_p/P$ real corporate bonds, $q \equiv Q/P$ the relative price of equities, w the real wage, T_h real personal taxes, and $i \equiv D/qE$ the dividend yield, where D are real dividends, the household's instant budget constraint is given by

$$\dot{b}_g + \dot{b}_p + q\dot{E} = wh + (R_g - \pi) b_g + (R_p - \pi) b_p + iqE - c - T_h. \tag{2}$$

Total personal taxation consists of taxes on ordinary personal income—that is, income arising from wages, interest payments, and dividends, taxes on nominal capital gains, and lump-sum taxes. Formally,

$$T_h = \tau_y \left(wh + R_g b_g + R_p b_p + iqE \right) + \tau_c \left(\dot{q} + q\pi \right) E + Z, \tag{3}$$

where $0 \leq \tau_y \leq 1$ represents the flat tax rate on ordinary personal income, $0 \leq \tau_c \leq 1$ the tax rate on nominal capital gains, and Z real lump-sum taxes.

The household chooses paths for $c, h > 0$ and b_g, b_p, E so as to maximize (1) subject to (2), (3), the initial conditions $B_g(0) = B_{g0}$, $B_p(0) = B_{p0}$, $E(0) = E_0$, and the no-Ponzi game conditions $\lim_{t\to\infty} e^{-\int_0^t [R_g(s)(1-\tau_y)-\pi(s)]ds} b_g(t) \geq 0$, $\lim_{t\to\infty} e^{-\int_0^t [R_p(s)(1-\tau_y)-\pi(s)]ds} b_p(t) \geq 0$, and $\lim_{t\to\infty} e^{-\int_0^t [R_p(s)(1-\tau_y)-\pi(s)]ds} q(t) E(t) \geq 0$, taking lump-sum taxes and the dividend yield as parametrically given. Optimality yields

$$u_c(c,h) = \lambda, \tag{4}$$

$$u_h(c,h) = -\lambda w \left(1 - \tau_y\right), \tag{5}$$

$$R_g \left(1 - \tau_y\right) - \pi \leq r - \frac{\dot{\lambda}}{\lambda}, \tag{6}$$

$$b_g \left[R_g \left(1 - \tau_y\right) - \left(r + \pi\right) + \frac{\dot{\lambda}}{\lambda} \right] = 0, \tag{7}$$

$$R_p \left(1 - \tau_y\right) - \pi \leq r - \frac{\dot{\lambda}}{\lambda}, \tag{8}$$

$$b_p \left[R_p \left(1 - \tau_y\right) - \left(r + \pi\right) + \frac{\dot{\lambda}}{\lambda} \right] = 0, \tag{9}$$

$$i \left(1 - \tau_y\right) + \frac{\dot{q}}{q} \left(1 - \tau_c\right) - \tau_c \pi \leq r - \frac{\dot{\lambda}}{\lambda}, \tag{10}$$

$$E \left[i \left(1 - \tau_y\right) + \frac{\dot{q}}{q} \left(1 - \tau_c\right) - \tau_c \pi - r + \frac{\dot{\lambda}}{\lambda} \right] = 0, \tag{11}$$

where λ represents the co-state variable, together with the transversality conditions given by $\lim_{t\to\infty} e^{-\int_0^t [R_g(s)(1-\tau_y)-\pi(s)]ds} b_g(t) = \lim_{t\to\infty} e^{-\int_0^t [R_p(s)(1-\tau_y)-\pi(s)]ds} b_p(t) = \lim_{t\to\infty} e^{-\int_0^t [R_p(s)(1-\tau_y)-\pi(s)]ds} \times q(t) E(t) = 0$.

Letting $\gamma \equiv r - \dot{\lambda}/\lambda = r - \dot{u}_c/u_c$ denote the rate of return on consumption (Turnovsky, 2000), conditions (6)-(11) can be written as

$$R_g (1 - \tau_y) - \pi \leq \gamma, \tag{12}$$

$$b_g [R_g (1 - \tau_y) - \pi - \gamma] = 0, \tag{13}$$

$$R_p (1 - \tau_y) - \pi \leq \gamma, \tag{14}$$

$$b_p [R_p (1 - \tau_y) - \pi - \gamma] = 0, \tag{15}$$

$$i (1 - \tau_y) + \frac{\dot{q}}{q} (1 - \tau_c) - \tau_c \pi \leq \gamma, \tag{16}$$

$$E \left[i (1 - \tau_y) + \frac{\dot{q}}{q} (1 - \tau_c) - \tau_c \pi - \gamma \right] = 0, \tag{17}$$

Equations (12)-(17) are the Karush-Kuhn–Tucker duality type conditions with respect to b_g, b_p, and E. Specifically, inequalities (12), (14), and (16) state that the real rate of return on any asset cannot exceed the rate of return on consumption. If any of the inequalities are satisfied strictly, then the corresponding asset is dominated and its equilibrium quantity is zero. On the other hand, if any of the assets is strictly positive in equilibrium, then the corresponding constraint, given by either (13), (15), or (17), is verified with equality.

2.2 Corporate Sector

The corporate sector has competitive firms producing output by means of a neoclassical production function of the form

$$y = f (k, h), \tag{18}$$

where k denotes the stock of capital. The production function $f (\cdot, \cdot)$ is twice continuously differentiable, obeys $f_k, f_h > 0$, $f_{kk}, f_{hh} < 0$, $f_{kh} > 0$, and is linearly homogeneous, implying $f_{kk} f_{hh} - f_{kh}^2 = 0$. For simplicity and without loss of generality, capital is assumed not to depreciate.[2]

Gross profit in real terms is given by

$$\Psi = y - wh \tag{19}$$

[2]This assumption can be relaxed in a rather straightforward manner and does not alter my results in any fundamental dimension.

and may be allocated, after the payment of corporate taxes and agency costs associated to debt, to pay interest to bondholders, dividends to stockholders, or in the form of earnings retention. Formally,

$$\Psi = R_p b_p + D + \Psi_{re} + T_f + a(\delta) b_p, \tag{20}$$

where Ψ_{re} denotes retained real earnings, T_f real corporate taxes, $a(\delta) b_p$ agency costs of debt, and

$$\delta \equiv \frac{b_p}{qE} \tag{21}$$

the debt-equity ratio. Corporate taxation consists of taxes on gross profits, with the interest payments on bonds being deductible. Thus,

$$T_f = \tau_p (y - wh - R_p b_p), \tag{22}$$

where $0 \leq \tau_p \leq 1$ represents the tax rate on corporate income. According to Osterberg (1989), the agency cost $a(\delta) b_p$ reflects the design of bond covenants and other contractual restrictions intended to control the conflict between bondholders and stockholders and force stockholders to maximize the market value of debt plus equity (Jensen and Meckling, 1976; Smith and Warner, 1979). Consistent with Osterberg (1989), I assume that function $a(\cdot)$ is continuously differentiable and satisfies $a(0) = 0$ and $a'(\cdot), a''(\cdot) > 0$.

The representative firm is subject to the financial constraint expressed in real terms by

$$\dot{k} = \Psi_{re} + q\dot{E} + \dot{b}_p + \pi b_p. \tag{23}$$

That is, additions to the corporate capital stock must be financed either by using retained earnings, by issuing equities, or by issuing bonds. Because bonds are denominated in nominal terms, inflation is a source of real revenue for the firm.

Combining production and financial constraints given by (18)-(20) and (22)-23) yields

$$q\dot{E} + \dot{b}_p + (1 - \tau_p)(f(k,h) - wh) - \dot{k} = [R_p (1 - \tau_p)] b_p + a(\delta) b_p + D. \tag{24}$$

Now, letting

$$V(t) \equiv b_p(t) + q(t) E(t)$$

define the market value of the corporate securities outstanding at the time t,

$$\Gamma \equiv (1 - \tau_p)(f(k,l) - wh) - \dot{k} \tag{25}$$

define the firms's real cash flows, and using $i \equiv D/qE$, equation (24) becomes

$$\dot{V} + \Gamma = \left[R_p\left(1-\tau_p\right)-\pi\right]b_p + a\left(\delta\right)b_p + iqE + \dot{q}E. \tag{26}$$

Equation (26) states that firm value increases and real cash flows must be used to pay the after-corporate income tax real interest to bondholders, the agency cost of debt, and real dividends and capital gains to stockholders. Using (21), this relationship can alternatively be written as

$$\dot{V} + \Gamma = r_{WACC}V, \tag{27}$$

where

$$r_{WACC} \equiv \left\{\left[R_p\left(1-\tau_p\right)-\pi\right]+a\left(\delta\right)\right\}\frac{\delta}{1+\delta} + \left(i+\frac{\dot{q}}{q}\right)\frac{\delta}{1+\delta}. \tag{28}$$

Integrating equation (27) forward and imposing the terminal boundary condition given by $\lim_{t\to\infty} e^{-\int_0^t r_{WACC}(s)ds}V\left(t\right)=0$, the initial value of the firm—which it seeks to maximize—is

$$V\left(0\right) = \int_0^\infty e^{-\int_0^t r_{WACC}(s)ds}\Gamma dt. \tag{29}$$

According to (28)-(29), the appropriate discount rate of future cash flows in the firm's objective function is the weighted average cost of capital—a familiar concept in the context of the traditional corporate finance theory, here expressed in real terms and given by

$$r_{WACC} = \left\{\left[R_p\left(1-\tau_p\right)-\pi\right]+a\left(\delta\right)\right\}\left(\frac{b_p}{V}\right) + \left(i+\frac{\dot{q}}{q}\right)\left(\frac{qE}{V}\right). \tag{30}$$

It equals the weighted average of the real cost of debt capital, given by the after-corporate income tax real interest rate on corporate bonds inclusive of the agency cost on debt, and the real cost of equity capital, given by the dividend payout rate plus the real rate of capital gains on equity. Because the real cash flow Γ is a function only of production variables, k and h, while the discount rate is a function only of financial variables, δ, R_p, i, and $\dot{q}/q$, the firm's optimizing problem can be solved in two sequential stages. In the first stage, the firm makes financial choices so as to minimize r_{WACC}. In the second stage, the firm makes production choices so as to maximize $V\left(0\right)$, given the minimized r_{WACC}.

Using equations (15) and (17)—which result from the duality-type conditions characterizing households' intertemporal optimization—to eliminate $R_p b_p$ and $\dot{q}E$ in equation (30), the weighted average cost of capital assumes the following form:

$$
\begin{aligned}
r_{WACC} &= \gamma + \left[\frac{(\tau_y - \tau_p)(\gamma + \pi)}{1 - \tau_y} + a(\delta)\right]\frac{\delta}{1+\delta} \\
&\quad + \left[\frac{\tau_c(\gamma + \pi) + i(\tau_y - \tau_c)}{1 - \tau_c}\right]\frac{1}{1+\delta}. \qquad (31)
\end{aligned}
$$

Only in the absence of taxes and agency costs on corporate debt are the cost of capital and, as a consequence, production choices independent of corporate financial decisions on δ and i, in accordance with Modigliani and Miller (1958) and Miller and Modigliani (1961). In order to concentrate attention on the role played by the optimal capital structure in the presence of taxes, I shall follow Osterberg (1989) and assume that the dividend payout ratio is set at the exogenous level $\bar{\imath}$.[3] Minimization of function (31) with respect to δ implies

$$
\left[\frac{(\tau_y - \tau_p)(\gamma + \pi)}{1 - \tau_y} + a(\delta)\right]\frac{1}{1+\delta} + \delta a'(\delta) = \left[\frac{\tau_c(\gamma + \pi) + \bar{\imath}(\tau_y - \tau_c)}{1 - \tau_c}\right]\frac{1}{1+\delta}. \qquad (32)
$$

At the optimum, the debt-equity ratio chosen by firms must satisfy the condition that the marginal cost of debt capital be equal to the marginal cost of equity capital. Equation (32) implicitly determines an interior optimal debt-equity ratio, ruling out corner solutions. Only in the limiting cases in which agency costs are either absent or exogenously given does optimality imply either all-bond or all-equity financing.

Applying the fact that the optimal corporate financial choice yields an interior solution within condition (15), equations (31) and (32) thus become

$$
\begin{aligned}
r_{WACC} &= R_p(1 - \tau_y) - \pi + [R_p(\tau_y - \tau_p) + a(\delta)]\frac{\delta}{1+\delta} \\
&\quad + \left[\frac{R_p\tau_c(1 - \tau_y) + \bar{\imath}(\tau_y - \tau_c)}{1 - \tau_c}\right]\frac{1}{1+\delta}, \qquad (33)
\end{aligned}
$$

$$
[R_p(\tau_y - \tau_p) + a(\delta)]\frac{1}{1+\delta} + \delta a'(\delta) = \left[\frac{R_p\tau_c(1 - \tau_y) + \bar{\imath}(\tau_y - \tau_c)}{1 - \tau_c}\right]\frac{1}{1+\delta}. \qquad (34)
$$

Solving equation (34) for δ as a function of R_p yields

$$
\hat{\delta} = \hat{\delta}(R_p), \qquad (35)
$$

[3] This assumption is also consistent with pioneering works on corporate finance and the macroeconomy such as Brock and Turnovsky (1981) and Turnovsky (1987). As pointed out by Brock and Turnovsky (1981), assuming that i is set at some legal minimum avoids the minimization of the dividend payout rate by the firm and the consequent repurchase of shares—a behavior discouraged in the United States by the Internal Revenue Code.

where $\hat{\delta}$ is the optimal debt-equity ratio and

$$\hat{\delta}'(R_p) = \frac{1}{(1+\delta)(2a' + \delta a'')} \left[\frac{\tau_c (1-\tau_y)}{1-\tau_c} - (\tau_y - \tau_p) \right]. \tag{36}$$

From (36), the pass-through from the nominal interest rate on corporate bonds to the optimal debt-equity ratio is of unambiguously positive sign when $\tau_p > \tau_y$. In this case, indeed, an increase in R_p raises the cost of debt capital by less than the cost of equity capital—due to a relatively high corporate income tax rate giving rise to a relatively high "tax shield" associated to the interest-deductibility of debt, hence inducing firms to switch toward debt financing. On the other hand, when $\tau_p < \tau_y$, the pass-through from to the nominal interest rate to optimal financial structure employed by firms is of ambiguous sign and turns to depend critically upon the tax code. In particular, if now $(\tau_y - \tau_p)/(1-\tau_y) > \tau_c/(1-\tau_c)$—due to relatively low corporate income and capital gains tax rates, an increase in R_p raises the cost of debt capital by more than the cost of equity capital, hence inducing firms to switch toward equity financing, differently from the previous case. Substituting (34)-(35) into (33) gives the minimized weighted average cost of capital:

$$\hat{r}_{WACC} = R_p (1-\tau_y) - \pi - a'\left(\hat{\delta}(R_p)\right)\hat{\delta}(R_p)^2 + \frac{R_p \tau_c (1-\tau_y) + \bar{\imath}(\tau_y - \tau_c)}{1-\tau_c}. \tag{37}$$

In the second stage of the optimizing problem, the firm chooses $k, h > 0$ in order to maximize

$$V(0) = \int_0^\infty e^{-\int_0^t \hat{r}_{WACC}(s)ds} \left[(1-\tau_p)(f(k,h) - wh) - \dot{k}\right] dt, \tag{38}$$

subject to the initial condition $k(0) = k_0$, where I have employed the definition of real cash flows given by (25). Optimality yields

$$(1-\tau_p) f_k(k,h) = \hat{r}_{WACC}, \tag{39}$$

$$f_h(k,h) = w, \tag{40}$$

$$\lim_{t\to\infty} e^{-\int_0^t \hat{r}_{WACC}(s)ds} k(t) = 0. \tag{41}$$

Using (39), (40), and the fact that function $f(\cdot,\cdot)$ is linearly homogeneous, equation (38) becomes

$$V(0) = \int_0^\infty e^{-\int_0^t \hat{r}_{WACC}(s)ds} \left(\hat{r}_{WACC} k - \dot{k}\right) dt.$$

Integrating by parts and invoking the transversality condition (41), one obtains

$$V(0) = k_0,$$

which asserts that the optimal firm value is pinned down the capital stock.

2.3 Public Sector

The instant budget constraint of the public sector expressed in real terms is given by

$$\begin{aligned} \dot{b}_g &= [R_g(1-t_y) - \pi] b_g - \tau_y (wh + R_p b_p + iqE) \\ &\quad -\tau_c (\dot{q} + q\pi) E - \tau_p (y - wh - R_p b_p) - Z, \end{aligned} \tag{42}$$

where, without loss of generality for the present analysis, I have set government purchases equal to zero. To close the model, one needs to specify the fiscal and monetary regimes. In order to concentrate on the consequences of corporate finance for monetary policy design, fiscal policy is assumed to be Ricardian in the sense of Benhabib, Schmitt-Grohé and Uribe (2001) and described in terms of a tax rule of the type $Z = \theta b_g$, where the time-varying and arbitrarily chosen θ is positive and bounded below by $\underline{\theta} > 0$. This stance of fiscal policy respects the terminal boundary condition precluding Ponzi's games and requiring that the present discounted value of government debt converges to zero, $\lim_{t\to\infty} e^{-\int_0^t [R_g(s)(1-\tau_y)-\pi(s)]ds} b_g(t) = 0$, for all possible, equilibrium and off-equilibrium, time paths of the remaining endogenous variables.

Monetary policy is described in terms of an interest-rate feedback rule whereby the nominal interest rate controlled by monetary authorities,

$$R \equiv R_g = R_p, \tag{43}$$

is set as an increasing function of the inflation rate,

$$R = R(\pi), \tag{44}$$

where $R(\cdot)$ is continuously differentiable and obeys $R(\cdot) > 0$, $R'(\cdot) \geq 0$. I assume that the central bank targets an inflation rate $\pi^* > -r$ that satisfies $R(\pi^*)(1-t_y) = r + \pi^*$. Following Leeper (1991)'s terminology, monetary policy is referred to as active if $R'(\cdot) > 1$ and passive if $R'(\cdot) < 1$. Under an active stance of interest rate policy, whenever monetary authorities observe symptoms of inflationary pressure, they will tighten policy sufficiently to ensure an increase in the real rate of interest, in accordance with the so-called Taylor principle (Taylor, 1993, 1999; Bordo, Cochrane and Taylor, 2024).

2.4 Equilibrium Dynamics

Combining the budget constraints (2)-(3), (24), and (42), observing that $b_p = [\delta/(1+\delta)]\, V$—where at the optimum $V = k$, and employing the optimal corporate financial policy (35), the no-arbitrage condition (43), and the monetary policy rule (44), one obtains the product market equilibrium condition,

$$f(k,h) = c + \dot{k} + a\left(\hat{\delta}(R(\pi))\right)\frac{\hat{\delta}(R(\pi))}{1+\hat{\delta}(R(\pi))}k. \tag{45}$$

Using (43) and (44) to replace R_p in equation (37), $\hat{r}_{WACC}$ can be expressed, in equilibrium, as a function of π,

$$\hat{r}_{WACC} = \hat{r}_{WACC}(\pi), \tag{46}$$

where, applying (36),

$$\begin{aligned} \hat{r}'_{WACC}(\pi) &= R'(\pi)(1-\tau_y) - 1 + R'(\pi) \\ &\times \left[(\tau_y - \tau_p)\frac{\hat{\delta}(R(\pi))}{1+\hat{\delta}(R(\pi))} + \frac{\tau_c(1-\tau_y)}{1-\tau_c}\frac{1}{1+\hat{\delta}(R(\pi))}\right]. \end{aligned} \tag{47}$$

Using equations (40) and (46) to replace w and $\hat{r}_{WACC}$ in equations (5) and (39), respectively, and combining the resulting expressions with the optimality condition (4), c, h, and λ can be written as a function of k and π. Specifically, letting $\Delta \equiv -(1-\tau_p) f_{kh} u_{ch} - (1-\tau_p) \times (1-\tau_y) f_{kk} f_h u_{cc} > 0$,

$$c = c(k,\pi), \tag{48}$$

with $c_k = -(1-\tau_p)[f_{kk} f_h u_{ch} - (1-\tau_y) f_{kk} u_{hh} u_c]/\Delta < 0$ and $c_\pi = \hat{r}'_{WACC}\{u_{hh} + (1-\tau_y) \times [f_h u_{ch} + f_{hh} u_c]\}/\Delta$—so that $\text{sgn}(c_\pi) = -\,\text{sgn}(\hat{r}'_{WACC})$,

$$h = h(k,\pi), \tag{49}$$

with $h_k = (1-\tau_p) f_{kk}[u_{ch} + (1-\tau_y) f_h u_{cc}]/\Delta > 0$ and $h_\pi = -\hat{r}'_{WACC}[u_{ch} + (1-\tau_y) f_h u_{cc}]/\Delta$ —so that $\text{sgn}(h_\pi) = \text{sgn}(\hat{r}'_{WACC})$, and

$$\lambda = \lambda(k,\pi), \tag{50}$$

with $\lambda_k = -(1-\tau_p) f_{kk} (u_{cc}u_{hh} - u_{ch}^2)/\Delta > 0$ and $\lambda_\pi = \hat{r}'_{WACC}[(u_{cc}u_{hh} - u_{ch}^2) + (1-\tau_y) \times f_{hh}u_{cc}u_c]/\Delta$—so that $\text{sgn}(\lambda_\pi) = \text{sgn}(\hat{r}'_{WACC})$. Substituting equations (48)-(50), along with the fact that $\dot{\lambda} = \lambda_k\dot{k} + \lambda_\pi\dot{\pi}$, in the product market equilibrium condition (45) and the co-state equation (7), and making use of (43) and (44), one obtains the following system of differential equations in the variables k and π, which characterize the dynamic evolution of the perfect-foresight equilibrium in the flexible-price economy:

$$\dot{k} = f(k, h(k,\pi)) - c(k,\pi) - a\left(\hat{\delta}(R(\pi))\right)\frac{\hat{\delta}(R(\pi))}{1+\hat{\delta}(R(\pi))}k, \tag{51}$$

$$\begin{aligned}\dot{\pi} &= \frac{\lambda(k,\pi)}{\lambda_\pi}\left[r + \pi - R(\pi)(1-\tau_y)\right] \\ &\quad -\frac{\lambda_k}{\lambda_\pi}\left(f(k,h(k,\pi)) - c(k,\pi) - a\left(\hat{\delta}(R(\pi))\right)\frac{\hat{\delta}(R(\pi))}{1+\hat{\delta}(R(\pi))}k\right).\end{aligned} \tag{52}$$

Linearization of equations (51) and (52) around the steady state[4] (k^*, π^*) yields

$$\begin{pmatrix} \dot{k} \\ \dot{\pi} \end{pmatrix} = J^F \begin{pmatrix} k - k^* \\ \pi - \pi^* \end{pmatrix}, \tag{53}$$

where

$$J^F = \begin{pmatrix} J_{11}^F & J_{12}^F \\ -\frac{\lambda_k}{\lambda_\pi}J_{11}^F & \frac{u_c}{\lambda_\pi}\left[1 - R'(1-\tau_y)\right] - \frac{\lambda_k}{\lambda_\pi}J_{12}^F \end{pmatrix},$$

$$J_{11}^F = f_k + f_h h_k - c_k - a\left(\hat{\delta}^*\right)\frac{\hat{\delta}^*}{1+\hat{\delta}^*} > 0,$$

[4]The steady-state equilibrium associated to the target inflation rate π^*, which by assumption solves the Fisher equation, $R(\pi^*)(1-t_y) = r + \pi^*$, obtained setting $\dot{k} = \dot{\pi} = 0$ in equations (51) and (52), is unique. Specifically, given π^*, the steady-state optimal values of the debt-equity ratio and the weighted average cost of capital are $\hat{\delta}^* = \hat{\delta}(R(\pi^*))$ and $\hat{r}^*_{WACC} = \hat{r}_{WACC}(\pi^*)$, respectively. Making use of the linear homogeneity of the production function, the steady-state value of the capital-labor ratio is given by the solution to $(1-\tau_p) f_{k/h}\left((k/h)^*, 1\right) = \hat{r}^*_{WACC}$. In turn, the steady-state value of the real wage is $w^* = f\left((k/h)^*, 1\right) - f_{k/h}\left((k/h)^*, 1\right)(k/h)^*$. Given $\hat{\delta}^*$, $(k/h)^*$, and w^*, the steady-state value of the employment of labor is obtained from the solution to $u_h(f\left((k/h)^*, 1\right) - a\left(\hat{\delta}^*\right)\left[\hat{\delta}^*/\left(1+\hat{\delta}^*\right)\right]h^*(k/h)^*, h^*)/u_c(f\left((k/h)^*, 1\right) - a\left(\hat{\delta}^*\right)\left[\hat{\delta}^*/\left(1+\hat{\delta}^*\right)\right]h^*(k/h)^*, h^*) = -w^*(1-\tau_y)$. Finally, given $(k/h)^*$ and h^*, and so $k^* = (k/h)^* h^*$, the steady-state levels of output and consumption are $y^* = f(k^*, h^*)$ and $c^* = y^* - a\left(\hat{\delta}^*\right)\left[\hat{\delta}^*/\left(1+\hat{\delta}^*\right)\right]k^*$, respectively.

$$J_{12}^F = f_h h_\pi - c_\pi - k^* R' \frac{a\left(\hat{\delta}^*\right) + \hat{\delta}^*\left(1+\hat{\delta}^*\right) a'}{\left(1+\hat{\delta}^*\right)^3 (2a' + \delta a'')} \left[\frac{\tau_c (1-\tau_y)}{1-\tau_c} - (\tau_y - \tau_p)\right].$$

The determinant of the Jacobian matrix J^F is

$$\det J^F = \frac{J_{11}^F u_c}{\lambda_\pi} \left[1 - R' (1-\tau_y)\right].$$

Using the fact that $\text{sgn}(\lambda_\pi) = \text{sgn}(\hat{r}'_{WACC})$, it follows that $\text{sgn}\big(\det J^F\big) = \text{sgn}\{[1 - R'(1-\tau_y)] / \hat{r}'_{WACC}\}$. Because k is a state variable and π is a jump variable with a free initial condition, in the neighborhood around the steady state (k^*, π^*) there exists a unique equilibrium trajectory of (k, π) converging asymptotically to (k^*, π^*) when the roots of J^F are of opposite sign, that is, when $\det J^F < 0$. This occurs if either $R'(1-\tau_y) < 1$ and, at the same time, $\hat{r}'_{WACC} < 0$ or $R'(1-\tau_y) > 1$ and, at the same time, $\hat{r}'_{WACC} > 0$. Using (47) evaluated at the steady state, it follows that equilibrium determinacy is verified under two alternative monetary policy regimes. The first regime prescribes a relatively non-aggressive monetary policy stance, one in which the degree of responsiveness of the nominal interest rate with respect to deviations of inflation from the target, measured by R', is below the threshold given by

$$\min\left[\frac{1}{1-\tau_y}, \frac{1}{1-\tau_y + (\tau_y - \tau_p)\frac{\hat{\delta}^*}{1+\hat{\delta}^*} + \frac{\tau_c(1-\tau_y)}{1-\tau_c}\frac{1}{1+\hat{\delta}^*}}\right].$$

The second regime prescribes, by contrast, a sufficiently aggressive monetary policy stance, one in which the degree of feedback responsiveness to inflation R' is above the threshold given by

$$\max\left[\frac{1}{1-\tau_y}, \frac{1}{1-\tau_y + (\tau_y - \tau_p)\frac{\hat{\delta}^*}{1+\hat{\delta}^*} + \frac{\tau_c(1-\tau_y)}{1-\tau_c}\frac{1}{1+\hat{\delta}^*}}\right].$$

I collect these results in the following proposition.

Proposition 1: *In the flexible-price economy described by (53), if either*

$$R'(\pi^*) < \min\left[\frac{1}{1-\tau_y}, \frac{1}{1-\tau_y + (\tau_y - \tau_p)\frac{\hat{\delta}^*}{1+\hat{\delta}^*} + \frac{\tau_c(1-\tau_y)}{1-\tau_c}\frac{1}{1+\hat{\delta}^*}}\right] \tag{54}$$

or

$$R'(\pi^*) > \max\left[\frac{1}{1-\tau_y}, \frac{1}{1-\tau_y + (\tau_y - \tau_p)\frac{\hat{\delta}^*}{1+\hat{\delta}^*} + \frac{\tau_c(1-\tau_y)}{1-\tau_c}\frac{1}{1+\hat{\delta}^*}}\right], \tag{55}$$

there exists a unique perfect-foresight equilibrium in which (k, π) *converge asymptotically to the steady state* (k^*, π^*)*. The unique equilibrium trajectory is given by the saddle-path solution*

$$\pi(t) = \pi^* + \left(\frac{\mu_1^F - J_{11}^F}{J_{12}^F}\right)(k(t) - k^*), \tag{56}$$

$$k(t) = k^* + e^{\mu_1^F t}(k_0 - k^*), \tag{57}$$

where $\mu_1^F < 0$ *is the negative eigenvalue associated to* J^F.

Importantly, in the present macroeconomic environment with corporate financing decisions, determinacy of the real allocation ensured by interest rate policies satisfying either (54) or (55) also implies nominal determinacy. For the initial price level must satisfy

$$\frac{B_{p0}}{P(0)} = \frac{\hat{\delta}(R(\pi(0)))}{1 + \hat{\delta}(R(\pi(0)))} k_0,$$

where B_{p0} and k_0 are predetermined and, from (56) and (57), $\pi(0) = \pi^* + \left[\left(\mu_1^F - J_{11}^F\right)/J_{12}^F\right] \times (k_0 - k^*)$. Hence, $P(0)$ is uniquely pinned down the initial stock nominal corporate bonds, the initial stock of capital, and the optimal corporate financial policies in response to the stabilizing stance of monetary policy. In other words, differently from Benhabib, Schmitt-Grohé and Uribe (2001), fiscal policy does not need to be Non-Ricardian—that is, uncommitted to guaranteeing the public solvency condition precluding Ponzi's games for all possible paths of endogenous variables, to uniquely anchor the level of prices. Nominal determinacy occurs here under a Ricardian fiscal policy, without an accompanying "fiscalist" regime along the lines proposed by the fiscal theory of the price level (Sims, 1994; Woodford, 1994, 1995; Cochrane, 1998, 2005, 2023).

By contrast, if either $R'(1 - \tau_y) < 1$ and $\hat{r}'_{WACC} > 0$ or $R'(1 - \tau_y) > 1$ and $\hat{r}'_{WACC} < 0$, indeterminacy or instability prevails in the neighborhood around the steady state equilibrium, depending on whether both roots of J^F have negative real parts or positive real parts, that is, on whether the trace of J^F is negative or positive, respectively. These results are formalized in the following proposition.

Proposition 2: *In the flexible-price economy described by (53), under*

$$\min\left[\frac{1}{1-\tau_y},\frac{1}{1-\tau_y+(\tau_y-\tau_p)\frac{\hat{\delta}^*}{1+\hat{\delta}^*}+\frac{\tau_c(1-\tau_y)}{1-\tau_c}\frac{1}{1+\hat{\delta}^*}}\right]$$
$$< \; R'(\pi^*) <$$
$$\max\left[\frac{1}{1-\tau_y},\frac{1}{1-\tau_y+(\tau_y-\tau_p)\frac{\hat{\delta}^*}{1+\hat{\delta}^*}+\frac{\tau_c(1-\tau_y)}{1-\tau_c}\frac{1}{1+\hat{\delta}^*}}\right]: \tag{58}$$

(a) *if* $tr J^F < 0$*, there exist a continuum of perfect-foresight equilibria in which* (k,π) *converge asymptotically to the steady state* (k^*,π^*)*;*

(b) *if* $tr J^F > 0$ *and* $k_0 \neq k^*$*, no perfect-foresight equilibria exist in which* (k,π) *converge asymptotically to the steady state* (k^*,π^*)*.*

I shall next pay attention to the economic interpretation of the analytical findings established in Propositions 1-2. Let me initially concentrate on the relatively non-aggressive monetary regime satisfying condition (54). Consider first a tax and financial structure that obeys

$$\tau_y+\frac{\tau_c(1-\tau_y)}{\hat{\delta}^*(1-\tau_c)}>\tau_p. \tag{59}$$

This condition is surely satisfied with regard to the U.S. tax code following the 2017 House Tax Cuts and Jobs Act, which has lowered the corporate income tax rate from a top marginal rate of 35 percent to a flat rate of 21 percent. Plausible parameterizations of the ordinary personal income tax rate (e.g., Trabandt and Uhlig, 2011) indeed imply $\tau_y > \tau_p$, so that the above condition turns to be verified for any parameterization of the capital gains tax rate τ_c and steady-state debt-equity ratio $\hat{\delta}^*$. Condition (59) arguably appears to be verified further with reference to the 1980-2017 period. Realistic parameterizations for this period are, in fact, $\tau_y = 0.28$, $\tau_p = 0.29$ (Congressional Budget Office, 2017), and $\tau_c = 0.18$,[5] so that the validity of (59) turns to be largely satisfied for any empirically plausible value of $\hat{\delta}^*$.[6]

From (47), condition (59) results in an increasing gap between the equilibrium weighted average cost of capital $\hat{r}_{WACC}$ and the after-tax real interest rate $R(1-\tau_y)-\pi$ in response to inflationary pressures. This is due to a relatively low tax rate on corporate income and/or a relatively low steady-state debt-equity ratio, which yield a relatively moderate tax shield resulting from the interest-deductibility of debt. Under these circumstances, the threshold

[5] https://taxfoundation.org/data/all/federal/federal-capital-gains-tax-collections-historical-data/.

[6] https://fred.stlouisfed.org/series/BOGZ1FL010000286Q.

above which indeterminacy or instability applies consistently with Proposition 2 is given by

$$\frac{1}{1-\tau_y+(\tau_y-\tau_p)\frac{\hat{\delta}^*}{1+\hat{\delta}^*}+\frac{\tau_c(1-\tau_y)}{1-\tau_c}\frac{1}{1+\hat{\delta}^*}}.$$

Observe that such a threshold is higher than unity if $\left(\tau_y+\hat{\delta}^*\tau_p\right)/\left(1-\tau_y\right)>\tau_c/\left(1-\tau_c\right)$—a condition that proves to be largely satisfied, in general, for any empirically plausible tax code and steady-state debt-equity ratio.[7]

Consider next a tax and financial structure that, conversely, obeys

$$\tau_p>\tau_y+\frac{\tau_c\left(1-\tau_y\right)}{\hat{\delta}^*\left(1-\tau_c\right)}. \tag{60}$$

This case resembles the pre-1980 U.S. tax and financial structure, characterized by corporate income tax rates that reached peaks above 40 percent, while ordinary personal income tax rates were close to 20 percent (see, e.g., Mendoza, Razin and Tesar, 1994), as well as by corporate debt-equity ratios that reached extraordinarily high levels, widely above 100 percent from 1955 to 1975—with a peak of 227 percent in 1961. Using as realistic baseline parameterizations for the overall post-World War II period up to 1979 $\tau_p=0.38$, $\tau_y=0.22$, $\tau_c=0.15$, and $\hat{\delta}^*=1.25$,[8] the above condition largely holds.

From (47), condition (60) now results in a decreasing gap between $\hat{r}_{WACC}$ and $R\left(1-\tau_y\right)-\pi$ in response to inflationary pressures. This is due to a relatively high tax rate on corporate income and/or a relatively high steady-state debt-equity ratio, which yield a relatively pronounced tax shield. Under these circumstances, the threshold above which indeterminacy or instability applies consistently with Proposition 2 is now $1/\left(1-\tau_y\right)$, which is unambiguously higher than unity.[9]

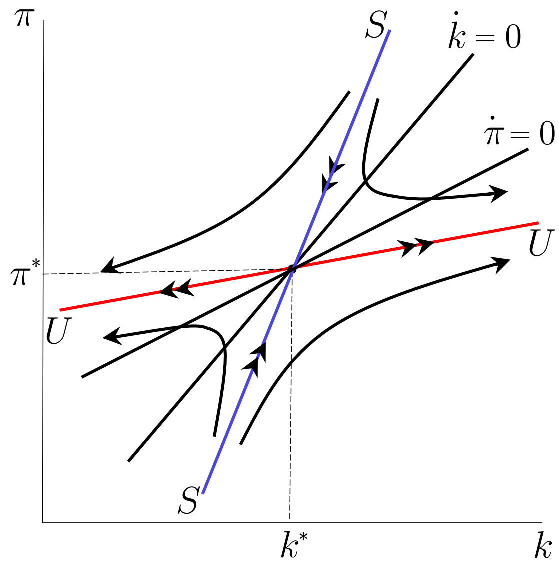
Taking stock, the first stabilizing monetary regime at hand encompasses both the case of a passive monetary policy, displaying $R'\left(\pi^*\right)<1$, and the case of a mildly active monetary policy, displaying $R'\left(\pi^*\right)>1$ but below the threshold above identified. Under these policies,

[7] See, e.g., Mendoza, Razin and Tesar (1994), De Fiore and Uhlig (2011), and Trabandt and Uhlig (2011). For the post-2017 period, in particular, choosing the parameterizations $\tau_y=0.28$, $\tau_p=0.21$, $\tau_c=0.18$, and $\hat{\delta}^*=0.93$ yields a threshold for the degree of responsiveness of the nominal interest rate with respect to deviations of inflation from the target above which indeterminacy or instability holds equal to 1.20. For the 1980-2017 period, conversely, choosing the parameterizations $\tau_y=0.28$, $\tau_p=0.29$, $\tau_c=0.18$, and $\hat{\delta}^*=0.88$ yields a threshold value for the monetary policy feedback parameter of 1.25. Data for calibration are again from Congressional Budget Office, the Tax Foundation, and FRED at the Federal Reserve Bank of St. Louis.

[8] Data for the capital gains tax rate and the steady-state debt-equity ratio are again from the Tax Foundation and FRED.

[9] Using $\tau_y=0.22$ on the basis of Mendoza, Razin and Tesar (1994) leads to a threshold value of 1.28, slightly above the value obtained for the 1980-2017 period.

Figure 1: Dynamic behavior of (k, π) in the flexible-price model under a passive or mildly active monetary policy stance satisfying condition (54)



Notes: The locus SS is the stable arm of the saddlepoint (k^*, π^*), expressed by equation (56). The locus UU is the unstable arm of (k^*, π^*), expressed by $\pi(t) = \pi^* - (\lambda_k/\lambda_\pi) J_{11}^F / \{\mu_2^F - (u_c/\lambda_\pi)[1 - R'(1-\tau_y)] + (\lambda_k/\lambda_\pi) J_{12}^F\} (k(t) - k^*)$, where $\mu_2^F > 0$ is the positive eigenvalue associated to J^F. For a given initial condition $k(0) = k_0$, the locus SS defines $(k(t), \pi(t))$ pairs consistent with a locally unique and stable perfect-foresight equilibrium.

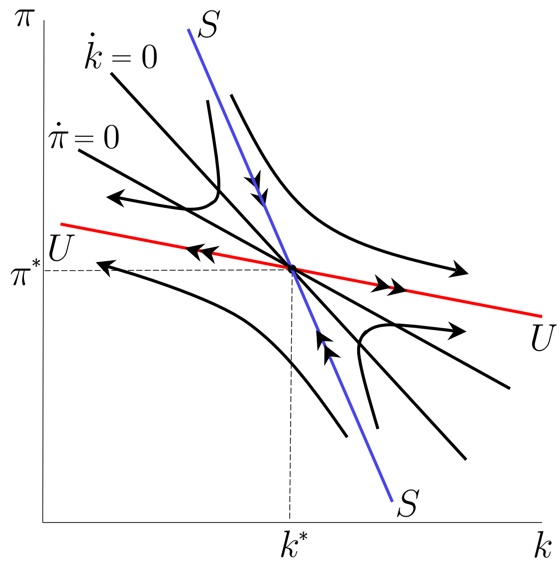
a nominal interest-rate hike implemented by the central bank in response to an increase in the inflation rate gets passed through into a decline in both the weighted average cost of capital and the after-tax real interest rate. The decline in the equilibrium real cost of capital arises from the tax shield combined with the firms' endogenous switch toward the lowest-priced financing mode. With the demand- and supply-side channels of monetary policy at work, equation (56) states that such a negative pass-through typically induces the existence of a positively sloped saddle path in the k-π space converging to the steady state (see Figure 1).[10] The reason is as follows. Assume that the initial stock of capital exceeds its steady-state value. The initial jump in inflation above the target rate causes a fall in the real cost of capital via the non-aggressive stance of monetary policy. As a result, maximizing firms

[10]I rule out the implausible hypothesis in which the variation in consumption of physical goods driven by an increase in inflation is more than counterbalanced by the variation in the opposite direction of consumption of agency services. Therefore, in my discussion, I restrict attention to the realistic case in which

$$\operatorname{sgn}\left\{ c_\pi + k^* R' \frac{a\left(\hat{\delta}^*\right) + \hat{\delta}^*\left(1+\hat{\delta}^*\right) a'}{\left(1+\hat{\delta}^*\right)^3 (2a' + \delta a'')} \left[\frac{\tau_c(1-\tau_y)}{1-\tau_c} - (\tau_y - \tau_p)\right] \right\} = -\operatorname{sgn}\left(\hat{r}'_{WACC}\right),$$

implying in turn $\operatorname{sgn}(J_{12}^F) = \operatorname{sgn}(\hat{r}'_{WACC})$.

Figure 2: Dynamic behavior of (k, π) in the flexible-price model under a sufficiently active monetary policy stance satisfying condition (55)



Notes: The locus SS is the stable arm of the saddlepoint (k^*, π^*), expressed by equation (56). The locus UU is the unstable arm of (k^*, π^*), expressed by $\pi(t) = \pi^* - (\lambda_k/\lambda_\pi) J_{11}^F / \{\mu_2^F - (u_c/\lambda_\pi)[1 - R'(1-\tau_y)] + (\lambda_k/\lambda_\pi) J_{12}^F\} (k(t) - k^*)$, where $\mu_2^F > 0$ is the positive eigenvalue associated to J^F. For a given initial condition $k(0) = k_0$, the locus SS defines $(k(t), \pi(t))$ pairs consistent with a locally unique and stable perfect-foresight equilibrium.

reduce recourse to labor in order for the after-tax marginal productivity of capital to equal the reduced cost of capital, as stated by equation (39). Consequently, there is an increase in leisure, which must be associated with a decline in the marginal utility of wealth and an increase in private consumption, for leisure and consumption are normal goods. These economic mechanisms explain $c_\pi > 0$, $h_\pi < 0$, and $\lambda_\pi < 0$ in equations (48)-(50). Two implications for macroeconomic dynamics emerge. First, the rise in consumption crowds out corporate investment, causing the stock of capital to move toward the steady state according to the law of motion of capital (45). Second, expectations of future increases in the marginal utility of wealth toward the steady state must be associated with reductions in the after-tax real interest rate according to the co-state equations (7)-(9). This does occur when the stance of interest rate policy is passive or moderately active, consistent with condition (54).

Let me now shift attention to the second stabilizing monetary regime, which calls for a sufficiently aggressive stance of monetary policy according to condition (55). Now, if condition (59) is satisfied—such as for the 1980-2017 and post-2017 U.S. historical fiscal and financial records, implying a gap between $\hat{r}_{WACC}$ and $R(1-\tau_y) - \pi$ that covaries positively with the inflation rate, the threshold below which indeterminacy or instability prevails according to

Proposition 2 is given by $1/(1-\tau_y)$.[11] On the other hand, if condition (60) prevails—such as for the pre-1980 U.S. record, implying a gap between $\hat{r}_{WACC}$ and $R(1-\tau_y)-\pi$ that covaries negatively with the inflation rate, the threshold below which indeterminacy or instability prevails is[12]

$$\frac{1}{1-\tau_y+(\tau_y-\tau_p)\frac{\hat{\delta}^*}{1+\hat{\delta}^*}+\frac{\tau_c(1-\tau_y)}{1-\tau_c}\frac{1}{1+\hat{\delta}^*}}>1.$$

It follows that the second stabilizing monetary regime at hand prescribes the application of a sufficiently active monetary policy, whereby $R'(\pi^*)$ is above a threshold greater than unity. In contrast to the previous regime, now a nominal interest-rate hike intended to fight inflationary pressures gets passed through into a rise in both the weighted average cost of capital and the after-tax real interest rate. The rise in the equilibrium real cost of capital originates precisely from the aggressive stance of monetary policy, which more than counterbalances the tax shield along with the firms' optimal switch toward the cheapest financing mode. Equation (56) implies that such a positive pass-through typically induces the existence of a negatively sloped saddle path in the k-π space converging to the steady state (see Figure 2). The initial jump in inflation below the target rate is associated with a fall in the real cost of capital below its steady-state value, which in turn engenders the stabilizing macroeconomic patterns depicted above.

3 A Sticky-Price Model

A key theoretical feature of most monetary models—including the New Keynesian literature—is the presence of nominal rigidities. In this section, therefore, I shall extend the framework so far studied to account for price stickiness and evaluate whether the presence of a Phillips curve arising from sluggish price adjustment significantly alters the previous results on the stabilizing properties of interest-rate feedback rules.

In the economy at hand, the household sector and public sector still deliver the optimality conditions (4)-(17) and the monetary policy rule (44).[13] In the next two subsections, I shall modify the corporate sector in order to introduce an imperfect competition-sticky price environment.

[11]Using $\tau_y = 0.28$ for both the 1980-2017 and post-2017 periods leads to a threshold for the sensitivity of interest rate policy to inflationary pressures below which indeterminacy or instability prevails equal to 1.28.

[12]Using the baseline calibration previously adopted for the pre-1980 fiscal and financial record gives a threshold value of 1.33.

[13]The representative household's budget constraint now incorporates the dividends from both capital rental firms and final goods producers—the latter operating under imperfect competition, as will be derived below. To the extent that the dividends are taken as parametrically given by the household, the optimality conditions obtained in subsection 2.1 are not affected.

3.1 Corporate Sector

The corporate sector has two types of firms. Competitive firms accumulate capital for rental to producers of differentiated final goods. The financial constraints of the representative capital rental firm are given by

$$r_k k = R_p b_p + D + \Psi_{re} + T_f + a(\delta) b_p,$$

where r_k denotes the rental rate of capital, and equation (23). Hence, by proceeding analogously with subsection 2.2, the initial value of the capital rental firm—which it seeks to maximize—assumes the form

$$V(0) = \int_0^\infty e^{-\int_0^t r_{WACC}(s)ds} \Phi dt,$$

where

$$\Phi \equiv (1-\tau_p) r_k k - \dot{k}$$

are the real cash flows. The first stage of the firm's optimization problem leads to equations (35)-(37). The second stage's problem is to choose k to maximize

$$V(0) = \int_0^\infty e^{-\int_0^t \hat{r}_{WACC}(s)ds} \left[(1-\tau_p) r_k k - \dot{k} \right] dt,$$

given the initial condition $k(0) = k_0$. Optimality yields

$$(1-\tau_p) r_k = \hat{r}_{WACC}, \tag{61}$$

together with the transversality condition (41).

The market for final products consists of a continuum of monopolistic firms, indexed by j over the unit interval, each producing a differentiated good j according to a neoclassical production function,

$$y^j = f\left(k^j, h^j\right). \tag{62}$$

Cost minimization implies the optimality condition

$$\frac{f_k(k^j, h^j)}{f_h(k^j, h^j)} = \frac{r_k}{w} = \frac{\hat{r}_{WACC}}{(1-\tau_p) w}, \tag{63}$$

where the latter equality follows from (61). Firm j faces a demand function $y^d (P^j/P)^{-\eta}$, where y^d denotes the level of aggregate demand, P^j the price firm j charges for its product, P the aggregate price level, and $\eta > 1$ the price elasticity of demand, assumed to be constant. The demand function is in accordance with the Dixit-Stiglitz aggregator for both consumption and investment, and with the associated utility-based price index $P = \left[\int_0^1 \left(P^j\right)^{1-\eta} dj\right]^{1/(1-\eta)}$, defined as the minimum expenditure required to buy one unit of the composite good, given the prices of the brands. Nominal rigidities are modeled à la Calvo (1983)-Yun (1996). Following Calvo (1983), the firm j's ability to adjust the nominal price of its product is contingent upon receiving a price-change signal. In the absence of a signal, the firm's price is assumed to rise automatically at the central bank's target inflation rate π^*. The probability that of receiving a price-change signal between periods t and $s > t$ is given by $1 - e^{\alpha(s-t)}$, where $\alpha > 0$. Hence, the problem faced firm j that is able to revise its price at time t is to choose P^j to maximize

$$\Upsilon\left(P^j\right) = \int_t^\infty e^{-(\alpha+r)(s-t)} \lambda(s) \left[\begin{array}{c} \frac{P^j(t) e^{\pi^*(s-t)}}{P(s)} y^d(s) \left(\frac{P^j(t) e^{\pi^*(s-t)}}{P(s)}\right)^{-\eta} \\ -r_k(s) k^j(s) - w(s) h^j(s) \end{array} \right] ds.$$

The first-order condition for the optimal price is

$$\begin{aligned} 0 &= \int_t^\infty e^{-(\alpha+r)s} \lambda(s) y^d(s) \left(\frac{P^j(t) e^{\pi^*(s-t)}}{P(s)}\right)^{-\eta} \\ &\quad \times \left[\frac{\eta - 1}{\eta} \frac{P^j(t) e^{\pi^*(s-t)}}{P(s)} - \frac{\hat{r}_{WACC}(s)}{(1-\tau_p) f_k\left(k^j(s), h^j(s)\right)}\right] ds, \end{aligned} \tag{64}$$

where $(\eta - 1)/\eta$ is the inverse of the gross mark-up. In the aggregate, real profits obtained by the final goods sector, given by $\Omega = y - r_k k - wh$, are distributed to the household sector.

3.2 Equilibrium Dynamics

Combining the budget constraints of the private and public sectors, and using (35), (43) and (44), one obtains the product market equilibrium condition, which yields in turn the law of motion of the capital stock:

$$\dot{k} = y - c - a\left(\hat{\delta}(R(\pi))\right) \frac{\hat{\delta}(R(\pi))}{1 + \hat{\delta}(R(\pi))} k. \tag{65}$$

Using (43) and (44) into (7) gives the equilibrium costate equation, which characterizes the dynamic evolution of the marginal utility of wealth:

$$\dot{\lambda} = \lambda\left[r + \pi - R(\pi)(1 - \tau_y)\right]. \tag{66}$$

In symmetric equilibrium all firms that revise their optimal pricing decision at time t will set the same price, $\mathcal{P}(t)$. Hence, the price index can be written as

$$P(t) = \left\{ \int_{-\infty}^{t} \alpha e^{-\alpha(t-s)} \left[\mathcal{P}(s) e^{\pi^*(t-s)} \right]^{1-\eta} dj \right\}^{1/(1-\eta)}. \tag{67}$$

Letting $p(t) \equiv \mathcal{P}(t) / P(t)$ and using function (46), condition (64) assumes the form

$$\begin{aligned} 0 &= \int_{t}^{\infty} e^{-(\alpha+r)s} \lambda(s) y^d(s) \left(p(t) e^{-\int_t^s (\pi(v)-\pi^*)dv} \right)^{-\eta} \\ &\quad \times \left[\frac{\eta-1}{\eta} p(t) e^{-\int_t^s (\pi(v)-\pi^*)dv} - \frac{\hat{r}_{WACC}(\pi(s))}{(1-\tau_p) f_k(k^j(s), h^j(s))} \right] ds. \end{aligned} \tag{68}$$

Differentiating (67) with respect to t, the law of motion of the price index can be expressed as

$$\pi(t) - \pi^* = \frac{\alpha}{1-\eta} \left(p(t)^{1-\eta} - 1 \right). \tag{69}$$

To obtain an autonomous dynamic system in the variables k, λ, and π, describing the paths of the present sticky-price economy in a tractable way, one needs to linearize the equilibrium conditions in the neighborhood of the steady state,[14] along the lines commonly performed in the context of the New Keynesian paradigm. Linearizing equations (65), (66), (68), and (69) around the steady state yields

$$\begin{aligned} \dot{k} &= (y-y^*) - (c-c^*) - a\left(\hat{\delta}^*\right) \frac{\hat{\delta}^*}{1+\hat{\delta}^*} (k-k^*) \\ &\quad - k^* R' \frac{a\left(\hat{\delta}^*\right) + \hat{\delta}^* \left(1+\hat{\delta}^*\right) a'}{\left(1+\hat{\delta}^*\right)^3 (2a' + \delta a'')} \left[\frac{\tau_c (1-\tau_y)}{1-\tau_c} - (\tau_y - \tau_p) \right] (\pi - \pi^*), \end{aligned} \tag{70}$$

$$\dot{\lambda} = u_c \left[1 - R' (1-\tau_y) \right] (\pi - \pi^*), \tag{71}$$

$$0 = \int_{t}^{\infty} e^{-(\alpha+r)s} \left\{ \begin{array}{c} \frac{\eta-1}{\eta} \left[(p(t)-1) - \int_t^s (\pi(v)-\pi^*) dv \right] \\ -\frac{\hat{r}'_{WACC}}{(1-\tau_p) f_k} (\pi - \pi^*) + \frac{(\eta-1)/\eta}{f_k} \left[f_{kk}(k-k^*) + f_{kh}(h-h^*) \right] \end{array} \right\} ds. \tag{72}$$

$$\pi(t) - \pi^* = \alpha (p(t) - 1). \tag{73}$$

[14]In the steady state $\pi = \pi^*$ and thus, from (69), $p^* = 1$. As a consequence, from (68), real marginal costs are equal to the inverse of the gross mark-up, implying in turn $(1-\tau_p) f_{k/h}\left((k/h)^*, 1\right) = [\eta/(\eta-1)] \times \hat{r}_{WACC}(\pi^*)$. That is, the capital-labor ratio is pinned down by the target inflation rate and is therefore independent of j. By proceeding analogously to Note 4, it follows that the steady state associated to π^* is unique and exhibits identical levels of capital and labor across firms.

Substituting (73) into (72) and differentiating with respect to t yields the dynamic equation for the equilibrium inflation rate,

$$\begin{aligned}\dot{\pi} &= r(\pi-\pi^*)+\alpha(\alpha+r)\frac{\eta}{\eta-1} \\ &\times\left\{-\frac{\hat{r}'_{WACC}}{(1-\tau_p)f_k}(\pi-\pi^*)+\frac{(\eta-1)/\eta}{f_k}\left[f_{kk}(k-k^*)+f_{kh}(h-h^*)\right]\right\}. \end{aligned} \tag{74}$$

To close the model, one needs to derive the aggregate production function and express c and h as a function of k, λ, and π. Linearizing (4), (5), (62) and (63), integrating over j,[15] and letting $\Xi \equiv (1-\tau_p)[f_k(u_{cc}u_{hh}-u_{ch}^2)+u_{cc}u_h(f_{kh}-f_{hh})] > 0$ yields

$$y = y^* + f_k(k-k^*) + f_h(h-h^*), \tag{75}$$

$$c = c^* + c_k(k-k^*) + c_\lambda(\lambda-\lambda^*) + c_\pi(\pi-\pi^*), \tag{76}$$

where $c_k \equiv (1-\tau_p)u_{ch}\{f_{kk}u_h + [(\eta-1)/\eta](1-\tau_y)f_{kh}f_k u_c\}/\Xi < 0$, $c_\lambda \equiv (1-\tau_p)f_k\{u_{hh} + f_{kh}u_h/f_k + [(\eta-1)/\eta](1-\tau_y)[f_{hh}u_c + f_h u_{ch}]/\Xi < 0$, and $c_\pi \equiv (1-\tau_y)f_h u_{ch}u_c\hat{r}'_{WACC}/\Xi$—so that $\operatorname{sgn}(c_\pi) = -\operatorname{sgn}(\hat{r}'_{WACC})$, and

$$h = h^* + h_k(k-k^*) + h_\lambda(\lambda-\lambda^*) + h_\pi(\pi-\pi^*), \tag{77}$$

where $h_k \equiv -(1-\tau_p)u_{cc}\{f_{kk}u_h + [(\eta-1)/\eta](1-\tau_y)f_{kh}f_k u_c\}/\Xi > 0$, $h_\lambda \equiv -(1-\tau_p)f_k\{[(\eta-1)/\eta](1-\tau_y)f_h u_{cc} + u_{ch}\}/\Xi > 0$, and $h_\pi \equiv [\eta/(\eta-1)]u_{cc}u_h\hat{r}'_{WACC}/\Xi$ —so that $\operatorname{sgn}(h_\pi) = \operatorname{sgn}(\hat{r}'_{WACC})$. Substituting (75)-(77) into (70) and (74) leads to

$$\begin{pmatrix}\dot{k}\\ \dot{\lambda}\\ \dot{\pi}\end{pmatrix} = J^S \begin{pmatrix} k-k^* \\ \lambda-\lambda^* \\ \pi-\pi^*\end{pmatrix}, \tag{78}$$

where

$$J^S = \begin{pmatrix} J_{11}^S & J_{12}^S & J_{13}^S \\ 0 & 0 & u_c\left[1-R'(1-\tau_y)\right] \\ J_{31}^S & J_{32}^S & J_{33}^S \end{pmatrix},$$

$$J_{11}^S = f_k + f_h h_k - c_k - a\left(\hat{\delta}^*\right)\frac{\hat{\delta}^*}{1+\hat{\delta}^*} > 0,$$

$$J_{12}^S = f_h h_\lambda - c_\lambda > 0,$$

[15] I make use of the linear approximation to the Dixit-Stiglitz aggregator for equilibrium output, $y = y^* + \int_0^1 (y^j - y^*)\,dj$, and impose the factor market equilibrium conditions, $k = \int_0^1 k^j dj$ and $n = \int_0^1 n^j dj$.

$$J_{13}^S = f_h h_\pi - c_\pi - k^* R' \frac{a\left(\hat{\delta}^*\right) + \hat{\delta}^*\left(1+\hat{\delta}^*\right)a'}{\left(1+\hat{\delta}^*\right)^3 (2a' + \delta a'')} \left[\frac{\tau_c(1-\tau_y)}{1-\tau_c} - (\tau_y - \tau_p)\right],$$

$$\begin{aligned} J_{31}^S &= \alpha(\alpha + r)\frac{f_{kk} + f_{kh}h_k}{f_k} \\ &= \alpha(\alpha + r)(1-\tau_p) f_{kk}\left(u_{cc}u_{hh} - u_{ch}^2\right) < 0, \end{aligned}$$

$$J_{32}^S = \alpha(\alpha + r)\frac{f_{kh}h_\lambda}{f_k} > 0,$$

$$\begin{aligned} J_{33}^S &= r + \alpha(\alpha + r)\frac{\eta}{\eta - 1}\left\{\frac{-\hat{r}_{WACC}' + [(\eta - 1)/\eta](1-\tau_p) f_{kh}h_\pi}{(1-\tau_p) f_k}\right\} \\ &= r - \alpha(\alpha + r)\frac{\eta}{\eta - 1}\frac{(1-\tau_p)[f_k(u_{cc}u_{hh} - u_{ch}^2) - f_{hh}u_{cc}u_h]}{(1-\tau_p) f_k \Xi}\hat{r}_{WACC}'. \end{aligned}$$

Because k is a state variable and both λ and π are jump variables, in the neighborhood around the steady state (k^*, λ^*, π^*) there exists a unique equilibrium trajectory of (k, λ, π) converging asymptotically to (k^*, λ^*, π^*) when J^S has one root with a negative real part and two roots with positive real parts. The determinant of J^S, which is given by

$$\det J^S = u_c[1 - R'(1-\tau_y)]\left(J_{12}^S J_{31}^S - J_{11}^S J_{32}^S\right),$$

is negative if $R'(1-\tau_y) < 1$. Under this condition, the number of roots of J^S with a positive real part is either zero or two, implying that the macroeconomic equilibrium is either locally unique or indeterminate. If at the same time the trace of J^S is positive, then the number of roots of J^S with a positive real part is exactly equal to two. The trace of J^S is given by

$$\mathrm{tr} J^S = J_{11}^S + J_{33}^S.$$

Examining J_{33}^S, as long as $\hat{r}_{WACC}'$ approaches zero and becomes eventually negative, the trace of J^S becomes positive and, as a consequence, the equilibrium is always unique. Using (47) evaluated at the steady state, it follows that equilibrium determinacy is certainly verified under two alternative monetary policy regimes. The first regime applies under condition (54), which prescribes a passive or mildly active interest-rate policy that has the property of passing through a decline in both the weighted average cost of capital and the after-tax real interest rate in response to an increase in the inflation rate. When $\tau_y + \tau_c(1-\tau_y)/\hat{\delta}^*(1-\tau_c) > \tau_p$—that is, when the gap between $\hat{r}_{WACC}$ and $R(1-\tau_y) - \pi$

increases under inflationary pressures as for the 1980-2017 and post-2017 U.S. fiscal and financial records, letting

$$\bar{R}' \equiv \left[1-\tau_y+(\tau_y-\tau_p)\frac{\hat{\delta}^*}{1+\hat{\delta}^*}+\frac{\tau_c(1-\tau_y)}{1-\tau_c}\frac{1}{1+\hat{\delta}^*}\right]^{-1} \times\left\{1+\frac{J_{11}^S+r}{\alpha(\alpha+r)\frac{\eta}{\eta-1}\frac{(1-\tau_p)[f_k(u_{cc}u_{hh}-u_{ch}^2)-f_{hh}u_{cc}u_h]}{(1-\tau_p)f_k\Xi}}\right\},$$

denote the value of R' at which the trace vanishes, the second regime prescribes a sufficiently active—but not overly aggressive—monetary policy stance, such that

$$\frac{1}{1-\tau_y+(\tau_y-\tau_p)\frac{\hat{\delta}^*}{1+\hat{\delta}^*}+\frac{\tau_c(1-\tau_y)}{1-\tau_c}\frac{1}{1+\hat{\delta}^*}} < R' < \min\left(\frac{1}{1-\tau_y},\bar{R}'\right). \tag{79}$$

This reaction of the nominal interest rate to an increase in inflation has now the property of passing through a rise in the weighted average cost of capital, unlike the previous regime, while still resulting in a decline in the after-tax real interest rate. I summarize the foregoing results in the following proposition.

Proposition 3: *In the sticky-price economy described by (78), if*

$$R'(\pi^*) < \min\left(\frac{1}{1-\tau_y},\bar{R}'\right),$$

there exists a unique perfect-foresight equilibrium in which (k,λ,π) converge asymptotically to the steady state (k^*,λ^*,π^*). The unique equilibrium trajectory is given by the saddle-path solution

$$\pi(t)=\pi^*+\frac{\mu_1^S-J_{11}^S}{J_{13}^S+\frac{J_{12}^S u_c[1-R'(1-\tau_y)]}{\mu_1^S}}(k(t)-k^*), \tag{80}$$

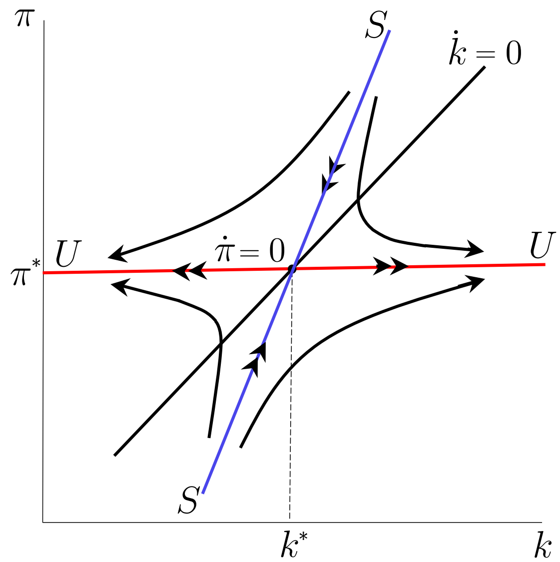
$$\lambda(t)=\lambda^*+\frac{u_c[1-R'(1-\tau_y)]}{\mu_1^S}(\pi(t)-\pi^*), \tag{81}$$

$$k(t)=k^*+e^{\mu_1^S t}(k_0-k^*), \tag{82}$$

where $\mu_1^S<0$ is the negative eigenvalue associated to J^S.

Suppose now that the trace of J^S is negative, that is, $R'>\bar{R}'$, and at the same time $1/(1-\tau_y)>\bar{R}'$. Then, by applying Routh's theorem (Gantmacher 1960), a monetary policy stance satisfying $\bar{R}'<R'<1/(1-\tau_y)$ delivers two roots of J^S with a positive

Figure 3: Dynamic behavior of (k, π) in the sticky-price model under a passive or mildly active monetary policy stance satisfying condition (54)



Notes: There is no need to build a three-dimensional phase diagram, for equilibrium dynamics in the presence of price stickiness collapse to the two-dimensional system given by $\dot{k} = J_{11}^S (k - k^*) + \{J_{13}^S + J_{12}^S u_c [1 - R'(1 - \tau_y)]/\mu_1^S\} (\pi - \pi^*)$ and $\dot{\pi} = \mu_1^S (\pi - \pi^*)$, where $\mu_1^S < 0$ is the negative eigenvalue associated to J^S. The locus SS is the stable arm of the saddlepoint (k^*, π^*), expressed by equation (80). The locus UU is the unstable arm of (k^*, π^*), which coincides with the $\dot{\pi} = 0$–locus. For a given initial condition $k(0) = k_0$, the locus SS defines $(k(t), \pi(t))$ pairs consistent with a locally unique and stable perfect-foresight equilibrium.

real part and therefore induces equilibrium determinacy if $-M + \det J^S / \mathrm{tr} J^S > 0$, where $M = -J_{32}^S u_c [1 - R'(1 - \tau_y)] + J_{11}^S J_{33}^S - J_{31}^S J_{13}^S$ is the sum of the principal minors of J^S. I state this result in the next proposition.

Proposition 4: *Assume that in the sticky-price economy described by (78),* $1/(1 - \tau_y) > \bar{R}'$*. Then, if*

$$\bar{R}' < R'(\pi^*) < \frac{1}{1 - \tau_y},$$

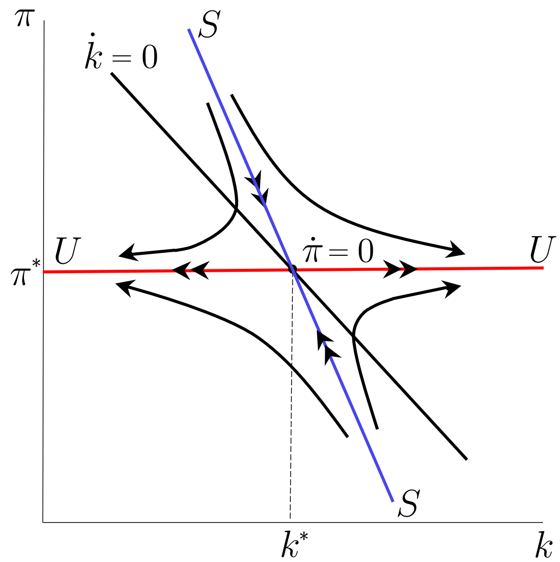
$$-M + \frac{\det J^S}{\mathrm{tr} J^S > 0} > 0,$$

where

$$\begin{aligned} M &= \text{Sum of the principal minors of } J^S \\ &= -J_{32}^S u_c [1 - R'(1 - \tau_y)] + J_{11}^S J_{33}^S - J_{31}^S J_{13}^S, \end{aligned}$$

there exists a unique perfect-foresight equilibrium in which (k, λ, π) *converge asymptotically to the steady state* (k^*, λ^*, π^*)*. The unique equilibrium trajectory is given by the saddle-path*

Figure 4: Dynamic behavior of (k, π) in the sticky-price model under a sufficiently active monetary policy stance satisfying condition (79)



Notes: The figure shows the phase diagram in the sticky-price model under condition (79), which in turn requires a relatively low tax shield—such that $\tau_y + \tau_c (1 - \tau_y) / \hat{\delta}^* (1 - \tau_c) > \tau_p$. I assume $J_{13}^S > -J_{12}^S u_c[1 - R' (1 - \tau_y)]/\mu_1^S$, implying a negatively sloped saddle path. The locus SS is the stable arm of the saddlepoint (k^*, π^*), expressed by equation (80). The locus UU is the unstable arm of (k^*, π^*), which coincides with the $\dot{\pi} = 0$–locus. For a given initial condition $k(0) = k_0$, the locus SS defines $(k(t), \pi(t))$ pairs consistent with a locally unique and stable perfect-foresight equilibrium.

solution (80)-(82).

In contrast to the preceding cases, when $R' (1 - \tau_y) > 1$, the determinant is positive, so that the number of roots of J^S with a positive real part is either one or three. That is, the macroeconomic equilibrium is either indeterminate or, for $k_0 \neq k^*$, unstable. If at the same time the trace of J^S is negative, that is, $R' > \bar{R}'$, the number of roots of J^S with a positive real part is exactly equal to one, and so the equilibrium exhibits indeterminacy. I highlight this result in the following proposition.

Proposition 5: *In the sticky-price economy described by (78), if*

$$R'(\pi^*) > \max\left(\frac{1}{1 - \tau_y}, \bar{R}'\right),$$

there exist a continuum of perfect-foresight equilibria in which (k, λ, π) converge asymptotically to the steady state (k^*, λ^*, π^*).

On the other hand, if the trace of J^S is positive, that is, $R' < \bar{R}'$, and at the same time

$1/\left(1-\tau_y\right)<\bar{R}'$, the number of roots of J^S with a positive real part is either one or three, and so the equilibrium is either indeterminate or, for $k_0 \neq k^*$, unstable. In particular, by applying again Routh's theorem, the equilibrium incurs indeterminacy (instability) if $-M+\det J^S/\mathrm{tr}J^S > (<)\, 0$. The following proposition collects these results.

Proposition 6: *Assume that in the sticky-price economy described by (78), $1/\left(1-\tau_y\right)<\bar{R}'$. Then, when*

$$\frac{1}{1-\tau_y} < R'\left(\pi^*\right) < \bar{R}',$$

(*a*) *if $-M+\det J^S/\mathrm{tr}J^S > 0$, there exist a continuum of perfect-foresight equilibria in which (k,λ,π) converge asymptotically to the steady state (k^*,λ^*,π^*);*

(*b*) *if $-M+\det J^S/\mathrm{tr}J^S < 0$ and $k_0 \neq k^*$, no perfect-foresigh equilibria exist in which (k,λ,π) converge asymptotically to the steady state (k^*,λ^*,π^*).*

The central reason explaining the analytical findings established in Propositions 3-7 hinges on the fact that $\hat{r}_{WACC}'$—which reveals the impact of a rise in inflation on the weighted average cost of capital via the monetary policy stance and the associated optimal corporate financing choices—does enter the linearized Phillips curve. Excessively aggressive interest rate policies in response to an increase in inflation exacerbate the rise in the real cost of capital, thus fostering real marginal costs and inducing firms to set higher prices. This reinforces the initial inflationary pressures, generating aggregate instability in the form of either multiple equilibria or instability. A unique stable equilibrium requires a passive or moderately active monetary policy. In particular, analogously to the case of flexible prices, equation (80) stipulates that a relatively inactive stance of monetary policy, satisfying condition (54) and ensuring both $\hat{r}_{WACC}' < 0$ and $R'\left(1-\tau_y\right) < 1$, delivers the existence of a positively sloped saddle path in the k-π space converging to the steady state (see Figure 3).[16] Conversely, if $\tau_y+\tau_c\left(1-\tau_y\right)/\hat{\delta}^*\left(1-\tau_c\right) > \tau_p$—a condition operative in the U.S. over both the 1980-2017 period and the post-2017 fiscal reform era, and $J_{13}^S > -J_{12}^S u_c[1-R'\left(1-\tau_y\right)]/\mu_1^S$, a sufficiently active—although not overly aggressive—stance of monetary policy, satisfying condition (79) and ensuring $\hat{r}_{WACC}' > 0$ and $R'\left(1-\tau_y\right) < 1$, induces the existence of a negatively sloped saddle path (see Figure 4). In the next two sections I shall use the properties of the saddle-path solution in the sticky-price economy to characterize transitional dynamics following permanent and temporary monetary policy shocks.

[16] As in the flexible-price environment, I rule out the unrealistic hypothesis in which the variation in consumption of physical goods generated by an increase in inflation is more than offset by the variation in the opposite side of consumption of agency services, so that $\mathrm{sgn}\left(J_{13}^S\right) = \mathrm{sgn}(\hat{r}_{WACC}')$.

4 Transitional Dynamics under Interest Rate Normalization

In this section, I use the imperfect-competition-sticky price model developed in Section 3 to analyze the macroeconomic consequences of interest rate normalization in the form of a permanent, exogenous MIT-type shock increasing the steady-state equilibrium rate of nominal interest one-for-one. The implications of normalizing interest rates after a protracted period of below-target inflation coupled with the nominal interest rate at the lower bound—which constrained monetary policy since the Great Recession—are a central issue in the ongoing macroeconomic debate. My analysis reveals that macroeconomic dynamics resulting from interest rate normalization are qualitatively dependent upon the tax structure and the steady-state debt-equity ratio. The key reason driving my results here is that the pass-through from the nominal interest rate controlled by the central bank to the weighted average cost of capital obtained by microfounding corporate financing choices in the presence of differential tax treatments of alternative securities renders monetary policy decisions non-supeneutral, for they affect the long-run capital-labor ratio via the modified golden rule prevailing in the present framework.

To see this, consistently with Schmitt-Grohé and Uribe (2022), consider an interest-rate policy rule of the form

$$R = R(\pi) + N(\nu),$$

where ν is an exogenous monetary variable, initially set at a given level, and $N(\cdot)$ is continuously differentiable and obeys $N(\cdot) > -R(\cdot)$, $N'(\cdot) = 1 - R'(\cdot)(1-\tau_y)$. The central bank is assumed to target an inflation rate $\pi^* > -r$ satisfying the Fisher equation, so that $(R(\pi^*) + N(\nu))(1-t_y) = r + \pi^*$. Therefore, $d\pi^*/d\nu = (1-t_y)$ and $dR^*/dv = 1$.

Since agents are forward looking, the transitional adjustment driven by an unanticipated, permanent increase in ν is determined in part by the expectations of the steady state. This is directly influenced by the interest rate policy via both the modified golden rule, given by $(1-\tau_p) f_k(k^*, h^*) = [\eta/(\eta-1)]\, \hat{r}^*_{WACC}$, where $\hat{r}^*_{WACC} = r - a'\left(\hat{\delta}(R^*)\right) \hat{\delta}(R^*)^2 + [R^*\tau_c(1-\tau_y) + \bar{\imath}(\tau_y - \tau_c)]/(1-\tau_c)$, and the product market equilibrium condition, given by $f(k^*, h^*) = c^* + a\left(\hat{\delta}(R^*)\right)\left[\hat{\delta}(R^*)/\left(1+\hat{\delta}(R^*)\right)\right] k^*$. Differentiating the overall steady-state relationships yields

$$\frac{dk^*}{d\nu} = \left.\frac{dk^*}{d\nu}\right|_{CCE} + \left.\frac{dk^*}{d\nu}\right|_{ACE},$$

where, letting

$$\begin{aligned}\Theta &\equiv (1-\tau_p) f_{kh}\left[\frac{\eta-1}{\eta}(1-\tau_y) f_h u_{cc}+u_{ch}\right]\left[f_k - a\left(\hat{\delta}^*\right)\frac{\hat{\delta}^*}{1+\hat{\delta}^*}\right] \\ &\quad -(1-\tau_p) f_{kk}\left[\frac{\eta-1}{\eta}(1-\tau_y) f_h\left(f_h u_{cc}+u_{ch}\right)+u_{hh}+f_h u_{ch}\right] \\ &< 0,\end{aligned}$$

$$\begin{aligned}\left.\frac{dk^*}{d\nu}\right|_{CCE} &= \Theta^{-1}\left[(\tau_y-\tau_p)\frac{\hat{\delta}^*}{1+\hat{\delta}^*}+\frac{\tau_c(1-\tau_y)}{1-\tau_c}\frac{1}{1+\hat{\delta}^*}\right] \\ &\quad \times\left[\frac{\eta-1}{\eta}(1-\tau_y)\left(f_{kn}^2 u_{cc}+f_{hh}u_c+f_h u_{ch}\right)+u_{hh}+f_h u_{ch}\right]\end{aligned}$$

is the "cost of capital effect", which operates via the modified golden rule, and

$$\begin{aligned}\left.\frac{dk^*}{d\nu}\right|_{ACE} &= \Theta^{-1}k^*\frac{a\left(\hat{\delta}^*\right)+\hat{\delta}^*\left(1+\hat{\delta}^*\right)a'}{\left(1+\hat{\delta}^*\right)^3(2a'+\delta a'')}\left[\frac{\tau_c(1-\tau_y)}{1-\tau_c}-(\tau_y-\tau_p)\right] \\ &\quad \times(1-\tau_p)\left[\frac{\eta-1}{\eta}(1-\tau_y) f_{kh}f_h u_{cc}+f_{kh}u_{ch}\right]\end{aligned}$$

is the "agency cost effect", which operates via the product market equilibrium condition. Using the saddle-path equation (80) and the fact that $k(0)$ is predetermined, the short-run response of inflation is given by

$$\frac{d\pi(0)}{d\nu}=\left.\frac{d\pi(0)}{d\nu}\right|_{FE}+\left.\frac{d\pi(0)}{d\nu}\right|_{ICE},$$

where

$$\left.\frac{d\pi(0)}{d\nu}\right|_{FE}=\frac{d\pi^*}{d\nu}>0$$

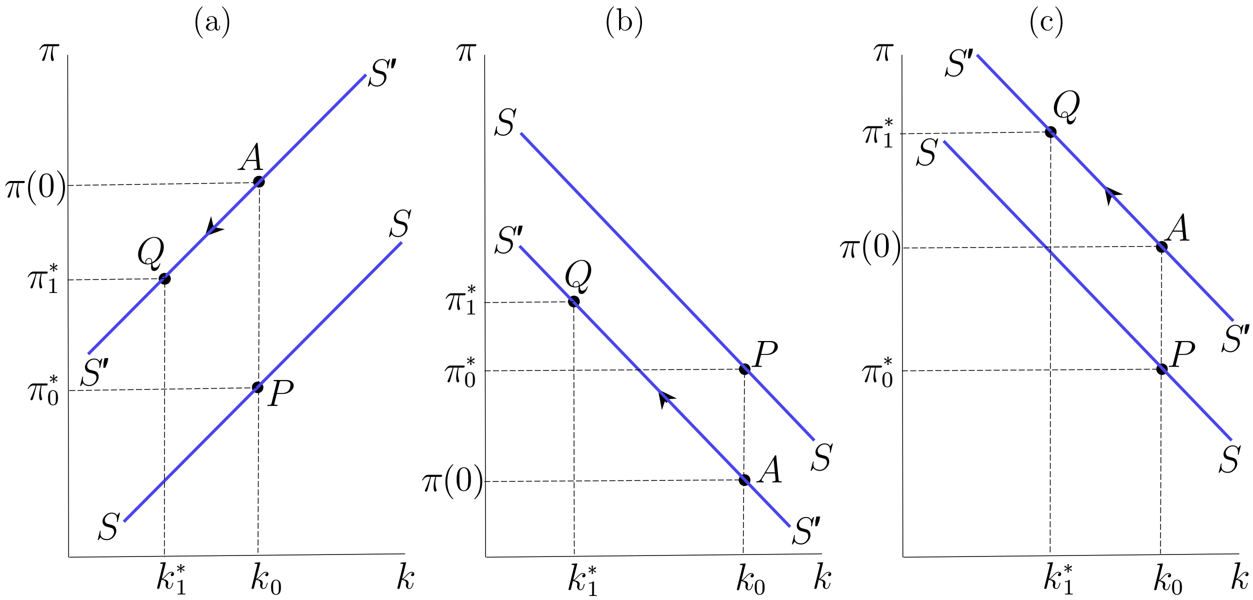
is the "Fisher effect" resulting from the Fisher equation and

$$\left.\frac{d\pi(0)}{d\nu}\right|_{ICE}=-\frac{\mu_1^S-J_{11}^S}{J_{13}^S+\frac{J_{12}^S u_c[1-R'(1-\tau_y)]}{\mu_1^S}}\frac{dk^*}{d\nu}.$$

is the "intertemporal capital accumulation/decumulation effect" resulting from the remaining steady-state conditions.

Figures 5-6 show the set of transitional dynamics that may emerge in response to in-

Figure 5: Transitional dynamics following interest rate normalization under $\tau_y + \tau_c(1-\tau_y)/\hat{\delta}^*(1-\tau_c) > \tau_p$ (condition (59))

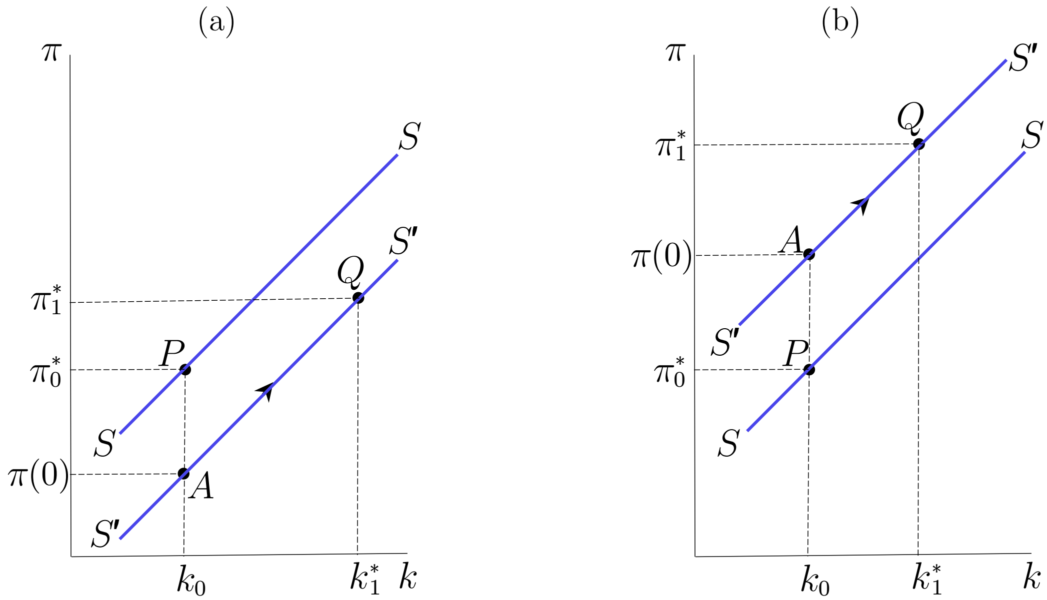


Notes: (k_0, π_0^*) is the initial steady-state equilibrium. (k_1^*, π_1^*) is the new steady-state equilibrium following the shock. Panel (a) assumes a passive or mildly active monetary policy stance satisfying condition (54). Panels (b)-(c) assume a sufficiently active monetary policy stance satisfying condition (79), which in turn requires a relatively low tax shield—such that $\tau_y + \tau_c(1-\tau_y)/\ \hat{\delta}^*(1-\tau_c) > \tau_p$. In this case, I assume $J_{13}^S > -J_{12}^S u_c[1 - R'(1-\tau_y)]/\mu_1^S$, implying a negatively sloped saddle path. In panel (b), the intertemporal capital decumulation effect is dominant. In panel (c), the Fisher effect is dominant.

terest rate normalization, consistently with the above analytical findings. In all panels, the economy is initially in steady state at the point P on the stable arm SS. Following the permanent increase in v, the stable arm and the steady-state equilibrium shift to $S'S'$ and Q, respectively. The inflation rate jumps instantaneously from P to A on $S'S'$ and then converges continuously to Q.

Consider first the case—realistically plausible, as we have seen, with reference to the 1980-2017 and post-2017 periods in the U.S.—in which $\tau_y + \tau_c(1-\tau_y)/\hat{\delta}^*(1-\tau_c) > \tau_p$ (Figure 5), implying that the long-run weighted average cost of capital covaries positively with the long-run nominal interest rate, due to a relatively low tax shield associated to the interest-deductibility of debt. Under these circumstances, interest rate normalization brings about a fall in the long-run capital stock through the cost of capital channel. The decline in the long-run capital stock is dampened by the agency cost channel if $\tau_c(1-\tau_y)/(1-\tau_c) > (\tau_y - \tau_p)$—as is the case in my baseline calibration, that is, if the monetary policy shock induces firms to switch toward debt financing, thereby boosting demand for agency services. If the cost of

Figure 6: Transitional dynamics following interest rate normalization under $\tau_p > \tau_y + \tau_c (1 - \tau_y) / \hat{\delta}^* (1 - \tau_c)$ (condition (60))



Notes: (k_0, π_0^*) is the initial steady-state equilibrium. (k_1^*, π_1^*) is the new steady-state equilibrium following the shock. Both panels (a)-(b) assume a passive or mildly active monetary policy stance satisfying condition (54). In panel (a), the intertemporal capital accumulation effect is dominant. In panel (b), the Fisher effect is dominant.

capital effect prevails on the agency cost effect, short-run investment decreases, with inflation that on impact overshoot (undershoot) its higher steady-state rate as long as monetary policy is relatively inactive (sufficiently active), that is satisfying condition (54) (condition (79)).

Consider, by contrast, the case—realistically plausible with reference to the pre-1980 period in the U.S.—in which $\tau_p > \tau_y + \tau_c (1 - \tau_y) / \hat{\delta}^* (1 - \tau_c)$ (Figure 6), implying that the long-run weighted average cost of capital covaries negatively with the nominal interest rate, due to a relatively high tax shield. Under these circumstances, interest rate normalization unambiguously brings about a rise in the long-run capital stock through both the cost of capital and the agency cost channels. Unlike the foregoing case, now short-run investment raises, with inflation that on impact always undershoot its higher steady-state rate, regardless of the conduct of monetary policy.

5 Transitional Dynamics under Temporary Monetary Tightening

The importance of capital and tax structures in determining equilibrium dynamics applies also in the event of transitory, exogenous MIT-type shock in the nominal interest rate. To see this, suppose that the central bank sets the policy rate according to

$$R = R(\pi) + \varepsilon,$$

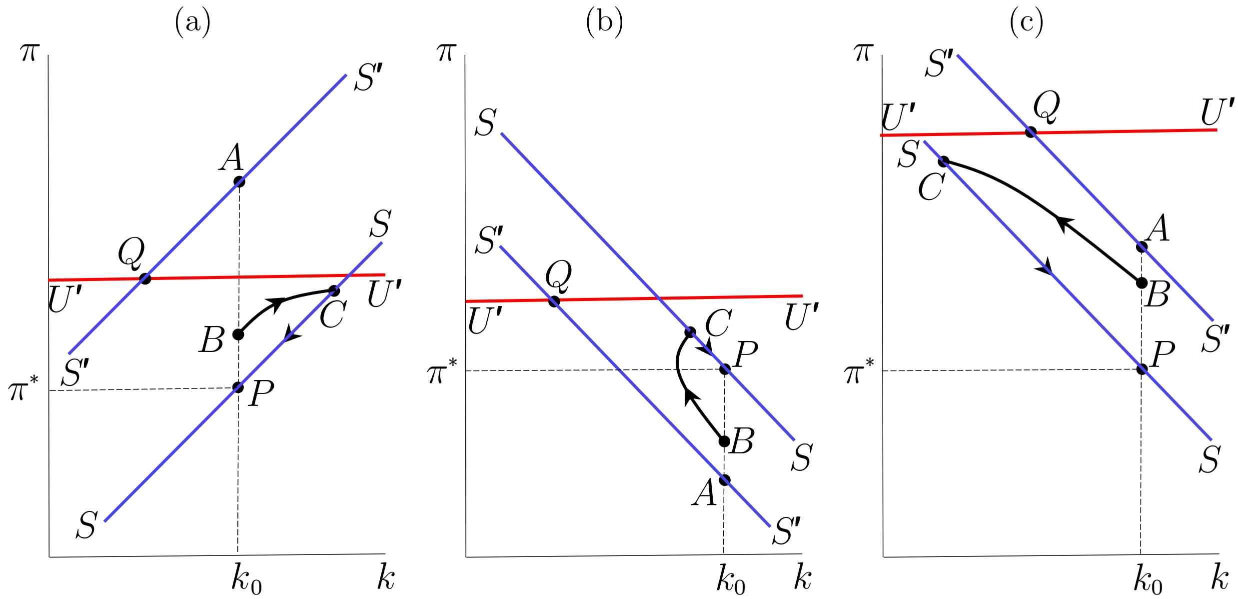
where $\varepsilon > -R(\cdot)$ is an exogenous monetary variable initially set at a given level and capturing a discretionary deviation from rule (44). The target inflation rate $\pi^* > -r$ satisfies $(R(\pi^*) + \varepsilon)(1 - t_y) = r + \pi^*$. Figures 7-8 show the set of dynamic adjustments that may occur in response to a temporary increase in ε. Specifically, to obtain transparent results and compare them with the case of a permanent monetary shock, I assume that at time 0, ε is increased by the central bank and is expected to be restored at its original level at time $T > 0$. Therefore, in all panels, the steady-state equilibrium remains at the point P on the stable arm SS. However, following the increase in ε, the stable arm shifts temporarily to $S'S'$ for the period $(0, T)$. As a consequence, the inflation rate jumps instantaneously from P to B and then follow the path BC—which *per se* tends to approach the temporarily shifted unstable arm $U'U'$[17]—until T. At that time, the economy reaches the point C on the original stable arm and converges back to the original equilibrium P.

In other words, the temporary change in the steady state and the saddle path makes macroeconomic variables move along a temporarily unstable equilibrium trajectory, in a way to stay on the initial saddle path at the time in which the monetary shock dissolves. Three consequences stand out. First, because forward-looking agents discount the effects of the temporary increase in ε, the height of the jump in $\pi(0)$ is lower than in the case of a permanent increase in ε. That is, B is between P and A. The higher the duration T of the temporary shock, the larger the size of the jump in $\pi(0)$ and, thus, the lower the distance between B and A.

Second, whether or not the inflation response to temporary monetary tightening exhibits a "price puzzle" (Sims, 1992; Eichenbaum, 1992) does depend on the monetary policy stance interacting with the tax code and the equilibrium corporate leverage—for they affect critically the pass-through from the exogenous nominal interest-rate hike to the weighted average cost of capital—as well as on the importance of the Fisher effect relatively to the intertemporal

[17] To keep the panels uncluttered, the unstable arm associated to the initial steady-state equilibrium is not depicted.

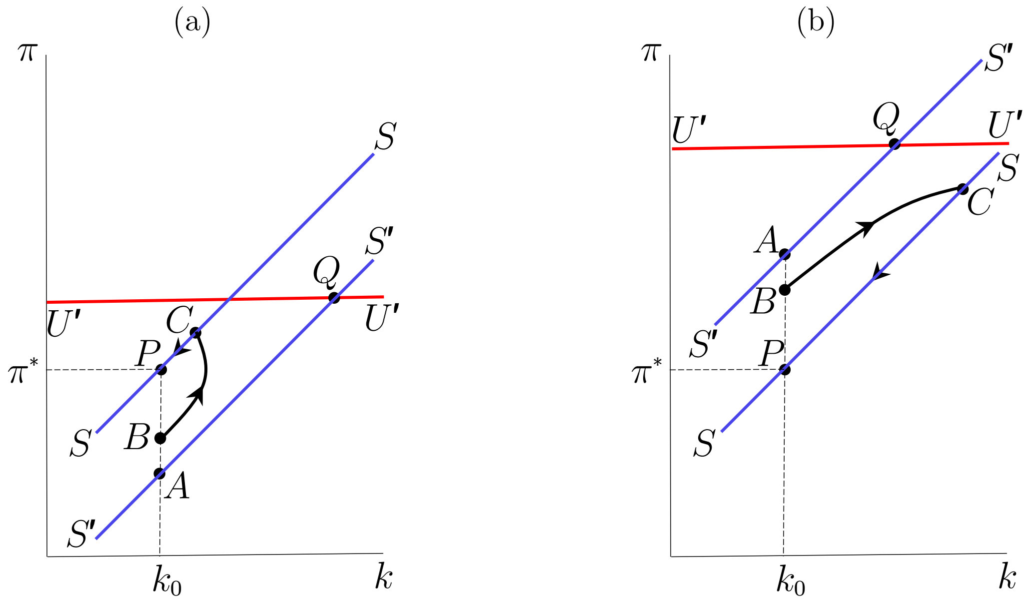
Figure 7: Transitional dynamics following temporary monetary tightening under $\tau_y + \tau_c(1-\tau_y)/\hat{\delta}^*(1-\tau_c) > \tau_p$ (condition (59))



Notes: Panel (a) assumes a passive or mildly active monetary policy stance satisfying condition (54). Panels (b)-(c) assume a sufficiently active monetary policy stance satisfying condition (79), which in turn requires a relatively low tax shield—such that $\tau_y + \tau_c(1-\tau_y)/\ \hat{\delta}^*(1-\tau_c) > \tau_p$. In this case, I assume $J_{13}^S > -J_{12}^S u_c[1-R'(1-\tau_y)]/\mu_1^S$, implying a negatively sloped saddle path. In panel (b), the intertemporal capital decumulation effect is dominant. In panel (c), the Fisher effect is dominant.

capital accumulation/decumulation effect. These aspects are arguably overlooked by the price-puzzle literature (Rabanal, 2007). In particular, my results show that a positive impact of the tight shock on inflation emerges in three cases. In the first case, shown in panel (a) of Figure 7, the monetary policy stance is relatively inactive, respecting condition (54), and $\tau_y + \tau_c(1-\tau_y)/\hat{\delta}^*(1-\tau_c) > \tau_p$—as for the U.S. fiscal and financial history during the 1980–2017 period and following the 2017 fiscal reform, resulting in a positive pass-through from the nominal interest rate to the gap between the real cost of capital and the after-tax real interest rate. In the second case, shown in panel (c) of Figure 7, the monetary policy stance is sufficiently active, respecting condition (79), $\tau_y + \tau_c(1-\tau_y)/\hat{\delta}^*(1-\tau_c) > \tau_p$ and $\left|J_{13}^S\right| > J_{12}^S u_c[1-R'(1-\tau_y)]/\mu_1^S$, resulting still in a positive pass-through but now in a positively sloped saddle path, and the Fisher effect is dominant over the intertemporal capital decumulation effect. In the third case, shown in panel (b) of Figure 8, the monetary policy stance is relatively inactive, $\tau_p > \tau_y + \tau_c(1-\tau_y)/\hat{\delta}^*(1-\tau_c)$—as for the pre-1980 period in the U.S. and so now resulting in a negative pass-through, with the Fisher effect still dominant over the intertemporal capital accumulation effect.

Figure 8: Transitional dynamics following temporary monetary tightening under $\tau_p > \tau_y + \tau_c (1 - \tau_y) / \hat{\delta}^* (1 - \tau_c)$ (condition (60))



Notes: Both panels (a)-(b) assume a passive or mildly active monetary policy stance satisfying condition (54). In panel (a), the intertemporal capital accumulation effect is dominant. In panel (b), the Fisher effect is dominant.

Third, the temporary unstable path driven by the transitory monetary disturbance opens the door to the possibility of nonmonotonic dynamics. For example, as it emerges from panel (b) of Figure 7, when monetary policy is sufficiently active, $\tau_y + \tau_c (1 - \tau_y) / \hat{\delta}^* (1 - \tau_c) > \tau_p$, and the intertemporal capital decumulation effect prevails over the Fisher effect, inflation falls on impact and then typically follow a nonmonotonic dynamics overshooting the target rate before approaching to the steady-state equilibrium.

6 Discussion and Conclusions

The dynamic properties of interest-rate feedback policy rules—whereby the nominal interest rate set by the central bank responds positively to upward deviations of inflation from the target rate—are traditionally studied in the context of general equilibrium models that overlook corporate financial policies about the optimal mix of debt, equity and retained earnings used to finance investment plans. The classic theory of corporate finance, on the other hand, employ partial equilibrium approaches, abstracting from the intertemporal optimization by households as well as from the stance of monetary policy. This paper is an effort to fill this gap.

I integrate optimal corporate financing decisions in the presence of tax incentives—implying deviations from the Modigliani-Miller capital structure irrelevance theorem—into flexible- and sticky-price general equilibrium models. Both demand- and supply-side channels of monetary policy transmission encompassing adjustments of corporate financial structure endogenously arise. I derive the appropriate weighted average cost of capital in general equilibrium, which does account for the intertemporal maximizing behavior by both households and firms as well as for the conduct of monetary policy in the form interest-rate feedback rules. A central aspect of the macroeconomic environment I study in this paper is that nominal interest-rate variations get passed through to the costs of debt and equity capital asymmetrically and, as a consequence, lead firms to adjust the capital structure employed to finance investments, in turn altering the gap between the equilibrium weighted average cost of capital and the real interest rate.

I employ the resulting model to analyze central issues for monetary theory and find results that would not appear in traditional monetary frameworks. In particular, preserving macroeconomic stability does not require the application of the Taylor principle—the well-known monetary policy recommendation emanating from the standard New Keynesian literature of raising the nominal interest rate more than proportionally with respect to an upward divergence of the inflation rate from the central bank's target. Passive monetary policies, which underreact to inflationary pressures, are compatible with the existence of a unique stable equilibrium. The Taylor principle is not only non-essential but may also reveal to be a non-sufficient condition to guarantee aggregate stability. When price stickiness is operative, fighting inflation too aggressively by means of a feedback parameter in the policy rule beyond a certain threshold—which is dependent upon the steady-state debt-equity ratio and the tax structure—is destabilizing, for it gives rise to either sunspot fluctuations or unstable equilibrium dynamics.

A key explanation for the above findings hinges on the fact that under realistic tax structures, the gap between the optimization-based weighted average cost of capital and the real interest rate covaries negatively with the policy rate, reflecting the "tax shield" linked to deductibility of interest payments on corporate debt in conjunction with the firms' optimal switch toward the lowest-priced financing mode in response to nominal interest-rate hikes. This negative comovement implies that a rise in inflation gets passed through into a fall in the real cost of capital under either a passive or a mildly active stance of monetary policy. As a result of the action of the supply-side channel of monetary policy, the foregoing property proves to induce saddle-path stability. When the initial stock of capital is higher than it steady-state value, the decline in the real cost of capital in consequence of above-target inflation dampens firms' recourse to labor. As long as leisure and private consumption are normal goods, the implied increase in leisure must entail a reduction in the marginal utility of wealth and a boost in consumption. Corporate investment turns to be crowded out, inducing convergence of the capital stock toward its steady-state value. From the co-state equation, when the central bank is engaged in a sufficiently non-aggressive monetary policy, the decline in the after-tax real interest rate action brings about future increases in the marginal utility of wealth toward its steady-state value, thus ensuring aggregate stability.

Inspection of the macroeconomic effects induced by permanent and temporary monetary policy shocks reveals that equilibrium dynamics along the transitional adjustment path are crucially dependent upon both capital and tax structures. A central aspect driving my results here is that the pass-through from the nominal interest rate controlled by the central bank to the weighted average cost of capital obtained microfounding corporate financing choices under differential tax treatments of alternative securities renders monetary policy decisions potentially non-superneutral. A permanent, exogenous shock in the form of interest-rate normalization after a period of low inflation coupled with the nominal interest rate at the lower bound affects not only the long-run inflation rate via the Fisher effect, but also the long-run capital-labor ratio via the modified golden rule that applies in the present economic environment. Specifically, in the case in which the steady-state debt-equity ratio and the tax rate on corporate income are relatively low—resulting in a relatively limited tax shield, the long-run gap between the weighted average cost of capital and the after-tax real interest rate raises in response to interest-rate normalization, making the long-run capital stock fall. Short-run investment thus decreases, with inflation that on impact overshoot (undershoot) its higher steady-state rate as long as monetary policy is relatively inactive (sufficiently active). By contrast, in the case in which the steady-state debt-equity ratio and the tax rate on corporate income are relatively high—resulting in a relatively pronounced tax shield, the long-run gap between the real cost of capital and the after-tax real interest rate decreases in response to interest-rate normalization, making the long-run capital stock increase. Unlike the foregoing case, now short-run investment raises, with inflation that on impact always undershoot its higher steady-state rate, regardless of the conduct of monetary policy.

The key influence of the steady-state financial structure and the tax code in determining equilibrium dynamics remains valid also in the event of a temporary, exogenous hike in the nominal interest rate. In this case, the temporary change in the steady state and the saddle path following the shock make macroeconomic variables move along a temporarily unstable equilibrium trajectory, which allows them to reach the initial saddle path at the time in which the monetary shock disappears. In the presence of forward-looking agents, the impact effects here are always lower than in the case of a permanent monetary shock. However, non-monotonic dynamics—such as a hump-shaped behavior of inflation—are likely to emerge. In addition, macroeconomic dynamics delivering an upward jump in inflation after a tight monetary shock may well occur, thus providing an uninvestigated explanation to the so-called "price puzzle"—the positive reaction of prices on impact to an unexpected tightening of monetary policy often detected in empirical studies—that is grounded upon both capital and tax structures, to the extent that they affect critically the pass-through from the nominal interest rate set by the central bank to the weighted average cost of capital.

In order to convey my arguments in a direct and analytically tractable way, and compare transparently my results with the standard literature on monetary policy rules, the investigation presented in this paper has made use of a number of simplifying assumptions. In particular, the optimal agents' behavior has implied, in equilibrium, the equality between the after-tax returns on bonds and equity. Consequently, when the central bank changes nominal interest rates in response to inflation, capital gains instantaneously adjust to maintain the no-arbitrage condition. As a result, the dynamics of equity values does not *per se* reflect firm fundamentals.

Therefore, valuable extensions of the framework under study arguably involve introducing adjustment frictions in capital gains and risk considerations, which prevent the no-arbitrage condition from holding continuously, as well as incorporating links between capital gains and the production sector. Firms' investment and production decisions, which in turn affect current and future expected profits, should realistically influence the way in which the dynamic evolution of equity values respond to monetary policy changes, over and above the pure nominal adjustment via the no-arbitrage condition. Even though a formal treatment of these aspects is beyond the scope of the present paper, the explicit consideration of such additional scenarios appears to reinforce—rather than undermine—the paper's key message: that is, taking into account the modes of corporate finance and the optimal corporate financial policies in the context of general equilibrium models is essential for a comprehensive characterization of the nexus between alternative monetary policy rules and macroeconomic stability. The analytically tractable setup I have developed in this work, along with the results I have established here, could then be used as a fruitful benchmark for further investigations in a variety of directions. In addition to the aforementioned extensions, future research may be intended to incorporate, for example, the zero-lower-bound problem on nominal interest rates, interest rate policy rules targeting average inflation, the interaction between monetary and fiscal policies, corporate and sovereign debt risk, and agents' learning.

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