Where Liquidity is Scarce: The Spirit of Capitalism and the Growth Effects of Monetary Policy

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Abstract

This paper offers a distinct standpoint on the growth effects of monetary policy in the presence of a spirit of capitalism, that is, an independent gratification conveyed through asset accumulation. Using a monetary Schumpeterian growth model with an endogenous market structure, we generalize the main insights of previous literature. In doing so, we uncover a novel general equilibrium mechanism and demonstrate that prior findings represent distinct regimes of this broader framework. In particular, we show that a higher nominal interest rate can have a negative effect on steady-state economic growth, challenging the result of long-run neutrality of monetary policy. The direction of the effect is governed not only by the presence of the spirit of capitalism as such, but by where liquidity is constrained. A structural calibration to the United States economy, disciplining liquidity exposures with independent evidence on startup finance and transaction-money holdings, isolates the quantitative importance of the new channel and places the economy comfortably in the region in which a higher nominal interest rate lowers long-run growth.

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1 Introduction

"Man is dominated by the making of money, by acquisition as the ultimate purpose of his life."

"... the development of the spirit of capitalism is best understood as part of the development of rationalism as a whole."

— Max Weber, *The Protestant Ethic and the Spirit of Capitalism*

Few questions in macroeconomics have been debated as extensively as whether monetary policy can affect an economy's long-run economic growth rate. The conventional premise is that it cannot. Once prices have adjusted, changes in money growth should have no lasting effect on real quantities, leaving inflation primarily as a distortion to be minimized. Recent work has challenged this premise. If households value wealth not only because it finances future consumption but also for its own sake, the preference commonly referred to as the *spirit of capitalism* (SoC), money need no longer be neutral for economic growth. Under this mechanism, recent literature has shown that the wealth motive strengthens accumulation sufficiently to overturn the standard neutrality result and weakens the usual case for price stability in the sense that a higher rate of inflation might increase long-run economic growth.

We show that this result depends crucially on where liquidity is scarce. In the existing literature, the relevant constraint is usually placed on consumption. We consider, among several novel features, a constraint on the financing of firm entry, that is, startup financing. In this much broader framework, where the creation of new firms and the funding constraints associated with this firm creation, are taken into account, the effect can reverse. When market entry must be financed with liquid funds, a higher nominal interest rate reduces long-run economic growth even in the presence of a strong wealth motive, and the case for price stability is strengthened rather than weakened. The sign of the growth effect therefore depends not only on households' preference for wealth, but also on the margin at which liquidity constraints bind.

Our novel general-equilibrium mechanism operates through firm value and endogenous market structure. In the model economy, household wealth consists of claims on firms. A stronger preference for wealth therefore increases households' demand for firm ownership. The effect of a higher nominal interest rate depends on how monetary policy affects the value of those firms. When the financing constraint applies to market entry, a higher nominal rate raises the cost of creating new firms and, thus, raises their equilibrium value. The higher cost weakens the accumulation incentive generated by the wealth motive and lowers economic growth. When the constraint instead applies to consumption, the same

increase in the nominal interest rate shifts household resources away from consumption and toward accumulation, raising economic growth. The preference for wealth is the same in the two cases, what changes is the location of the liquidity constraint.[1]

The modeling choice for imposing particular constraints is empirically disciplined. A substantial corporate-finance literature, presented in depth in the following section, shows that external finance is particularly scarce for young firms and that their financing conditions are especially sensitive to monetary policy. Monetary tightening reduces startup and venture capital financing, with especially strong effects at early stages of the firm's life cycle. We use the available empirical evidence not only to motivate the constraint on market entry but also to quantify it. In the model, the intensity of the market entry constraint equals the share of entry costs financed by interest-bearing debt. In United States data on newly founded firms, this share is about 44 percent, well above the ratio of transaction balances to consumption that governs the consumption constraint. This evidence points toward market entry financing as an economically relevant margin through which monetary policy operates. Under this generalized framework, the growth-enhancing effect of higher inflation as found in the recent literature is reversed. Two elements of the framework are important for this mechanism. First, firms enter and exit, and market size at the firm level is determined endogenously. Market entry must therefore respond to economic incentives, including the cost of external finance. This cannot be captured in models in which each firm's market is identified with the aggregate economy. Such models also generate the familiar scale effect whereby larger economies grow faster. We instead build on the literature with endogenous market structure, in which entry and exit determine the market size of individual firms and innovation incentives depend on firm size rather than the size of the aggregate economy. This class of models is also consistent with the empirical observation that research effort per firm has remained broadly stable even as aggregate research effort has increased. Second, the monetary friction operates directly through the financing of market entry. Together, these two features allow monetary policy to affect the value of firm creation and therefore the interaction between wealth accumulation and long-run economic growth.

The welfare results point in the same direction. Long-run welfare declines monotonically with the nominal interest rate, implying that the optimal policy drives the opportunity cost of holding money to zero, as under the Friedman rule. A stronger spirit of capitalism reinforces this result. When the liquidity constraint applies to market entry, a stronger wealth motive increases the welfare importance of economic growth, while also making growth more sensitive to the distortion created by inflation. The case for a low

[1]The standard mechanism (cf. Peretto, 1998) is still present. Less entry increases market size per incumbent and, taken in isolation, tends to raise the return to vertical R&D. Our negative growth effect, however, comes from the additional spirit of capitalism wedge generated by the market-entry financing friction. Whenever the nominal interest rate i rises, this wedge falls and weakens the accumulation incentive.

nominal interest rate therefore becomes stronger as the wealth motive increases. This differs from the existing literature, in which a low optimal inflation rate arises in spite of a positive effect of inflation on economic growth. In our model, the welfare result is instead consistent with a negative growth effect.

Our results are robust to several extensions. Positive market entry along the balanced growth path as generated by population growth, the presence of exogenous market exit of firms, and the generalization that liquidity is also needed for R&D of the incumbent all leave our qualitative results unchanged and have mostly minor effects on the quantitative results. Only in the case of a comparatively high market exit rate, the effect of costlier market entry may dominate the other channels.

The cross-country pattern found in the data is consistent with the theoretical prediction of a sign-reversal in the relationship between inflation and economic growth. To our knowledge, this is the first paper to relate the inflation–growth association to measured wealth preferences. Using six waves of the World Values Survey covering 81 countries, we construct a measure of the strength of the wealth motive based on households' reported emphasis on thrift and accumulation. We then examine how the relationship between inflation and economic growth varies with this measure. The estimated relationship changes systematically with the strength of the wealth motive. When the wealth motive is weak, the association between inflation and economic growth is slightly positive. As the wealth motive becomes stronger, the association declines, crosses zero, and becomes negative. Although these estimates are descriptive rather than causal, the sign reversal occurs in the data along precisely the dimension singled out by the theory: the strength of the wealth motive.

Our contribution is therefore threefold. First, we provide a unified framework in which the long-run growth effects of monetary policy depend on the incidence of liquidity constraints rather than on the wealth motive alone. The framework nests monetary neutrality, the growth-enhancing effect obtained when liquidity constrains consumption, and a growth-reducing effect when liquidity constrains firm creation. This shows that opposite results in the literature can be understood as different regimes of a common mechanism. Second, by making firm startups endogenous, we identify a new interaction between monetary policy, firm valuation, market structure, and wealth accumulation that was otherwise absent from the literature. Third, we show that the Friedman rule remains optimal and that a stronger wealth motive reinforces this result.

The paper proceeds as follows. Section 2 provides a short overview of the relevant literature, while Section 3 motivates the analysis using stylized facts on the interaction between the spirit of capitalism and economic growth. In Section 4, we develop the model and in Section 5, we derive the long-run growth and welfare effects of monetary policy. In Section 6, we compare the results of the model with United States data. Section 7 checks the robustness of the model. Finally, we conclude in Section 8.

2 Related Literature

The paper relates to the literature on the long-run growth effects of monetary policy, from Tobin (1965) to modern Schumpeterian models in which economic growth results from purposeful innovation. In this literature, monetary policy affects real activity when innovative investment requires liquid funds. Chu and Cozzi (2014) impose a cash constraint on research activity, allowing monetary policy to affect long-run economic growth, and subsequent work has developed several related mechanisms.

Two strands of the literature are particularly relevant for our analysis. The first is the endogenous-market-structure literature. First-generation endogenous economic growth models imply a scale effect because each firm's market expands with the size of the aggregate economy. Models with endogenous firm entry and exit instead allow an increase in the number of firms to reduce the market size of individual incumbents, so that innovation incentives depend on firm size rather than directly on the size of the aggregate economy (Peretto, 1998, 2007; Howitt, 1999). This provides an alternative to the semi-endogenous growth approach of Jones (1995), in which the scale effect is removed but long-run economic growth becomes independent of most policy variables. Chu and Ji (2016) introduce monetary policy into a framework with endogenous market structure and we extend that model by introducing a constraint on the financing of firm entry and the spirit of capitalism.

Laincz and Peretto (2006) document the mechanism of the endogenous market structure literature directly. Aggregate R&D employment rose steadily over the postwar period, while R&D personnel per establishment displayed no long-run trend. This is precisely the pattern generated when entry expands the number of product lines to hold per-firm market size, and hence the return to in-house research, at its equilibrium level. That this return depends on firm size rather than the size of the aggregate economy is itself an industrial organization regularity that the fixed unit-continuum structure of first-generation growth models cannot represent (see Cohen and Klepper, 1996*a*,*b*; Adams and Jaffe, 1996). Ha and Howitt (2007) argue that the joint long-run behavior of R&D inputs and total factor productivity is more consistent with fully endogenous growth, since research effort trended upward postwar, while TFP growth did not decline as the semi-endogenous mechanism requires.

This same endogeneity of the entry margin is what gives the paper's distinctive assumption an operational grounding. Our mechanism runs through a liquidity constraint on the financing of entry. Such a constraint is meaningful only if entry is an economic decision that responds to the cost of funds, which is exactly what endogenous market structure delivers and what the exogenous structure alternative lacks by construction. The evidence that this margin is sensitive to financial and monetary conditions is also well established. Ma and Zimmermann (2023) show that the decrease in startup and ven-

ture funding following monetary tightening is concentrated among early-stage entrants, the very population on which the entry cost, and the liquidity constraint imposed below, operate.

That the liquidity constraint should bind on entry rather than on research undertaken by incumbents coincides with the recent corporate-finance evidence. Himmelberg and Petersen (1994) document that R&D is harder to finance externally than physical investment, because it is intangible, offers little collateral, and generates asymmetric information. What matters for our modeling choice is the finding that the constraint is concentrated among young firms. Brown, Fazzari and Petersen (2009) find that cash flow and external equity matter significantly for young high-technology firms but not for mature ones, with sensitivities large enough that shifts in finance supply can account for much of the 1990s R&D boom. Once cash-reserve smoothing and equity issuance are accounted for, Brown, Martinsson and Petersen (2012) reach a parallel conclusion for European firms. Cloyne et al. (2023) show that the investment and borrowing of younger, non-dividend-paying firms fall sharply after a monetary tightening. Their study provides direct support that the constraint operates through the cost of external funds, and therefore through monetary policy. More recently, Bøler, Moxnes and Ulltveit-Moe (2026) document that, while older firms also face liquidity constraints, young firms are indeed more exposed to short-maturity and liquidity pressures.

The second strand of relevant literature introduces the spirit of capitalism into monetary Schumpeterian growth models. He et al. (2023) show that a sufficiently strong preference for wealth can make money non-neutral for long-run economic growth and can generate a positive effect of inflation on growth. Ming et al. (2026) reaffirm these results in an open-economy setting. Our framework combines these two strands by introducing a preference for wealth into a model with endogenous firm entry and a financing constraint on that entry. This allows us to show that the economic growth effect depends on where the monetary friction is located.

Our paper also relates to the broader literature that allows wealth to enter household utility directly. The idea that accumulation may be valued independently of future consumption has a long history and was formalized by Kurz (1968), Zou (1994, 1995), Bakshi and Chen (1996), and Smith (1999), among others. These papers show that a direct preference for wealth can affect saving behavior, capital accumulation, and asset prices. More recent work has given the mechanism a quantitative role. Carroll (1998) argues that preferences over wealth help explain the saving behavior of affluent households, while subsequent studies use similar mechanisms to account for high saving rates among the rich and the concentration of wealth at the top (Francis, 2009; Mian, Straub and Sufi, 2021; Gaillard et al., 2023). Michaillat and Saez (2021) have also incorporated wealth-in-utility into broader macroeconomic settings.

A related literature distinguishes preferences for absolute wealth from preferences for

relative standing or social status (Easterlin, 1995; Clark and Oswald, 1996; Kawamoto, 2009; Hof and Prettner, 2019, 2023). Empirical work has also attempted to measure such preferences directly and relate them to economic outcomes (Pan, Zhang and Zou, 2018; Chu, Fan and Wang, 2020). We use this empirical literature to motivate our proxy for the wealth motive. Our focus differs in asking how the preference for wealth interacts with the location of liquidity constraints in determining the effect of monetary policy on long-run economic growth.

3 Empirical Motivation

The model we propose in Section 4 is built to be consistent with the following sets of facts. First, we rely on the empirical support presented in the preceding section, regarding the strength of binding financial constraints on (especially younger) R&D firms, and the endogenous market entry and exit of firms, so that per firm R&D incentives depend on firm size rather than the size of the aggregate economy. In addition, we provide some stylized facts on the actual association between monetary policy and economic growth in the presence of the spirit of capitalism, using data spanning 81 countries across six World Values Survey (WVS) waves.[2] Overall, however, it is important to stress that our empirical analysis does not aim to uncover any causal effects, it is merely meant to motivate the theoretical analysis.

We start building our intuition by looking at the data behind the key relationships of the model. Here, we focus on the main results of interest for the model that follows in Section 4. The remaining data specifics and empirical results are provided in Appendix D. Following Pan, Zhang and Zou (2018) and Chu, Fan and Wang (2020), the proxy for wealth accumulation preferences (representing the spirit of capitalism) is constructed by using the share of respondents that select *thrift saving money and things* as important in the World Values Survey (WVS), aggregated at the national level for each country-wave. This measure is a percentage that represents the fraction of individuals who regard wealth accumulation as important, and its range lies in [0, 1]. The higher the value is that this variable obtains, the stronger are the preferences for wealth accumulation.

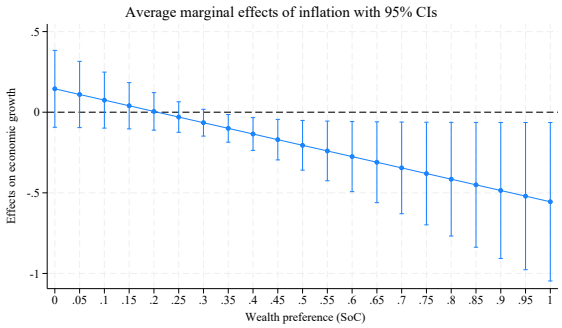
We use the following empirical specification:

$$g_{it} = \alpha + \beta_1 k_{it} + \beta_2 \pi_{it} + \delta(k_{it} \times \pi_{it}) + \sum_{j=1}^{N} \beta_j X_{j,it} + \gamma_i + \theta_t + \epsilon_{it}, \tag{R}$$

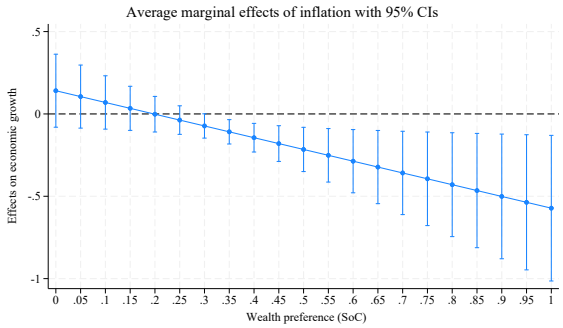
where g_{it} is the growth rate of real GDP (and GDP per capita), respectively. The variable

[2]The six waves of data are based on the waves used in the World Values Survey (WVS) and include the following periods: 1981 - 1984 (wave 1); 1990 - 1994 (wave 2); 1995 - 1998 (wave 3); 1999 - 2004 (wave 4); 2005 - 2009 (wave 5); 2010 - 2014 (wave 6). The country-wave data points are presented in Table 17.

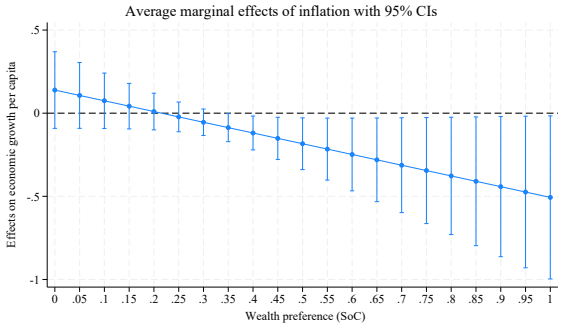
k_{it} denotes the average value of absolute wealth preferences in country i at wave t, and π_{it} is the inflation rate in country i at wave t. The control variables, denoted by $X_{j,it}$, include the degree of openness, government consumption as a share of GDP, and the human capital index. The parameter γ_i represents the wave-invariant effect, θ_t is the country-invariant effect, and ϵ_{it} is the error term. The interaction term $k_{it} \times \pi_{it}$ captures the change in the slope of inflation for every unit increase in absolute wealth preferences. Our interest lies in the sum $\beta_2 + \delta k_{it}$, which captures the association between inflation and growth in the presence of the spirit of capitalism, accounting for two-way fixed effects and the control variables. We analyze four variants of specification (R): using real GDP or the real GDP per capita growth rate as a measure for the dependent variable, using a two-way fixed effects specification, and using a specification in which in addition we control for the other covariates. The main empirical results are presented as marginal plots of this parameter across the entire domain of k_{it}, while the rest of the results are provided in Appendix D.



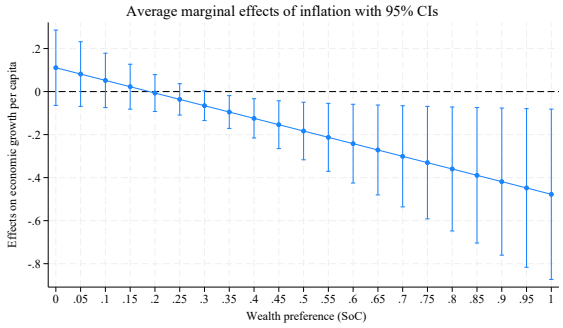
(a) Real GDP growth – baseline



(b) Real GDP growth – with controls



(c) Real GDP growth per capita – baseline



(d) Real GDP growth per capita – with controls

Figure 1: Association between inflation and economic growth across levels of the spirit of capitalism

Figure 1 plots this marginal association of inflation and growth across the observed domain of absolute wealth preferences. A consistent pattern emerges across all four specifications. Where the wealth accumulation motive is low, inflation exhibits, if anything, a weakly positive but statistically insignificant association with economic growth. As the

wealth accumulation motive rises in importance, this association weakens, turns negative, and becomes statistically significant at some point. The marginal association thus declines monotonically in wealth accumulation preferences and changes sign within the observed range, a pattern that is robust to the choice of economic growth measures and to the inclusion of controls.

In Appendix D, we show that this pattern even holds when i) we instrument both inflation and wealth accumulation preferences using instruments motivated by the existing literature, ii) using an alternative proxy for wealth accumulation preferences, iii) doing a cross-country analysis and an analysis of subsamples of countries. Thus, the data suggest that the relationship between inflation and growth depends on the strength of the wealth accumulation motive, shifting from weakly positive to significantly negative as that preference intensifies. This is precisely the interaction that motivates our analysis with our model providing a structural account of exactly this dependence. The model delivers a marginal effect of monetary policy on economic growth that likewise weakens and reverses as the spirit of capitalism strengthens. Furthermore, our analysis identifies the mechanism–the interaction of the wealth motive with the way liquidity is constrained–through which such a reversal arises.

4 Model

We now turn to developing an empirically grounded framework that can provide an explanation for the association between inflation and long-run economic growth in the presence of the spirit of capitalism. Building on the intuition of Peretto (2007, 2011) and Chu and Ji (2016), we unify and extend existing strands of the literature within a broader generalized framework by incorporating liquidity constraints on firm entry and the spirit of capitalism. This rich framework better aligns these models with empirical evidence, captures the distinct effects reported in prior studies, and offers the flexibility to accommodate various model extensions.

4.1 Households

Consider an economy in which time t is continuous and lifetime utility of the representative household is given by

$$U = \int_0^\infty e^{-\rho t}[\ln(C_t) + k\ln(A_t) + \gamma\ln(L - l_t)]\,dt. \tag{1}$$

Here, C_t refers to real consumption of final goods at time t, A_t is the real value of financial assets in the form of equity shares in monopolistic intermediate-goods producing firms, L is the exogenous endowment of time for labor, and l_t refers to the endogenous choice of labor supply. The parameters $\rho > 0$ and $\gamma > 0$ determine the subjective discount rate

and leisure preference, respectively, while the parameter $k \geq 0$ captures the household preference for wealth, that is, the strength of the spirit of capitalism.[3]

The household maximizes equation (1) subject to the budget constraint

$$\dot{A}_t + \dot{M}_t = r_t A_t + w_t l_t + i_t B_t - \pi_t M_t - C_t + \tau_t, \tag{2}$$

where r_t is the real rate of return on assets A_t, M_t is the real value of money holdings, w_t refers to the wage rate, B_t denotes the household's supply of loans to entrepreneurs, and i_t is the rate of return on B_t. The household also faces a lump–sum transfer (or tax) τ_t, and π_t is the inflation tax that reflects the cost of holding money. The cash-in-advance (CIA) constraint on consumption and market-entry financing is given by

$$\eta_c C_t + B_t \leq M_t, \tag{3}$$

where $\eta_c \in [0, 1]$ denotes the strength of the cash-in-advance constraint on consumption. Equation (3) states that the share of real consumption and market entry investment of the household is limited by the real value of money holdings, that is, these outlays can only be paid for by liquid assets. The representative household maximizes equation (1), subject to equations (2) and (3). The optimal consumption condition is

$$\frac{1}{C_t} = \lambda_t(1 + \eta_c i_t), \tag{4}$$

where λ_t is the Hamiltonian co-state variable on equation (2) reflecting the shadow value of financial wealth to the household. The optimality condition for labor supply is

$$w_t(L - l_t) = \gamma C_t(1 + \eta_c i_t) \qquad \Leftrightarrow \qquad \frac{\gamma C_t}{L - l_t} = \frac{w_t}{1 + \eta_c i_t}, \tag{5}$$

stating that the marginal rate of substitution between leisure and consumption (the left-hand side) must be equal to the effective real wage in terms of consumption (the right-hand side). In contrast to the standard case, in which the denominator on the right-hand side is equal to one, the cash-in-advance constraint implies that consumption must be funded by money holdings, which are associated with an opportunity cost, and this drives a wedge between the real wage rate and its value in terms of consumption.

The Euler equation for real assets is given by

$$-\frac{\dot{\lambda}_t}{\lambda_t} = r_t - \rho + k\frac{1}{\lambda_t A_t}. \tag{6}$$

In addition to the standard return on saving given by the difference between the interest rate and impatience $(r_t - \rho)$, households also receive a direct benefit of holding assets through the spirit of capitalism as given by $k/(\lambda_t A_t)$. Thus, optimality requires that the

[3]Following Angeletos and Panousi (2009), introducing the spirit of capitalism in a representative-agent framework can be considered as a general way to model the "psychology of entrepreneurs" described by Schumpeter.

decrease in the shadow value of holding wealth equals the sum of these two returns on saving.

Combining equations (4) and (6) and given a constant nominal interest rate yields the consumption Euler equation

$$\frac{\dot{C}_t}{C_t} = r_t - \rho + k\frac{(1+\eta_c i)C_t}{A_t}. \tag{7}$$

Setting $k = 0$ nests the familiar Euler equation, which also holds in the monetary Schumpeterian growth model. When $k > 0$, the last term of equation (7) indicates that the intertemporal choice of the household depends on the marginal rate of substitution between consumption and wealth. The implication, following Michaillat and Saez (2021), is that the household is less forward–looking and future interest rates have a lower impact on today's consumption, compared to the familiar Euler equation.

4.2 Final Goods Sector

Following Aghion and Howitt (2005, 2009) and Peretto (2007, 2011), final goods are produced in a perfectly competitive sector by firms with a production technology

$$Y_t = \int_0^{N_t} X_t(j)^\theta \left[Z_t(j)^\alpha Z_t^{1-\alpha}\frac{l_t}{N_t}\right]^{1-\theta} dj, \tag{8}$$

where $\{\theta, \alpha\} \in (0,1)$ are the private returns to quality and the elasticity of output with respect to intermediates, respectively, $X_t(j)$ is the quantity of the intermediate good produced by industry j at time t, $Z_t(j)$ is the quality of intermediate good j at time t, and $Z_t = \frac{1}{N_t}\int_0^{N_t} Z_t(j)\,dj$ is the average quality of all intermediate goods. This term reflects R&D spillovers with their extent being captured by $(1-\alpha)$. The first-order conditions from the profit-maximization problem of final goods producers yield the conditional demand functions for labor and intermediate inputs

$$w_t = (1-\theta)\frac{Y_t}{l_t}, \tag{9}$$

$$X_t(j) = \left(\frac{\theta}{p_t(j)}\right)^{\frac{1}{1-\theta}} Z_t(j)^\alpha Z_t^{1-\alpha}\frac{l_t}{N_t}, \tag{10}$$

where $p_t(j)$ is the price of $X_t(j)$ expressed in units of the final good. Under perfect competition, final goods producers pay $\int_0^{N_t} p_t(j)X_t(j)\,dj = \theta Y_t$ to intermediate goods producers.

4.3 Intermediate Goods Sector

Two types of R&D, vertical and horizontal, co-exist. Vertical R&D is the improvement of the quality of existing goods carried out by incumbents in an attempt to increase

the demand for their products. Horizontal R&D is the introduction of new varieties performed by new entrants in the industry (startups).

Incumbents. There is a continuum of monopolistic producers of intermediate differentiated goods $j \in [0, N_t]$ that perform two roles. First, they produce intermediate goods employing a one-for-one technology using final goods for which they have to incur a fixed operating cost of ϕZ_t in units of final goods (Peretto, 2011). The second role of intermediate goods producers is to perform in-house R&D: to improve the quality of existing goods, firm j invests $R_t(j)$ units of the final good. The innovation production technology is given by

$$\dot{Z}_t(j) = R_t(j). \tag{11}$$

The value of the monopolistic firm is the present value of all its future profit flows from the moment in which it innovates onward:

$$V_t(j) = \int_t^{\infty} e^{-(\int_t^u r_s\, ds)} \Pi_u(j)\, du. \tag{12}$$

The profit flow of firm j at time t is, in turn, given by

$$\Pi_t(j) = [p_t(j) - 1]X_t(j) - \phi Z_t - R_t(j). \tag{13}$$

The monopolistic firm maximizes equation (12), subject to equations (10) and (11). Following Peretto (1998, 1999, 2007) and Cozzi, Giordani and Zamparelli (2007), we focus on a symmetric equilibrium and can state the following lemma.

Lemma 1. *The equilibrium price is given by*

$$p_t(j) = \frac{1}{\theta}, \tag{14}$$

and the return to in-house R&D is given by

$$r_t^I = \alpha(1-\theta)\theta^{\frac{1+\theta}{1-\theta}} \frac{l_t}{N_t}. \tag{15}$$

Proof. See Appendix F. □

The return to in-house R&D is increasing in the market size of each firm, measured by employment per firm, l_t/N_t.

Entrants. A firm that is active at time t must have been established at an earlier date. Firms that enter the innovation sector pay a setup cost to access the level of aggregate technology. This process is referred to as market entry, and we suppose it is positive ($\dot{N}_t > 0$). The free-entry condition is

$$V_t(j) = \beta(1 + \eta_r i_t)X_t(j), \tag{16}$$

where $\beta > 0$ is a cost parameter, and $\eta_r \in [0, 1]$ is the strength of the cash-in-advance constraint on borrowing to finance market-entry expenditures. The firm pays a setup cost of $\beta X_t(j)$ to introduce a new variety of products to the market. To cover the entry cost, an entrepreneur needs to borrow money at the nominal interest rate i_t, which creates an extra burden of interest payment. Thus, the free entry condition states that the discounted stream of operating profits will be equal to the effective entry cost in equilibrium. If it were higher, market entry would occur and drive the discounted stream of operating profits down until the condition is fulfilled with equality.

Under symmetry, $V_t(j) = V_t$ and the Hamilton–Jacobi–Bellman (HJB) equation implies that the return to entry is

$$r_t^e = \frac{\Pi_t}{V_t} + \frac{\dot{V}_t}{V_t}. \tag{17}$$

This is the standard financial market no-arbitrage condition stating that the real rate of return needs to be equal to the return on shares, which consists of dividend payments (the first term on the right-hand side) plus valuation gains (the second term on the right-hand side).

4.4 Monetary Authority

The nominal money supply is denoted by E_t and its growth rate by $\Xi_t = \dot{E}_t/E_t$. The real money balance holdings in this economy are denoted by $M_t = E_t/P_t$, where P_t is the price of final goods. The monetary policy instrument that the monetary authority considers is the nominal interest rate i_t. The rate of inflation is endogenously determined by $\pi_t = \Xi_t - \dot{M}_t/M_t$. Hence, it is the growth rate of the money supply that affects the real economy in the long run, and a one-time change in the level of money supply has no long-run effect on the real economy. This is the well-known distinction between the neutrality and superneutrality of money. Finally, the monetary authority returns the seigniorage revenue as a lump-sum transfer: $\tau_t = \dot{E}_t/P_t = \dot{M}_t + \pi_t M_t$.

The modified Fisher equation gives rise to a positive long-run relationship between the inflation rate and the nominal interest rate that is supported by empirical studies such as Mishkin (1992), Crowder and Hoffman (1996), Westerlund (2008). In our model, the inflation rate pins down to $\pi = i - r - k(1 + \eta_c i_t)C_t/A_t = i - g(i) - \rho$, where the second equality follows from the Euler equation. Therefore, as long as $\partial g(i)/\partial i < 1$, we have $\partial \pi/\partial i = 1 - \partial g(i)/\partial i > 0$.

The model is designed to focus on long-run growth and welfare and not on studying exogenous shocks during business cycles or shocks caused by government policies. Since inflation is locally increasing in the nominal interest rate, both can be used interchangeably to index long-run monetary policy within this region. Our preference is to work

with the nominal interest rate because it makes the exposition cleaner, it is consistent with the existing literature, and it reflects the actual conduct of monetary policy.

4.5 Equilibrium

The equilibrium is a time path of allocations $\{A_t,\ M_t,\ C_t,\ Y_t,\ X_t(j),\ R_t(j)\}$ and prices $\{r_t,\ i_t,\ p_t(j),\ w_t,\ V_t(j)\}$ such that:

- the representative household maximizes lifetime utility, taking $\{r_t,\ i_t$ and $w_t\}$ as given,
- final goods producers are perfect competitors and maximize profits, taking $\{p_t(j),\ w_t\}$ as given,
- monopolistic intermediate goods producing firms maximize $\{V_t(j)\}$, choosing $\{R_t(j), p_t(j)\}$ and taking $\{r_t\}$ as given,
- entrant firms make entry decisions, taking $\{V_t\}$ as given,
- the total value of assets equals the total value of firms, $A_t = V_t N_t$,
- the amount of money borrowed by entrepreneurs is $\eta_r \beta X_t \dot{N}_t = B_t$ because of the closed economy setting,
- the labor-market clearing condition holds,
- the market-clearing condition for final goods holds and is given by $Y_t = C_t + N_t(X_t + \phi Z_t + R_t) + \beta X_t \dot{N}_t$.

Substituting equation (10) in equation (8), imposing symmetry and the equilibrium price $p_t(j) = 1/\theta$, yields the aggregate production function

$$Y_t = \theta^{\frac{2\theta}{1-\theta}} Z_t l_t. \tag{18}$$

The monetary authority sets the nominal interest rate as its policy instrument. We analyze the effect of a permanent change to a constant level i. The optimality condition of labor supply in (5), together with the labor-demand condition in (9), yield

$$l_t = \left[1 + \frac{\gamma(1+\eta_c i)}{1-\theta} \frac{C_t}{Y_t} \right]^{-1} L. \tag{19}$$

Equation (19) shows that l_t is pinned down by the consumption–output ratio. Given that monopolistic firms are owned by the households, following the no-arbitrage argument, in equilibrium the return to in-house R&D must equal the real interest rate r_t. Therefore,

$$r_t = r_t^I = \alpha(1-\theta)\,\theta^{\frac{1+\theta}{1-\theta}} \frac{l_t}{N_t}. \tag{20}$$

Using $\frac{\dot{Z}_t}{Z_t} = \frac{\dot{C}_t}{C_t} - \left(\frac{\dot{C}_t}{C_t} - \frac{\dot{Y}_t}{Y_t}\right) - \frac{\dot{l}_t}{l_t}$ and substituting $\frac{\dot{l}_t}{l_t} = -\frac{L-l_t}{L}\left(\frac{\dot{C}_t}{C_t} - \frac{\dot{Y}_t}{Y_t}\right)$, equation (7), and equation (20) yields the equilibrium growth rate of aggregate quality

$$\frac{\dot{Z}_t}{Z_t} = \alpha(1-\theta)\theta^{\frac{1+\theta}{1-\theta}}\frac{l_t}{N_t} - \rho + \frac{k(1+\eta_c i)}{\Psi}\frac{C_t}{Y_t} - \frac{l_t}{L}\left(\frac{\dot{C}_t}{C_t} - \frac{\dot{Y}_t}{Y_t}\right), \tag{21}$$

where $\Psi = \beta(1+\eta_r i)\theta^2$. Hence, the dynamics of the economy is driven by the following laws of motion in the space $(\frac{\dot{C}_t}{C_t} - \frac{\dot{Y}_t}{Y_t}, \frac{\dot{N}_t}{N_t})$

$$\frac{\dot{C}_t}{C_t} - \frac{\dot{Y}_t}{Y_t} = \frac{1}{\Psi}\left[(1+k+k\eta_c i)\frac{C_t}{Y_t} - (1-\theta) - \frac{\Psi\eta_r i}{(1+\eta_r i)}\frac{\dot{N}_t}{N_t}\right] - \rho, \tag{22}$$

$$\frac{\dot{N}_t}{N_t} = \frac{1}{\beta(1+\eta_r i)}\left[\frac{1-\theta}{\theta} - \left(\phi + \frac{\dot{Z}_t}{Z_t}\right)\theta^{-\frac{2}{1-\theta}}\frac{N_t}{l_t}\right] - \rho + \frac{k(1+\eta_c i)}{\Psi}\frac{C_t}{Y_t} - \left(\frac{\dot{C}_t}{C_t} - \frac{\dot{Y}_t}{Y_t}\right). \tag{23}$$

The following proposition provides the parameter restrictions and the steady-state values of the equilibrium $\left((C/Y)^*, (N/l)^*, g^*\right)$.

Proposition 1. *Let* $\Lambda \equiv \frac{k(1+\eta_c i)}{\Psi}\left(\frac{C}{Y}\right)^* \geq 0$, $\mathcal{P} \equiv \phi - \rho + \Lambda$, *and* $\mathcal{Q} \equiv \frac{(1-\alpha)(1-\theta)}{\theta\beta(1+\eta_r i)} - \rho + \Lambda$. *Under the parameter restrictions* $\mathcal{P} > 0$, $\mathcal{Q} > 0$, *and* $g^* > 0$, *the economy admits a unique interior balanced growth path* $\left((C/Y)^*, N^*\right)$, *with* $(C/Y)^* \in (0, \infty)$, $l^* \in (0, L)$, *and* $N^* > 0$, *which is locally saddle-path stable and determinate. The steady-state values of the consumption-to-output ratio, the firm-to-labor ratio, and the economic growth rate are given by*

$$\left(\frac{C}{Y}\right)^* = \frac{\beta(1+\eta_r i)\theta^2\rho + (1-\theta)}{1+k+k\eta_c i}, \tag{24}$$

$$\frac{N^*}{l^*} = \beta(1+\eta_r i)\,\theta^{\frac{2}{1-\theta}}\,\frac{\mathcal{Q}}{\mathcal{P}}, \tag{25}$$

$$g^* = z^* = \frac{\alpha(1-\theta)}{\theta\,\beta(1+\eta_r i)}\,\frac{\mathcal{P}}{\mathcal{Q}} + \mathcal{P} - \phi. \tag{26}$$

Proof. See Appendix A. □

5 Long-run growth and welfare effects of monetary policy

In this section, we analyze the effects of monetary policy on long-run economic growth and social welfare. Throughout, we consider the effects of a permanent change in the nominal interest rate. In Subsection 5.1, we decompose the growth effect of monetary policy and discuss the change of its sign as the spirit of capitalism strengthens. In Subsection 5.2, we analyze the effects of monetary policy on balanced-growth-path welfare.

5.1 Effects of monetary policy on long-run growth

Proposition 2 below provides our first main result. The effect of a permanent change in the nominal interest rate on steady-state economic growth can be decomposed into two channels: the spirit of capitalism wedge channel and the entry-cost channel. The wedge channel is the response of economic growth to the way in which the nominal interest rate i shifts the spirit-of-capitalism wedge. This channel depends on where liquidity is constrained. When the cash-in-advance constraint applies to consumption, a higher nominal interest rate strengthens the incentive to shift resources away from consumption and toward wealth accumulation. When it applies to entry financing, by contrast, a higher nominal interest rate raises the cost of market entry. This makes creating firms more expensive, reducing the number of startups. A lower firm creation rate, in turn, increases the value of existing firms. The associated wealth effect decreases the marginal utility of accumulating assets such that wealth creation decreases, which reduces the spirit-of-capitalism wedge.

The entry-cost channel is the direct effect of a higher entry cost at a fixed wedge. It is present only when $\eta_r > 0$, and its sign is $-\operatorname{sign}(\mathcal{P} - \phi) = -\operatorname{sign}(\Lambda - \rho)$, using $\mathcal{P} - \phi = \Lambda - \rho$. It therefore changes sign at $\Lambda = \rho$, being positive when the spirit of capitalism is weak and negative when it is strong. The decomposition below shows that the reversal generated by entry financing is not just the conventional cost-of-finance effect. It operates importantly through the interaction between firm valuation and households' preference for wealth.

Proposition 2. *The effect of the nominal interest rate on long-run economic growth can be decomposed into a spirit of capitalism wedge channel and an entry-cost channel as given by*

$$\frac{\partial g^*}{\partial i} = \underbrace{\frac{\partial g^*}{\partial \Lambda}\frac{\partial \Lambda}{\partial i}}_{\text{SoC wedge channel}} \quad \underbrace{- \beta\eta_r \frac{\alpha(1-\theta)}{\theta} \frac{\mathcal{P}(\mathcal{P}-\phi)}{[\beta(1+\eta_r i)]^2\,\mathcal{Q}^2}}_{\text{entry-cost channel}} \tag{27}$$

where

$$\frac{\partial g^*}{\partial \Lambda} = 1 + \frac{\alpha(1-\theta)}{\theta\beta(1+\eta_r i)}\frac{\mathcal{Q}-\mathcal{P}}{\mathcal{Q}^2} \qquad \mathcal{Q}-\mathcal{P} = \frac{(1-\alpha)(1-\theta)}{\theta\beta(1+\eta_r i)} - \phi. \tag{28}$$

Furthermore, in the spirit of capitalism wedge channel, we can further decompose

$$\frac{\partial \Lambda}{\partial i} = \underbrace{\frac{\left(\rho + \frac{1-\theta}{\Psi}\right) k\eta_c}{(1+k+k\eta_c i)^2}}_{consumption-CIA\ contribution\ (\geq 0)} \quad \underbrace{- \frac{k(1+\eta_c i)}{1+k+k\eta_c i}\frac{(1-\theta)\,\beta\eta_r\theta^2}{\Psi^2}}_{entry-CIA\ contribution\ (\geq 0)}. \tag{29}$$

Proof. See Appendix B. □

Proposition 2 implies that three effects are operative: 1) a direct consumption-cash-in-advance effect through the spirit of capitalism wedge channel: a higher nominal interest

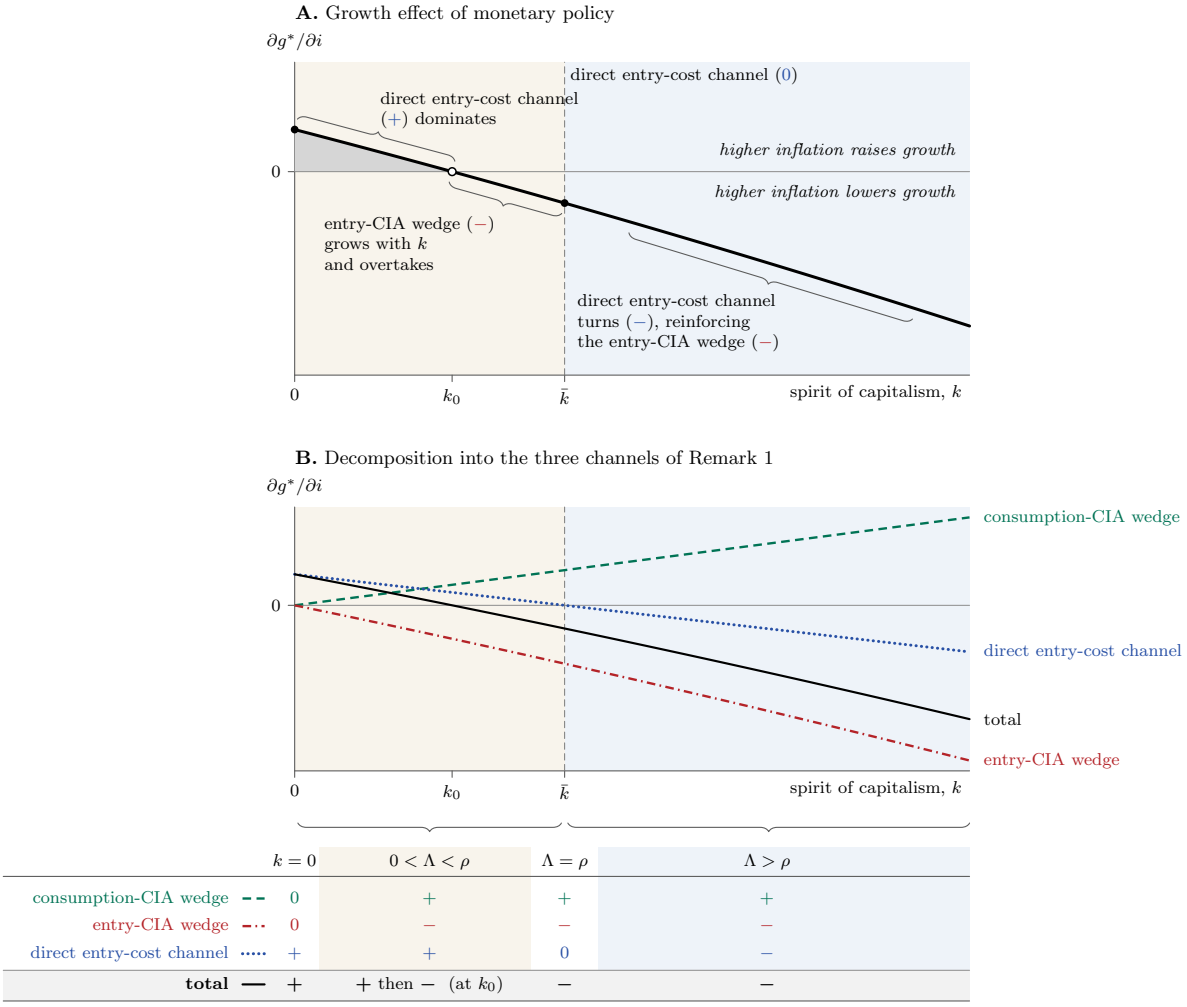
rate makes consumption more costly in liquidity terms. This pushes resources away from consumption and toward asset accumulation with a positive effect on economic growth (this is the channel that is also present in He et al., 2023). 2) The direct entry cost effect: a higher nominal interest rate directly raises the effective cost of market entry. This effect operates through endogenous market structure and the market size available to incumbent firms. Its sign depends on the strength of the wealth motive: it is positive when $\Lambda < \rho$, as the adjustment in market structure raises market size per incumbent and strengthens vertical innovation, and negative when $\Lambda > \rho$. 3) The indirect entry cost effect through the spirit of capitalism wedge channel: more costly firm creation raises the value of each firm and therefore household wealth. Since marginal utility decreases in wealth, this weakens the incentives to accumulate wealth and therefore exerts a negative effect on economic growth. In the calibration, this channel dominates the entry cost channel.

Remark 1. Altogether, we therefore have the following effects of the nominal interest rate on economic growth

$$\begin{aligned}\frac{\partial g^*}{\partial i} = &\underbrace{\underbrace{\frac{\partial g^*}{\partial \Lambda}\left[\left(\rho + \frac{1-\theta}{\Psi}\right)\frac{k\eta_c}{(1+k+k\eta_c i)^2}\right]}_{\text{consumption-CIA wedge channel}} - \underbrace{\frac{\partial g^*}{\partial \Lambda}\left[\frac{k(1+\eta_c i)}{1+k+k\eta_c i}\frac{(1-\theta)\beta\eta_r\theta^2}{\Psi^2}\right]}_{\text{entry-CIA wedge channel}}}_{\text{SoC wedge channel}} \\ &- \underbrace{\beta\eta_r\frac{\alpha(1-\theta)}{\theta}\frac{P(P-\phi)}{[\beta(1+\eta_r i)]^2 Q^2}}_{\text{direct entry-cost channel}}.\end{aligned} \tag{30}$$

An implication of the decomposition is that, given $\eta_r > 0$, the effect of the nominal interest rate on economic growth can change sign as the spirit of capitalism strengthens. When $k = 0$, the spirit of capitalism wedge channel disappears and the direct entry-cost effect is positive whenever $\phi > \rho$. As k rises, the entry cash-in-advance constraint generates an increasingly negative spirit of capitalism wedge channel. At $\Lambda = \rho$, the direct entry-cost channel is zero, while the wedge channel remains negative. Thus, the model can generate a shift from a positive to a negative growth effect of an increase in the nominal interest rate as the wealth motive strengthens. We provide a schematic depiction of the decomposition in Figure 2.

Varying the different regimes built in our setup, we are able to provide the established main results in the literature as special cases. In an economy with no spirit of capitalism and only a cash-in-advance constraint on consumption ($k = 0, \eta_r = 0, \eta_c > 0$), we can derive the superneutrality condition of Chu and Ji (2016) as a special case. In an economy with the spirit of capitalism but no cash-in-advance constraint on entry ($k > 0, \eta_r = 0, \eta_c > 0$), the growth effect of a permanent change in the nominal interest rate is positive.



	$k = 0$	$0 < \Lambda < \rho$	$\Lambda = \rho$	$\Lambda > \rho$
consumption-CIA wedge	0	+	+	+
entry-CIA wedge	0	−	−	−
direct entry-cost channel	+	+	0	−
total	+	+ then − (at k_0)	−	−

Figure 2: The growth effect of the nominal interest rate as the wealth motive strengthens. Panel A: the total effect $\partial g^*/\partial i$ against the spirit of capitalism k (schematic); the shaded area marks where higher inflation raises growth. The figure shows how the changing relative strength of the three channels shifts the sign of the inflation–growth relationship as the wealth motive strengthens. Panel B: the decomposition of Remark 1 into the consumption-CIA wedge (dashed), the entry-CIA wedge (dash-dotted), the direct entry-cost channel (dotted), and the total (solid). The dashed vertical line marks $\bar{k}$, where $\Lambda = \rho$, the direct entry-cost channel is zero, and $g^* = r^*$; the benchmark calibration lies at $\bar{k}$. The table reports the sign of each channel by regime. Drawn for $\phi > \rho$ and $\partial\Lambda/\partial i < 0$.

This is in the direction of the He et al. (2023) result. All these results are summarized in Corollary 1 in Appendix B.

When is the growth effect of a permanent change of the nominal interest rate negative? A transparent sufficient case arises when the wedge and the direct entry-cost channels are non-positive, with at least one of the two effects being strictly negative. If $\partial g^*/\partial\Lambda > 0$ and $\partial\Lambda/\partial i \leq 0$, the spirit of capitalism wedge channel is non-positive. The entry-cost channel is non-positive whenever $\Lambda \geq \rho$, and zero exactly when $\Lambda = \rho$. Proposition 3 summarizes these results. They are not necessary conditions, as when $\Lambda < \rho$, the entry-

cost channel is positive, but the total growth effect can still be negative if the negative spirit of capitalism wedge channel dominates.

Proposition 3. *Suppose $\eta_r > 0$ and, on the balanced growth path,*

$$\text{(i)} \quad \frac{\partial g^*}{\partial \Lambda} > 0 \qquad \Big(\textit{sufficient: } \tfrac{(1-\alpha)(1-\theta)}{\theta\beta(1+\eta_r i)} \geq \phi\Big); \tag{31}$$

$$\text{(ii)} \quad \Lambda \geq \rho \qquad \Longleftrightarrow \qquad k(1+\eta_c i) \geq \frac{\rho\,\Psi}{1-\theta} = \frac{\rho\,\beta(1+\eta_r i)\,\theta^2}{1-\theta}; \tag{32}$$

$$\text{(iii)} \quad \frac{\partial \Lambda}{\partial i} \leq 0 \qquad \big(\textit{automatic, and strict, if } \eta_c = 0\big). \tag{33}$$

with at least one of (ii)–(iii) holding with a strict inequality. Then $\partial g^*/\partial i < 0$: a higher nominal interest rate lowers long-run economic growth.

Proof. See Appendix B. □

5.2 Effects of monetary policy on social welfare

On the balanced growth path, consumption and assets grow at the common rate g^*, while labor is constant. Using $\int_0^\infty e^{-\rho t}dt = 1/\rho$ and $\int_0^\infty e^{-\rho t} t\,dt = 1/\rho^2$, the welfare function can be written as

$$U = \frac{1}{\rho}\Big[\ln C_0 + k \ln A_0 + \gamma \ln(L - l^*)\Big] + \frac{(1+k)\,g^*}{\rho^2}. \tag{34}$$

Two features distinguish this from the standard welfare function without the spirit of capitalism. First, the term $k \ln A_0$ ensures that the initial level of wealth enters welfare directly. Second, the growth term carries the spirit-of-capitalism augmented weight $(1 + k)$, so a stronger spirit of capitalism raises the welfare value of economic growth.

We normalize $Z_0 = 1$, which yields $Y_0 = \theta^{2\theta/(1-\theta)} l^*$. The initial levels of consumption and wealth are

$$C_0 = \Big(\frac{C}{Y}\Big)^* \theta^{\frac{2\theta}{1-\theta}} l^*, \qquad A_0 = \Psi\,\theta^{\frac{2\theta}{1-\theta}} l^*, \tag{35}$$

respectively. Differentiating equation (34) and using equation (35), the interest-rate effect on balanced-growth-path welfare can be decomposed into a static and a growth part

$$\frac{\partial U}{\partial i} = \underbrace{\frac{1}{\rho}\left[\frac{\partial \ln C_0}{\partial i} + k\frac{\partial \ln A_0}{\partial i} + \gamma\frac{\partial \ln(L-l^*)}{\partial i}\right]}_{W_{static}} + \underbrace{\frac{1+k}{\rho^2}\,\frac{\partial g^*}{\partial i}}_{W_{growth}}. \tag{36}$$

Differentiating equation (24) yields the following expressions

$$\begin{aligned} \frac{\partial \ln(C/Y)^*}{\partial i} &= \frac{\rho\Psi}{\rho\Psi + (1-\theta)}\,\frac{\eta_r}{1+\eta_r i} - \frac{k\eta_c}{1+k+k\eta_c i}, \\ \frac{\partial \ln \Upsilon}{\partial i} &= \frac{\eta_c}{1+\eta_c i} + \frac{\partial \ln(C/Y)^*}{\partial i}, \end{aligned} \tag{37}$$

where $\Upsilon \equiv \frac{\gamma(1+\eta_c i)}{1-\theta}(C/Y)^*$ such that $l^* = L/(1+\Upsilon)$. Denoting $\lambda \equiv l^*/L \in (0,1)$, the static part can be expressed as

$$W_{\text{static}} = \underbrace{\frac{\partial \ln(C/Y)^*}{\partial i}}_{\text{composition of } C/Y} + k \underbrace{\frac{\eta_r}{1+\eta_r i}}_{\text{wealth level}} + \underbrace{\left[(1+k+\gamma)\lambda - (1+k)\right] \frac{\partial \ln \Upsilon}{\partial i}}_{\text{labor: scale loss + leisure gain}}. \tag{38}$$

The growth channel, $\frac{1+k}{\rho^2}\partial g^*/\partial i$, takes the sign of $\partial g^*/\partial i$ and is amplified by the spirit of capitalism. Within W_{static}, the labor bracket $(1+k+\gamma)\lambda - (1+k)$ is negative whenever labor is suboptimally low

$$\lambda = \frac{l^*}{L} < \frac{1+k}{1+k+\gamma}. \tag{39}$$

This threshold rises with k, so a stronger spirit of capitalism makes equation (39) easier to satisfy. Multiplied by the final term, this expression delivers the familiar net of a scale loss and a leisure gain. The first two terms of equation (38) are regime-specific. Under the consumption cash-in-advance constraint ($\eta_r = 0$), both vanish or are negative, while under the entry cash-in-advance constraint ($\eta_c = 0$), both are positive.

The Friedman rule ($i^* = 0$) is optimal when $\partial U/\partial i \leq 0$ for all admissible $i \geq 0$. From equation (36), this requires the static and growth parts to net non-positive.

Proposition 4. *Suppose the economy is in the entry-cash-in-advance regime and $\partial g^*/\partial i \leq 0$ for all admissible $i \geq 0$. Then:*

- *If, in addition, $W_{static}(i) \leq 0$ for all admissible $i \geq 0$, then $\partial U/\partial i \leq 0$ throughout the admissible policy range and the Friedman rule maximizes steady-state welfare.*
- *If $W_{static}(i) > 0$ somewhere, the Friedman rule maximizes steady-state welfare provided the growth loss dominates:*

$$-\frac{1+k}{\rho}\frac{\partial g^*}{\partial i} \;\geq\; W_{static}(i) \qquad \text{for all admissible } i \geq 0. \tag{40}$$

Proof. See Appendix C. □

6 Calibration

We now calibrate the model to the United States economy. Section 6.1 describes the calibration strategy, and Section 6.2 provides the evidence for disciplining the two parameters governing the mechanism, η_c and η_r. Section 6.3 presents the benchmark economy and uses it to isolate the key mechanism. Section 6.4 asks where the United States economy lies relative to the boundary that separates growth-reducing from growth-enhancing monetary policy. Section 6.5 draws out the welfare implications. Section 6.6 provides further sensitivity checks.

6.1 Calibration strategy

We conduct a structural calibration that combines externally disciplined parameters with an exactly identified method-of-moments calibration. Let $\Theta = (\alpha, \phi, \beta, \gamma, k)$ denote the internally calibrated parameters and let $m(\Theta)$ denote the vector of model-implied balanced-growth moments. The calibrated vector solves

$$\widehat{\Theta} = \arg\min_{\Theta} \left[m(\Theta) - m^{\text{data}}\right]^{\top} \left[m(\Theta) - m^{\text{data}}\right], \qquad \dim(\Theta) = \dim(m) = 5, \tag{41}$$

so that $m(\widehat{\Theta}) = m^{\text{data}}$ exactly. The five moments are the long-run growth rate g^*, the real interest rate r^*, aggregate labor supply l^*, the ratio of consumption to financial wealth $(C/A)^*$, and the R&D–GDP ratio.

Table 1 lists the externally-set parameters. Following De Loecker, Eeckhout and Unger (2020), with a markup of $1/\theta = 1.6$ for the recent United States experience, we pin down $\theta = 0.625$. The discount rate $\rho = 0.04$ follows He et al. (2023), L is a normalization, and the nominal interest rate at which the model is evaluated, $i = 0.05$, is the average one-year Treasury yield. The intensities of the two cash-in-advance constraints, η_r and η_c, are not free parameters. Each is set from its empirical counterpart in the model, as described in Section 6.2. We use no evidence on the growth effects of monetary policy in the calibration, therefore the cross-country interaction between inflation and the spirit of capitalism documented in Section 3 is not targeted, and it serves as an independent check on the calibrated model.

We calibrate the wealth moment as follows. In the model, the financial wealth that enters preferences is the value of firms, $A_t = V_t N_t$. Money balances are held separately and do not enter the spirit-of-capitalism term. Following He et al. (2023), we quantify this moment by removing money from their own construction, which yields a ratio of consumption to the value of equity of $1/(1/0.43 - 1) = 0.754$, which is the counterpart consistent with our definition of A and the value we target. Targeting their value of 0.43 instead, leaves every qualitative result and the sign of every growth effect unchanged (see Section 6.6).

6.2 Disciplining the liquidity parameters

The free-entry condition, $V_t = \beta(1 + \eta_r i_t)X_t$, and the aggregate borrowing condition, $B_t = \eta_r \beta X_t \dot{N}_t$, give η_r a direct structural interpretation. It is the share of the cost of creating a firm that is financed by borrowing on which the nominal interest rate is paid. Its closest empirical analogue is the share of startup financial capital raised as outside debt. Using the Kauffman Firm Survey, which follows the cohort of United States firms founded in 2004, Robb and Robinson (2014) show that outside debt—personal and business bank loans, credit lines and other institutional borrowing—is the largest single

Table 1: Externally assigned and disciplined parameters

Parameter	Description	Value	Source
θ	elasticity of output to intermediates ($1/\theta$ = markup)	0.625	De Loecker, Eeckhout and Unger (2020)
ρ	subjective discount rate	0.040	He et al. (2023)
i	nominal interest rate	0.050	average one-year Treasury yield
L	labor endowment	1.000	normalization
η_r	intensity of the cash-in-advance constraint on entry	0.439	Robb and Robinson (2014); Table 2
η_c	intensity of the cash-in-advance constraint on consumption	0.160	M1/consumption, 2004; Table 2

source of financing for new firms and accounts for 43.9 percent of their first-year financial capital. Thus, we set $\eta_r = 0.439$.

In addition, we rely on alternative measures that constrain the viable parameter set, reported in Table 2. The share is 0.43 for startups without employees and 0.46 for home-based startups, the earliest-stage firms in the survey. It is 0.49 when owners' personal credit-card debt is counted as borrowing and 0.37 when trade credit is added to the denominator. It is lowest, 0.23, for high-technology startups, which rely more heavily on outside equity (Robb and Robinson, 2014). Partially identifying this parameter allows us to provide an empirically disciplined range, despite not obtaining a literal observation of it.

On the balanced growth path, the number of firms is constant, so entry borrowing is zero and the cash-in-advance constraint reads $M_t = \eta_c C_t$. The parameter η_c is therefore exactly the ratio of transaction balances to consumption. Its empirical counterpart is M1 under its pre-2020 definition—currency, demand deposits, and other checkable deposits—rather than currency alone, since checkable deposits also prefund purchases. M1 as redefined in 2020 includes savings deposits and is not a transaction aggregate. Dating the measure to 2004, the year of the Kauffman cohort, gives $\eta_c = 0.16$. Because some checkable deposits bear interest, this measure might even overstate the balances exposed to the nominal rate.

Both parameters measure the exposure of the corresponding expenditure to the opportunity cost represented by the nominal interest rate. Although they are measured from separate startup-finance and household evidence, without reference to the growth effects they determine, they have the same structural interpretation in the model. The economically relevant comparison is therefore not between money and debt as accounting categories, but between the interest-rate exposure of consumption and firm creation.

Table 2: Empirical discipline for the liquidity parameters

Parameter	Measure	Value
η_r	High-technology startups: outside debt / financial capital	0.234
	All startups: outside debt / (financial capital + trade credit)	0.366
	Startups without employees: outside debt / financial capital	0.432
	All startups: outside debt / financial capital	**0.439**
	Home-based startups: outside debt / financial capital	0.461
	All startups: (outside + owner debt) / financial capital	0.485
η_c	**M1 (pre-2020 definition) / personal consumption expenditures, 2004**	**0.160**

Notes: Kauffman Firm Survey, 2004 cohort, first-year financial capital, means including zeros. All rows follow from Robb and Robinson (2014) (Tables 4 and 5). The high-technology startups row is obtained from an earlier working paper version of the paper. M1: Board of Governors of the Federal Reserve System, H.6 release. Consumption: Bureau of Economic Analysis.

Table 3: Internally calibrated parameters

Parameter	Description	Value
α	private return to quality	0.111
ϕ	fixed operating cost per firm	0.144
β	entry cost parameter	1.246
γ	leisure preference	1.984
k	spirit of capitalism	0.053

Table 4: Targeted moments

Moment	Model	Data
g^*	1.80%	1.80%
r^*	1.80%	1.80%
l^*	0.333	0.333
$(C/A)^*$	0.754	0.754
R&D/GDP	2.60%	2.60%

Sources for the moments: long-run growth, FOMC long-run projection; real interest rate, He et al. (2023); labor supply, one third of the time endowment; consumption relative to the value of firms, He et al. (2023) with money balances removed from wealth (Section 6.1); R&D–GDP ratio, OECD, United States, 1990–2016.

6.3 The benchmark economy and the mechanism

Tables 3 and 4 report the calibrated parameters and the moment fit. The system is exactly identified and the model reproduces all five moments. The balanced-growth Euler equation gives $g^* = r^* - \rho + \Lambda$. To isolate the novel mechanism, in the benchmark calibration, we equate the growth and real-rate targets, which implies $\Lambda = \rho$ exactly. Since the direct entry-cost channel of Proposition 2 carries the sign of $\Lambda - \rho$, it is identically zero at the benchmark, and the growth effect of the nominal interest rate is generated entirely by the spirit of capitalism wedge channel

$$\left.\frac{\partial g^*}{\partial i}\right|_{\text{benchmark}} = \underbrace{-0.0111}_{\text{SoC wedge channel}} + \underbrace{0}_{\text{entry-cost channel}} = -0.0111. \tag{42}$$

Quantifying this new proposed mechanism, a one-percentage-point increase in the nominal interest rate lowers long-run growth by 0.011 percentage points.

The same equality pins down the strength of the wealth motive in closed form, $k = \rho/[(1 + \eta_c i)(C/A)^*] = 0.053$. This lies well above the minimum strength required for

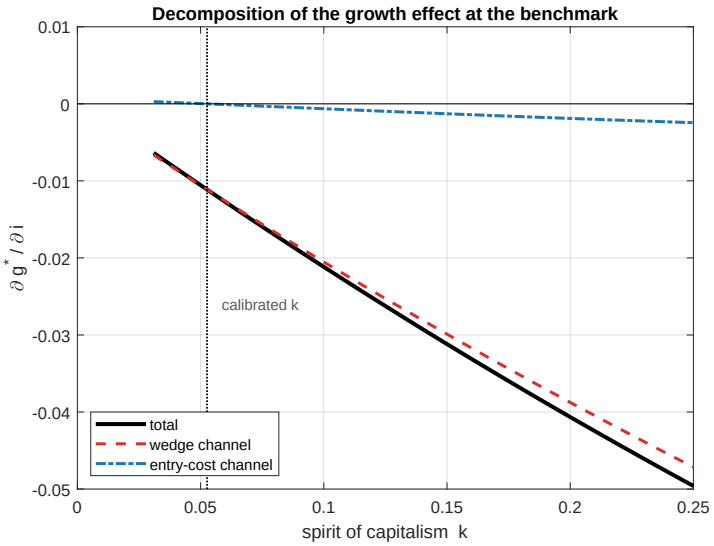


Figure 3: Decomposition of the growth effect at the benchmark ($\eta_c = 0.16$, $\eta_r = 0.439$, $i = 5\%$). The total effect $\partial g^*/\partial i$ (solid); the spirit of capitalism wedge channel (dashed); and the entry-cost channel (dash-dotted). Curves are shown over the admissible range.

positive growth in the calibrated economy, $k > 0.030$. It is smaller than the value of about 0.09 reported by He et al. (2023) because the wealth measures differ. We address this further in Section 6.6.

Figure 3 decomposes the growth effect across the admissible range of k. The spirit of capitalism wedge channel is negative for every admissible k and it determines the sign of the total effect. The entry-cost channel is zero at the calibrated k and remains second-order in magnitude. It changes sign where $\Lambda = \rho$ but never governs the sign of the total effect. Relocating the liquidity constraint from consumption to entry reverses the sign of $\partial\Lambda/\partial i$, and with it the sign of the spirit of capitalism wedge channel and the long-run inflation–growth relationship.

Figures 4 and 5 compare the benchmark calibration with the two polar regimes, holding the calibrated parameters fixed. The consumption cash-in-advance regime ($\eta_c = 0.16$, $\eta_r = 0$) and the entry cash-in-advance regime ($\eta_c = 0$, $\eta_r = 0.439$), each evaluated at the measured intensity of its constraint. Over the entire admissible range of k, a higher nominal interest rate raises growth when only consumption is constrained, reproducing the mechanism of He et al. (2023), and lowers it when only entry is constrained. The benchmark, in which both constraints operate at their measured intensities, lies on the entry side. In levels, the three schedules share a common intercept of 1.86 percent at $i = 0$. Over a ten-point range of the nominal interest rate, economic growth rises by 0.067 percentage points in the consumption regime and falls by 0.175 percentage points in the entry regime and by 0.111 percentage points at the benchmark. Table 5 confirms that the ranking holds across the entire policy range. The spirit of capitalism is identical in all three economies, what differs is where liquidity is scarce.

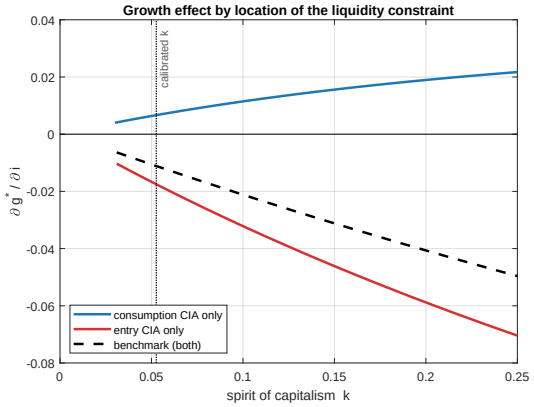


Figure 4: The growth effect $\partial g^*/\partial i$ against k under consumption cash-in-advance only, entry cash-in-advance only, and at the benchmark ($i = 5\%$), over the admissible range $g^* > 0$. The dotted line marks the calibrated k.

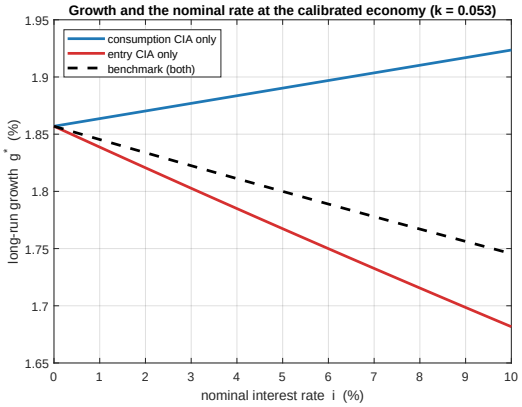


Figure 5: Long-run growth against the nominal interest rate at the calibrated economy. The schedules share the intercept $g^* = 1.86\%$ at $i = 0$. Growth rises under consumption cash-in-advance and falls under the benchmark and entry cash-in-advance.

Table 5: The growth effect $\partial g^*/\partial i$ by regime and nominal interest rate (calibrated $k = 0.053$)

Regime	0%	2%	4%	6%	8%	10%
Consumption cash-in-advance only	+0.0067	+0.0067	+0.0067	+0.0067	+0.0067	+0.0067
Entry cash-in-advance only	−0.0183	−0.0180	−0.0177	−0.0174	−0.0171	−0.0168
Benchmark (both constraints)	−0.0117	−0.0114	−0.0112	−0.0110	−0.0108	−0.0106

6.4 Where the United States economy lies

When both constraints are active, which of them governs the sign of the growth effect? We recalibrate the model to all five moments at each pair (η_c, η_r) and locate, for every entry intensity, the consumption intensity at which the growth effect changes sign. Because every recalibrated economy matches $g^* = r^*$, it satisfies $\Lambda = \rho$, its entry-cost channel is zero, and the boundary is exact. A higher nominal interest rate lowers long-run growth if and only if $\eta_r > \eta_c$. The sign depends only on the difference between the two intensities. Holding $\eta_r - \eta_c$ at its benchmark value of 0.279 and varying their common level over a wide range moves the growth effect between -0.0113 and -0.0109 and never changes its sign. Weak evidence on the common level of liquidity exposure is second-order with respect to the sign of the effect. What matters is the relative exposure of entry and consumption.

Figure 6 overlays the evidence of Table 2 on this boundary, and Table 6 reports the economic growth effect in each recalibrated economy. The benchmark calibrated economy is located in the region in which inflation lowers growth. The consumption intensity would have to rise above η_r for each measure of entry financing for the sign to reverse. Every

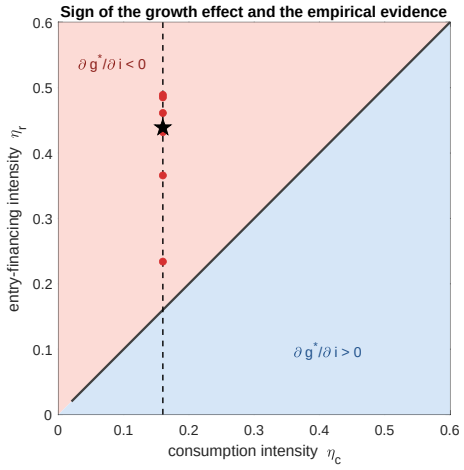


Figure 6: Sign of the growth effect and the empirical evidence. The boundary is computed by recalibrating the model to all five moments at each point. Above it ($\eta_r > \eta_c$) a higher nominal interest rate lowers long-run growth, below it ($\eta_c > \eta_r$) it raises growth. Circles: measures of η_r from Table 2 at the measured η_c (dashed line). Star: benchmark calibration.

measure of entry financing, combined with the measured consumption intensity, delivers a negative growth effect, ranging from -0.0030 for high-technology startups to -0.0129 for all startups.

Table 6: The growth effect across measures of entry financing ($\eta_c = 0.16$)

Measure of η_r	η_r	$\partial g^*/\partial i$
High-technology startups	0.234	-0.0030
All startups, trade credit in denominator	0.366	-0.0082
Startups without employees	0.432	-0.0109
All startups (benchmark)	0.439	-0.0111
Home-based startups	0.461	-0.0120
All startups, including owner debt	0.485	-0.0129

We can validate externally this quantitative evidence against empirical results. Two independent strands of evidence are consistent with it. At the firm level, monetary tightening disproportionately depresses the borrowing and investment of young firms (Cloyne et al., 2023) and startup and venture funding (Ma and Zimmermann, 2023), which is the exposure that a large η_r implies. Across countries, the association between inflation and growth becomes negative as the wealth motive strengthens, which is the pattern the calibrated model predicts in the region where the United States economy lies.

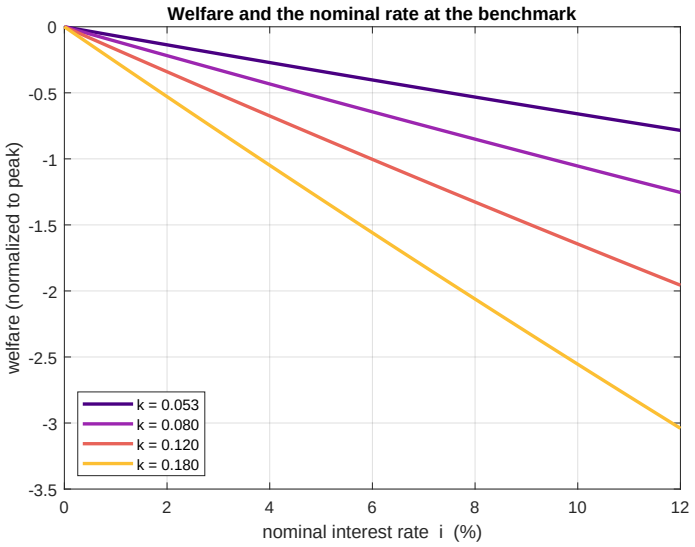


Figure 7: Balanced-growth welfare against the nominal interest rate at the benchmark calibrated economy, for several strengths of the spirit of capitalism. Each schedule is normalized so that its maximum is zero.

6.5 Welfare and the optimal nominal interest rate

We now turn to the welfare consequences of the mechanism along the balanced growth path, using the welfare function in equation (34). Figure 7 plots welfare against the nominal interest rate at the benchmark for several strengths of the spirit of capitalism. At every value of k in the admissible range, welfare is maximized at $i^* = 0$. Hence, the Friedman rule is optimal on the balanced growth path.

The decomposition in equation (36) shows why. The static component is positive at the benchmark. A higher nominal interest rate raises leisure and shifts the composition of initial resources in ways the household values. The growth component is negative and, being weighted by $(1 + k)/\rho^2$, is about ten times the static component in absolute value. Moreover, the schedules steepen as k rises so the welfare cost of a positive nominal interest rate increases with the strength of the spirit of capitalism.

6.6 Sensitivity checks

Robustness to the real-interest-rate target. The benchmark calibration pins down $\Lambda = \rho$, where the direct entry-cost channel is exactly zero. This isolated the spirit of capitalism wedge channel, but it might over-constrain the calibration. We show below that relaxing this equality strengthens our quantitative results. Table 7 recalibrates the model with r^* less than g^*, the configuration that much of the recent evidence on real interest rates regards as empirically relevant, holding the other four moments fixed. Since $\Lambda = g^* - r^* + \rho$, lowering r^* raises Λ above ρ, and by Proposition 2 the direct entry-cost channel turns negative. The total effect becomes more negative, from -0.0111 to -0.0130

Table 7: Robustness to the real-interest-rate target (full recalibration; g^*, l^*, $(C/A)^*$ and the R&D–GDP ratio held fixed)

r^*	Λ	k	α	wedge	entry-cost	total $\partial g^*/\partial i$	boundary η_c
1.8% (benchmark)	0.040	0.053	0.111	−0.01113	0.000000	−0.01113	0.439
1.5%	0.043	0.057	0.092	−0.01182	−0.000045	−0.01187	0.442
1.0%	0.048	0.063	0.062	−0.01296	−0.000076	−0.01303	0.445

Notes: "boundary η_c" is the consumption intensity at which the sign of $\partial g^*/\partial i$ reverses, at $\eta_r = 0.439$.

at $r^* = 1.0\%$.

The entry-cost channel reinforces the result only in sign, while it remains below one percent of the total, consistent with Section 6.3. For economies satisfying $r^* < g^*$, both channels are negative, whereas our benchmark calibration is the boundary case. The sign boundary correspondingly shifts slightly into the region where consumption is more tightly constrained, to $\eta_c = 0.445$ at $r^* = 1.0\%$, enlarging the region in which inflation lowers economic growth. Because α falls as r^* declines, the plausible range is bounded from below, and we report $r^* = 1.5\%$ and 1.0%.

The wealth target. Table 8 recalibrates the benchmark with the consumption–wealth ratio of He et al. (2023), $(C/A)^* = 0.43$, whose wealth measure includes money balances. Only the entry-cost parameter and the strength of the spirit of capitalism change considerably: k rises to 0.092, close to the value of about 0.09 reported by He et al. (2023). At the benchmark, $\Lambda = \rho$ still holds, the growth effect is generated entirely by the spirit of capitalism wedge channel, and its sign and magnitude are essentially unchanged across all measures of entry financing.

Table 8: Benchmark with $(C/A)^* = 0.43$

	α	ϕ	β	γ	k
Calibrated values	0.111	0.144	2.185	1.984	0.092
			$\partial g^*/\partial i$		
$\eta_r = 0.234$			−0.0028		
$\eta_r = 0.439$ (benchmark)			−0.0104		
$\eta_r = 0.485$			−0.0121		

Recalibration across the constraint plane. Table 9 reports the sign of $\partial g^*/\partial i$ when the model is recalibrated to all five moments at each point of a grid over (η_c, η_r). Two conclusions follow. First, the reversal operates through the valuation of the wealth motive rather than the direct entry-cost channel. Second, with the data (and hence essentially k) held fixed, the sign of $\partial g^*/\partial i$ is determined entirely by the relative tightness of the

two constraints: positive when the consumption constraint binds more strongly ($\eta_c > \eta_r$), negative when the entry constraint binds more strongly ($\eta_c < \eta_r$), and zero on the diagonal $\eta_c = \eta_r$.

Table 9: Sign of $\partial g^*/\partial i$ under full recalibration

	$\eta_r = 0$	0.10	0.16	0.234	0.30	0.439
$\eta_c = 0$	0	−	−	−	−	−
$\eta_c = 0.10$	+	0	−	−	−	−
$\eta_c = 0.16$	+	+	0	−	−	−
$\eta_c = 0.234$	+	+	+	0	−	−
$\eta_c = 0.30$	+	+	+	+	0	−
$\eta_c = 0.439$	+	+	+	+	+	0

Structural parameters. Table 10 varies one parameter at a time, holding the rest at benchmark values. The economic growth effect of increasing the nominal interest rate is negative throughout, including at the lowest measure of entry financing and when the consumption intensity is raised to 0.24.

Table 10: Sensitivity of $\partial g^*/\partial i$ (benchmark parameters held fixed)

Variation	$\partial g^*/\partial i$	Variation	$\partial g^*/\partial i$	Variation	$\partial g^*/\partial i$
Benchmark	−0.0111	$\eta_c = 0$	−0.0175	markup 1.4	−0.0058
$\eta_r = 0.234$	−0.0030	$\eta_c = 0.24$	−0.0079	markup 1.8	−0.0172
$\eta_r = 0.366$	−0.0083	$\alpha = 0.15$	−0.0114	$\rho = 0.03$	−0.0114
$\eta_r = 0.485$	−0.0129	$\alpha = 0.20$	−0.0119	$\rho = 0.05$	−0.0109

7 Extensions and generality of the mechanism

We present several model extensions, robustness checks, and quantitative results, augmenting our generalized framework. For brevity, the full analyses are relegated to Appendix G and we only mention the main results here. These extensions demonstrate the generality and flexibility of our framework, which we hope will be of use to future researchers.

Exogenous entry. We extend the model to allow population growth to generate a permanent, exogenous flow of entry. Firm density N_t/L_t is stationary, the number of firms grows at rate n, and the entry cash-in-advance constraint binds with strictly positive

borrowing in steady state. Market size per firm, and hence the incentive for vertical R&D, is unaffected, so the model remains free of scale effects. Population growth enters the model through a single channel: the real resources absorbed by continuous entry, a share $\beta\theta^2 n$ of output. Its introduction lowers the consumption-to-output ratio and with it the spirit of capitalism wedge, which weakens both components of the corresponding wedge channel. The quantitative difference with respect to the effects reported in Section 6 is negligible.

Exogenous exit. We extend the model by introducing a constant Poisson hazard ζ at which each firm exits with zero salvage value. Entrants then replace exiting firms at rate ζ, so entry remains strictly positive on the balanced growth path and the entry cash-in-advance constraint binds with positive borrowing in steady state. Modeling exit in this manner changes the model in two places: the hazard is added to the discount rate in firm valuation and in the return to in-house R&D, and the threshold at which the direct entry-cost channel changes sign rises from ρ to $\rho + \zeta$. Because the calibration still pins $\Lambda = \rho$, the direct entry-cost channel now works against the spirit of capitalism wedge channel rather than being shut down, while the spirit of capitalism wedge channel itself remains negative for any empirically relevant hazard. At the exogenous destruction rate estimated by Acemoglu et al. (2018), $\zeta = 0.037$, the economic growth effect of increasing the nominal interest rate is -0.0099. It remains negative for $\zeta < 0.071$, beyond which the market-size effect of costlier entry dominates, as our Proposition 2 predicts.

Welfare along the transition. Our welfare analysis compares balanced growth paths. When monetary policy changes, however, the economy does not move to its new balanced growth path at once. The number of firms is predetermined and adjusts only gradually, through market entry. We compute the full transition after an unanticipated, permanent cut in the nominal interest rate from its calibrated value of 5 percent, and evaluate lifetime welfare along the entire path. A lower nominal rate makes entry cheaper, so the number of firms rises toward a higher steady-state level. While firms are still scarce relative to their new steady-state number, each firm's market is larger, the return to in-house R&D is higher, and productivity growth briefly exceeds its new long-run rate. Moving to the Friedman rule raises lifetime welfare by the equivalent of a permanent 1.37 percent increase in consumption, compared with 1.36 percent when only balanced growth paths are compared, and the gain declines steadily as the new rate rises toward 5 percent. Among all feasible rate cuts, the Friedman rule therefore remains optimal once transition dynamics are taken into account.

Relative wealth and status. In the economy of Section 4 households value their wealth in absolute terms. Another strand of the literature is concerned with relative

wealth and status. Appendix G.4 lets a share $\chi \in [0,1]$ of the wealth motive be positional, so that households derive utility from their wealth relative to average wealth. Because each household takes average wealth as given, its private incentive to accumulate is identical to the baseline economy. The growth mechanism therefore does not depend on whether wealth is valued for its own sake or for the status it represents. What changes is welfare. In a symmetric equilibrium no household can improve its relative position, so the positional component of wealth accumulation has no social value, and the welfare weight on wealth falls. Two opposing effects follow. The new positional component removes the social value of the higher wealth that a higher nominal rate generates, but it also reduces the welfare cost of the slower growth that the higher rate causes. At the calibrated parameters, the first effect dominates. The Friedman rule remains optimal, and the balanced-growth welfare gain from moving from 5 percent to a zero nominal interest rate rises slightly.

Liquidity constraint on in-house R&D. Here we extend the model from Section 4 to shift the discussion towards Chu and Cozzi (2014). We allow the incumbent to cover some of the R&D costs with borrowed funds on which the nominal interest rate is paid. A higher nominal rate then raises the user cost of vertical innovation directly, which adds a new channel to the decomposition of Proposition 2 and lowers economic growth. Due to the lack of analytical tractability, we proceed to quantitatively examine the properties of this extension. We use empirical evidence from Hall and Lerner (2010) and Benfratello, Schiantarelli and Sembenelli (2008) and treat $\eta_I \in [0, 0.094]$ as the empirically relevant range. At its upper bound, the growth effect of the nominal interest rate strengthens from -0.0111 to -0.0126, the Friedman rule remains optimal, and the effect becomes monotonically stronger over the whole range. Liquidity needs of incumbents therefore reinforce the conclusion that inflation lowers economic growth in this generalized framework.

8 Conclusion

The question whether monetary policy can affect long-run economic growth is long-standing. It has been revived in the recent literature showing that when households value wealth for its own sake (representing the spirit of capitalism), a higher nominal interest rate can raise long-run economic growth. We analyze the robustness of this result. To this end, we propose a Schumpeterian growth model with endogenous market structure incorporating the spirit of capitalism and we allow for a cash-in-advance constraint to be operative on funding consumption, funding market entry, or funding both.

Our results show that the sign of the long-run growth effect of monetary policy is not determined by the wealth motive alone, but by the dimension of where liquidity is constrained. When the cash-in-advance constraint only applies to consumption, a

higher nominal interest rate induces individuals to shift from consumption toward asset accumulation, which raises long-run economic growth (this result is exactly in line with He et al., 2023). However, when the cash-in-advance constraint applies on the funding of market entry, a rise in the nominal interest rate reduces entry and increases the value of firms. This, in turn, has the effect of inflating wealth relative to output, which reduces the marginal incentive to accumulate and, thus, reduces economic growth.

We show further that, whenever the wealth motive is weak, the direct effect of higher entry costs on economic growth can even be positive because a reduced entry rate increases the market size of incumbent firms, which, in turn, increases their incentives to perform vertical R&D. Overall, therefore, the interactions among monetary policy, its effects on firm valuation, and the preferences of households for wealth accumulation are what is crucial for the long-run economic growth effect of monetary policy.

When the economic growth rate coincides with the real interest rate along the balanced growth path, the mechanism simplifies: the sign of the economic growth effect depends only on the relative strength of the two liquidity constraints. Whenever the cash-in-advance constraint on entry is stronger than the cash-in-advance constraint on consumption, an increase in the nominal interest rate reduces economic growth.

Our quantitative analysis for a calibration of the model to the United States economy shows the following results. A ten-percentage-point increase of the nominal interest rate raises economic growth by roughly +0.067 percentage points if only the cash-in-advance constraint on consumption is operative. However, a similar ten-percentage-point increase of the nominal interest rate reduces the economic growth rate by 0.175 percentage points when only the cash-in-advance constraint on entry is operative, and by 0.111 percentage points when both constraints are operative. These effects are economically meaningful but modest, which reinforces their credibility.

Welfare along the balanced growth path follows similar dynamics as the effect of the nominal interest rate on economic growth. Welfare increases monotonically with the interest rate when only the cash-in-advance constraint on consumption is operative, whereas the opposite holds true when only the cash-in-advance constraint on entry is operative.

The policy implications of our findings are that i) monetary policy can have effects on economic growth and welfare in the long run, ii) these effects are not unambiguous but depend on the mechanisms by which liquidity constraints operate, and iii) the preference of wealth (the spirit of capitalism) is insufficient to generate a positive effect of inflation and the nominal interest rate on economic growth. Our results therefore yield important generalizations of the previous literature.

The following avenues are promising for future research. First, a deeper empirical analysis could test the channels that we propose more directly and could infer the causal effects of a change in the nominal interest rate on economic growth. Second, it would

be interesting to analyze whether heterogeneity on the household side could change the results.

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References

Acemoglu, Daron, Ufuk Akcigit, Harun Alp, Nicholas Bloom, and William Kerr. 2018. "Innovation, Reallocation, and Growth." *American Economic Review*, 108(11): 3450–3491.

Adams, James D., and Adam B. Jaffe. 1996. "Bounding the Effects of R&D: An Investigation Using Matched Establishment-Firm Data." *RAND Journal of Economics*, 27(4): 700–721.

Aghion, Philippe, and Peter Howitt. 2005. "Growth with Quality-Improving Innovations: An Integrated Framework." In *Handbook of Economic Growth*. Vol. 1, , ed. Philippe Aghion and Steven Durlauf, 67–110. Amsterdam:Elsevier.

Aghion, Philippe, and Peter Howitt. 2009. *The Economics of Growth.* Vol. 1 of *MIT Press Books*. 1 ed., The MIT Press.

Angeletos, George-Marios, and Vasia Panousi. 2009. "Revisiting the supply side effects of government spending." *Journal of Monetary Economics*, 56(2): 137–153.

Bakshi, Gurdip S, and Zhiwu Chen. 1996. "The Spirit of Capitalism and Stock-Market Prices." *American Economic Review*, 86(1): 133–157.

Benfratello, Luigi, Fabio Schiantarelli, and Alessandro Sembenelli. 2008. "Banks and innovation: Microeconometric evidence on Italian firms." *Journal of Financial Economics*, 90(2): 197–217.

Bilbiie, Florin O., Fabio Ghironi, and Marc J. Melitz. 2012. "Endogenous Entry, Product Variety, and Business Cycles." *Journal of Political Economy*, 120(2): 304–345.

Bøler, Esther Ann, Andreas Moxnes, and Karen Helene Ulltveit-Moe. 2026. "Strapped for Cash: The Role of Financial Constraints for Innovating Firms, Misallocation and Aggregate Productivity Growth." *American Economic Journal: Macroeconomics*. Forthcoming.

Brown, James R., Gustav Martinsson, and Bruce C. Petersen. 2012. "Do financing constraints matter for R&D?" *European Economic Review*, 56(8): 1512–1529.

Brown, James R., Steven M. Fazzari, and Bruce C. Petersen. 2009. "Financing Innovation and Growth: Cash Flow, External Equity, and the 1990s R&D Boom." *Journal of Finance*, 64(1): 151–185.

Carroll, Christopher D. 1998. "Why Do the Rich Save So Much?" National Bureau of Economic Research, Inc NBER Working Papers 6549.

Chu, Angus C., and Guido Cozzi. 2014. "R&D And Economic Growth In A Cash-In-Advance Economy." *International Economic Review*, 55(2): 507–524.

Chu, Angus C., and Lei Ji. 2016. "Monetary Policy And Endogenous Market Structure In A Schumpeterian Economy." *Macroeconomic Dynamics*, 20(5): 1127–1145.

Chu, Angus C., Haichao Fan, and Xilin Wang. 2020. "Status-seeking culture and development of capitalism." *Journal of Economic Behavior & Organization*, 180(C): 275–290.

Clark, Andrew E., and Andrew J. Oswald. 1996. "Satisfaction and comparison income." *Journal of Public Economics*, 61(3): 359–381.

Cloyne, James, Clodomiro Ferreira, Maren Froemel, and Paolo Surico. 2023. "Monetary Policy, Corporate Finance, and Investment." *Journal of the European Economic Association*, 21(6): 2586–2634.

Cohen, Wesley M, and Steven Klepper. 1996*a*. "Firm Size and the Nature of Innovation within Industries: The Case of Process and Product R&D." *The Review of Economics and Statistics*, 78(2): 232–243.

Cohen, Wesley M, and Steven Klepper. 1996*b*. "A Reprise of Size and R&D." *Economic Journal*, 106(437): 925–951.

Cozzi, Guido, Paolo E. Giordani, and Luca Zamparelli. 2007. "The refoundation of the symmetric equilibrium in Schumpeterian growth models." *Journal of Economic Theory*, 136(1): 788–797.

Crowder, William J, and Dennis L Hoffman. 1996. "The Long-Run Relationship between Nominal Interest Rates and Inflation: The Fisher Equation Revisited." *Journal of Money, Credit and Banking*, 28(1): 102–118.

De Loecker, Jan, Jan Eeckhout, and Gabriel Unger. 2020. "The Rise of Market Power and the Macroeconomic Implications." *The Quarterly Journal of Economics*, 135(2): 561–644.

Easterlin, Richard A. 1995. "Preferences and prices in choice of career: The switch to business, 1972-1987." *Journal of Economic Behavior & Organization*, 27(1): 1–34.

Francis, Johanna L. 2009. "Wealth and the capitalist spirit." *Journal of Macroeconomics*, 31(3): 394–408.

Gaillard, Alexandre, Christian Hellwig, Philipp Wangner, and Nicolas Werquin. 2023. "Consumption, Wealth, and Income Inequality: A Tale of Tails." Federal Reserve Bank of Chicago Working Paper Series WP 2023-43.

Garriga, Ana Carolina. 2016. "Central Bank Independence in the World: A New Data Set." *International Interactions*, 42(5): 849–868.

Guiso, Luigi, Paola Sapienza, and Luigi Zingales. 2006. "Does Culture Affect Economic Outcomes?" *Journal of Economic Perspectives*, 20(2): 23–48.

Ha, Joonkyung, and Peter Howitt. 2007. "Accounting for Trends in Productivity and R&D: A Schumpeterian Critique of Semi-Endogenous Growth Theory." *Journal of Money, Credit and Banking*, 39(4): 733–774.

Hall, Bronwyn H. 2002. "The Financing of Research and Development." *Oxford Review of Economic Policy*, 18(1): 35–51.

Hall, Bronwyn H., and Josh Lerner. 2010. "The Financing of R&D and Innovation." In *Handbook of the Economics of Innovation*. Vol. 1, , ed. Bronwyn H. Hall and Nathan Rosenberg, 609–639. Amsterdam:Elsevier.

He, Qichun, Yulei Luo, Jun Nie, and Heng fu Zou. 2023. "Money, Growth, and Welfare in a Schumpeterian Model with the Spirit of Capitalism." *Review of Economic Dynamics*, 47: 346–372.

Himmelberg, Charles P, and Bruce C Petersen. 1994. "R&D and Internal Finance: A Panel Study of Small Firms in High-Tech Industries." *The Review of Economics and Statistics*, 76(1): 38–51.

Hof, Franz X., and Klaus Prettner. 2019. "The quest for status and R&D-based growth." *Journal of Economic Behavior & Organization*, 162(C): 290–307.

Hof, Franz X., and Klaus Prettner. 2023. "Relative consumption, relative wealth, and long-run growth: when and why is the standard analysis prone to incorrect conclusions?" *Macroeconomic Dynamics*, 27(1): 250–274.

Howitt, Peter. 1999. "Steady Endogenous Growth with Population and R & D Inputs Growing." *Journal of Political Economy*, 107(4): 715–730.

Jones, Charles I. 1995. "R&D-Based Models of Economic Growth." *Journal of Political Economy*, 103(4): 759–784.

Kawamoto, Koichi. 2009. "Status-seeking behavior, the evolution of income inequality, and growth." *Economic Theory*, 39(2): 269–289.

Kurz, M. 1968. "The General Instability of a Class of Competitive Growth Processes." *The Review of Economic Studies*, 35(2): 155–174.

Laincz, Christopher, and Pietro Peretto. 2006. "Scale effects in endogenous growth theory: an error of aggregation not specification." *Journal of Economic Growth*, 11(3): 263–288.

Ma, Yueran, and Kaspar Zimmermann. 2023. "Monetary Policy and Innovation." National Bureau of Economic Research, Inc NBER Working Papers 31698.

Mian, Atif, Ludwig Straub, and Amir Sufi. 2021. "The Saving Glut of the Rich." Princeton University. Economics Department. Working Papers 2021-70.

Michaillat, Pascal, and Emmanuel Saez. 2021. "Resolving New Keynesian Anomalies with Wealth in the Utility Function." *The Review of Economics and Statistics*, 103(2): 197–215.

Ming, Yang, Minxian Sun, Chan Wang, and Jingyi Wang. 2026. "Monetary policy and growth in an open economy with the spirit of capitalism." *Journal of Economic Dynamics and Control*, 190: 105372.

Mishkin, Frederic S. 1992. "Is the Fisher effect for real? : A reexamination of the relationship between inflation and interest rates." *Journal of Monetary Economics*, 30(2): 195–215.

Pan, Shiyuan, Mengbo Zhang, and Heng-Fu Zou. 2018. "Status Preference And The Effects Of Patent Protection: Theory And Evidence." *Macroeconomic Dynamics*, 22(4): 837–863.

Peretto, Pietro F. 1998. "Technological Change and Population Growth." *Journal of Economic Growth*, 3(4): 283–311.

Peretto, Pietro F. 1999. "Cost reduction, entry, and the interdependence of market structure and economic growth." *Journal of Monetary Economics*, 43(1): 173–195.

Peretto, Pietro F. 2007. "Corporate taxes, growth and welfare in a Schumpeterian economy." *Journal of Economic Theory*, 137(1): 353–382.

Peretto, Pietro F. 2011. "The Growth and Welfare Effects of Deficit–Financed Dividend Tax Cuts." *Journal of Money, Credit and Banking*, 43(5): 835–869.

Robb, Alicia M., and David T. Robinson. 2014. "The Capital Structure Decisions of New Firms." *The Review of Financial Studies*, 27(1): 153–179.

Smith, William T. 1999. "Risk, the Spirit of Capitalism and Growth: The Implications of a Preference for Capital." *Journal of Macroeconomics*, 21(2): 241–262.

Tobin, James. 1965. "Money and Economic Growth." *Econometrica*, 33(4): 671–684.

Westerlund, Joakim. 2008. "Panel cointegration tests of the Fisher effect." *Journal of Applied Econometrics*, 23(2): 193–233.

Zou, Heng-fu. 1994. "'The spirit of capitalism' and long-run growth." *European Journal of Political Economy*, 10(2): 279–293.

Zou, Heng-fu. 1995. "The spirit of capitalism and savings behavior." *Journal of Economic Behavior & Organization*, 28(1): 131–143.

Appendix

A Balanced growth path: existence, uniqueness and stability

Final goods producers pay $p_t N_t X_t = \theta Y_t$ to intermediate goods producing firms. Substituting this expression and Equation (16) into the equilibrium condition, $A_t = V_t N_t$, yields $A_t = \Psi Y_t$. Substituting the seigniorage transfer condition $\tau_t = \dot{M}_t + \pi_t M_t$ in equation (2) and dividing by $A_t = \Psi Y_t$ yields the law of motion

$$\frac{\dot{C}_t}{C_t} - \frac{\dot{Y}_t}{Y_t} = \mathcal{A}_0 - \omega \frac{\dot{N}_t}{N_t}, \tag{A1}$$

where

$$\mathcal{A}_0 \equiv \frac{1}{\Psi}\left[(1 + k + k\eta_c i)\frac{C_t}{Y_t} - (1-\theta)\right] - \rho, \qquad \omega \equiv \frac{\eta_r i}{1+\eta_r i} \in [0,1). \tag{A2}$$

The coupling coefficient on $\dot{N}_t/N_t$ follows from $\frac{1}{\Psi} \cdot \frac{\Psi \eta_r i}{1+\eta_r i} = \omega$. It is the only place at which the market entry margin enters the consumption dynamics, and it is absent when $\eta_r = 0$.

The entry no-arbitrage condition $r_t^e = r_t$ together with the free-entry condition in equation (16), the HJB equation in (17), and $\dot{V}_t/V_t = \dot{X}_t/X_t = \dot{Z}_t/Z_t + \dot{l}_t/l_t - \dot{N}_t/N_t$, gives, before substitution,

$$\frac{\dot{N}_t}{N_t} = \frac{1}{\beta(1+\eta_r i)}\left[\frac{1-\theta}{\theta} - \left(\phi + \frac{\dot{Z}_t}{Z_t}\right)\theta^{-\frac{2}{1-\theta}}\frac{N_t}{l_t}\right] - \rho + \frac{k(1+\eta_c i)}{\Psi}\frac{C_t}{Y_t} - \left(\frac{\dot{C}_t}{C_t} - \frac{\dot{Y}_t}{Y_t}\right). \tag{A3}$$

Substituting $\dot{Z}_t/Z_t$ from (21) yields two cancellations. First, the term $\alpha(1-\theta)\theta^{\frac{1+\theta}{1-\theta}}\frac{l_t}{N_t}$ inside $(\phi + \frac{\dot{Z}_t}{Z_t})$ meets $\theta^{-\frac{2}{1-\theta}}\frac{N_t}{l_t}$ and collapses to the constant $\frac{\alpha(1-\theta)}{\theta}$, using $\theta^{\frac{1+\theta}{1-\theta} - \frac{2}{1-\theta}} = \theta^{-1}$. Second, the transitional correction $-\frac{l_t}{L}\left(\frac{\dot{C}_t}{C_t} - \frac{\dot{Y}_t}{Y_t}\right)$ inside $\frac{\dot{Z}_t}{Z_t}$ meets $\theta^{-\frac{2}{1-\theta}}\frac{N_t}{l_t}$, the l_t cancels, and the term contributes $\frac{\theta^{-\frac{2}{1-\theta}}}{\beta(1+\eta_r i)}\frac{N_t}{L}$ to the coefficient of the gap. The standalone gap term in (D3), which follows from $\frac{\dot{Z}_t}{Z_t} + \frac{\dot{l}_t}{l_t} = \frac{\dot{Y}_t}{Y_t}$ and equals $-\left(\frac{\dot{C}_t}{C_t} - \frac{\dot{Y}_t}{Y_t}\right)$, contributes -1. Hence the coefficient of the gap is $\frac{\theta^{-\frac{2}{1-\theta}}}{\beta(1+\eta_r i)}\frac{N_t}{L} - 1$. Collecting the terms that do not multiply the gap into B_0, and the coefficient of the gap into B_1, the law of motion of entry can be written as linear in the gap

$$\frac{\dot{N}_t}{N_t} = \mathrm{B}_0 + \mathrm{B}_1\left(\frac{\dot{C}_t}{C_t} - \frac{\dot{Y}_t}{Y_t}\right), \tag{A4}$$

with

$$\mathrm{B}_0 \equiv \frac{(1-\alpha)(1-\theta)}{\theta\beta(1+\eta_r i)} - \rho + \frac{k(1+\eta_c i)}{\Psi}\frac{C_t}{Y_t} - \frac{\theta^{-\frac{2}{1-\theta}}}{\beta(1+\eta_r i)}\frac{N_t}{l_t}\left[\phi - \rho + \frac{k(1+\eta_c i)}{\Psi}\frac{C_t}{Y_t}\right], \tag{A5}$$

$$\mathrm{B}_1 \equiv \frac{\theta^{-\frac{2}{1-\theta}}}{\beta(1+\eta_r i)}\frac{N_t}{L} - 1. \tag{A6}$$

Because $\mathcal{A}_0$, B_0, B_1, and ω are themselves functions of $\frac{C_t}{Y_t}$ and N_t through the composites above and through $l_t = \left[1 + \frac{\gamma(1+\eta_c i)}{1-\theta}\frac{C_t}{Y_t}\right]^{-1} L$, the two laws of motion above form a nonlinear autonomous system in the two variables, one of which, $\frac{C_t}{Y_t}$, is free to jump, while the other, N_t, is predetermined. The simultaneous solution for the two growth rates is an exact pointwise inversion, valid everywhere, since $1 + \omega \mathrm{B}_1 > 0$. The balanced growth path solves $\frac{d}{dt}\ln\frac{C_t}{Y_t} = \frac{\dot{N}_t}{N_t} = 0$ (equivalently $\mathcal{A}_0 = \mathrm{B}_0 = 0$), which is tractable in closed form. Local determinacy is then assessed by linearizing the nonlinear system around the balanced growth path, so we can only examine local stability. Finally, we can rewrite the solution of this system as

$$\begin{bmatrix} \frac{d}{dt}\ln\frac{C_t}{Y_t} \\ \frac{\dot{N}_t}{N_t} \end{bmatrix} = \begin{bmatrix} \frac{\mathcal{A}_0 - \omega \mathrm{B}_0}{1+\omega \mathrm{B}_1} \\ \frac{\mathcal{A}_0 \mathrm{B}_1 + \mathrm{B}_0}{1+\omega \mathrm{B}_1}. \end{bmatrix} \tag{A7}$$

A.1 Existence and uniqueness

Setting $\frac{d}{dt}\ln\frac{C_t}{Y_t} = 0$, implies $\mathcal{A}_0 - \omega \mathrm{B}_0 = 0$, since the denominator is positive. Combined with $\frac{\dot{N}_t}{N_t} = 0$, and substituting it into the above expression, yields the condition that, on the balanced growth path, $\mathcal{A}_0 = 0$. Solving it yields the steady-state consumption-to-output ratio

$$\left(\frac{C}{Y}\right)^* = \frac{\beta(1+\eta_r i)\theta^2\rho + (1-\theta)}{1 + k + k\eta_c i} > 0. \tag{A8}$$

Next, we define three composite expressions that simplify the derivations and recur extensively

$$\Lambda \equiv \frac{k(1+\eta_c i)}{\Psi}\left(\frac{C}{Y}\right)^* \geq 0, \qquad \mathcal{P} \equiv \phi - \rho + \Lambda, \qquad \mathcal{Q} \equiv \frac{(1-\alpha)(1-\theta)}{\theta\beta(1+\eta_r i)} - \rho + \Lambda. \tag{A9}$$

To set up the ground for the proofs that follow, we assume that the growth rate of the economy on the balanced growth path and the signs of the final two composite expressions in equation (A9) are positive throughout. In addition, we establish that $1 + \omega\,\mathrm{B}_1 > 0$, ensuring that the pointwise inversion in equation (A7) is well defined.

Assumption 1. *$\mathcal{P} > 0$, $\mathcal{Q} > 0$, and $g^* > 0$.*

Lemma 2. *For all $N \geq 0$, $1 + \omega\,\mathrm{B}_1 > 0$ for all admissible parameters.*

Proof. Given B_1 in equation (A6),

$$1 + \omega\,\mathrm{B}_1 = \frac{1}{1+\eta_r i} + \omega\,\frac{\theta^{-\frac{2}{1-\theta}}}{\beta(1+\eta_r i)}\frac{N^*}{L} > \frac{1}{1+\eta_r i} > 0,$$

with $1 + \omega \mathrm{B}_1 = 1$ when $\eta_r = 0$. □

Next, we show the existence and uniqueness properties of the steady state. From Equation (A7) and the discussion above, the steady state is equivalently characterized by $\mathcal{A}_0 = 0$ and $\mathrm{B}_0 = 0$.

First, $\mathcal{A}_0 = 0$ is linear in C_t/Y_t and, from Equation (A2), solves uniquely to Equation (A8). Its numerator and denominator are strictly positive, so $(C/Y)^* > 0$. Given $(C/Y)^*$, Equation (19) delivers a unique $l^* = \left[1 + \frac{\gamma(1+\eta_c i)}{1-\theta}(C/Y)^*\right]^{-1} L \in (0, L)$.

We proceed by evaluating $\mathrm{B}_0 = 0$ at $(C/Y)^*$. Using the definitions in equation (A9), the two N-free terms sum to $\mathcal{Q}$, and the bracket equals $\mathcal{P}$, so

$$\mathcal{Q} = \frac{\theta^{-\frac{2}{1-\theta}}}{\beta(1+\eta_r i)} \frac{N^*}{l^*} \mathcal{P} \quad \Longrightarrow \quad \frac{N^*}{l^*} = \beta(1+\eta_r i)\, \theta^{\frac{2}{1-\theta}} \frac{\mathcal{Q}}{\mathcal{P}}.$$

The firm-to-labor ratio is unique, and $N^* > 0$ from Assumption 1. The balanced growth rate follows from Equation (21) as

$$g^* = \left(\frac{\dot{Z}_t}{Z_t}\right)^* = \frac{\alpha(1-\theta)}{\theta\, \beta(1+\eta_r i)} \frac{\mathcal{P}}{\mathcal{Q}} + \mathcal{P} - \phi, \tag{A10}$$

where $\mathcal{P} - \phi = \Lambda - \rho$.

A.2 Saddle-path stability and determinacy

In this subsection we establish the local stability of the system. Let $x \equiv C_t/Y_t$, and

$$\varphi(x, N) \equiv \frac{\mathcal{A}_0 - \omega \mathrm{B}_0}{1 + \omega \mathrm{B}_1}, \qquad \Gamma(x, N) \equiv \frac{\mathrm{B}_0 + \mathrm{B}_1 \mathcal{A}_0}{1 + \omega \mathrm{B}_1}, \tag{A11}$$

denote the two growth rates on the right-hand sides of equation (A7), so that the system is $\dot{x} = x\, \varphi(x, N)$ and $\dot{N} = N\, \Gamma(x, N)$. The Jacobian of the system at (x^*, N^*) is

$$J = \begin{bmatrix} \partial_x(x\varphi) & \partial_N(x\varphi) \\ \partial_x(N\Gamma) & \partial_N(N\Gamma) \end{bmatrix},$$

where subscripts denote partial derivatives. At the steady state, $\varphi = \Gamma = 0$, so the terms $\varphi\, \partial_x x$ and $\Gamma\, \partial_N N$ drop, and

$$J = \begin{bmatrix} x^* \varphi_x & x^* \varphi_N \\ N^* \Gamma_x & N^* \Gamma_N \end{bmatrix}, \qquad \det J = x^* N^* \left(\varphi_x \Gamma_N - \varphi_N \Gamma_x\right).$$

At the steady state, the numerators of both φ and Γ in equation (A11) vanish, since $\mathcal{A}_0^* = \mathrm{B}_0^* = 0$. Consequently, the derivative-of-denominator terms in the quotient rule vanish. Moreover, terms proportional to $\mathcal{A}_0$, such as $\mathrm{B}_{1,x}\mathcal{A}_0$ and $\mathrm{B}_{1,N}\mathcal{A}_0$, also vanish.

Henceforth, all partial derivatives are evaluated at (x^*, N^*), unless otherwise stated. Defining $d \equiv 1 + \omega \mathrm{B}_1$, we therefore have

$$\varphi_x = \frac{\mathcal{A}_{0,x} - \omega \mathrm{B}_{0,x}}{d}, \qquad \varphi_N = \frac{\mathcal{A}_{0,N} - \omega \mathrm{B}_{0,N}}{d},$$
$$\Gamma_x = \frac{\mathrm{B}_{0,x} + \mathrm{B}_1 \mathcal{A}_{0,x}}{d}, \qquad \Gamma_N = \frac{\mathrm{B}_{0,N} + \mathrm{B}_1 \mathcal{A}_{0,N}}{d}.$$

Expanding $\varphi_x \Gamma_N - \varphi_N \Gamma_x$, the products $\mathcal{A}_{0,x}\mathrm{B}_1\mathcal{A}_{0,N}$ and $\mathcal{A}_{0,N}\mathrm{B}_1\mathcal{A}_{0,x}$ cancel, as do $\omega \mathrm{B}_{0,x}\mathrm{B}_{0,N}$ and $\omega \mathrm{B}_{0,N}\mathrm{B}_{0,x}$, and the remainder collects as

$$\varphi_x \Gamma_N - \varphi_N \Gamma_x = \frac{\big(\mathcal{A}_{0,x}\mathrm{B}_{0,N} - \mathcal{A}_{0,N}\mathrm{B}_{0,x}\big)(1 + \omega \mathrm{B}_1)}{d^2} = \frac{\mathcal{A}_{0,x}\mathrm{B}_{0,N} - \mathcal{A}_{0,N}\mathrm{B}_{0,x}}{d}.$$

Following equation (A2), $\mathcal{A}_0$ does not depend on N, so $\mathcal{A}_{0,N} = 0$. Therefore

$$\det J = \frac{x^* N^*}{1 + \omega \mathrm{B}_1} \mathcal{A}_{0,x} \, \mathrm{B}_{0,N}. \tag{A12}$$

The three factors have the following signs. From Equation (A2), $\mathcal{A}_{0,x} = \frac{1+k+k\eta_c i}{\Psi} > 0$ and from equation (A5), since l_t depends on C_t/Y_t only and not on N_t,

$$\mathrm{B}_{0,N} = -\frac{\theta^{-\frac{2}{1-\theta}}}{\beta(1+\eta_r i)} \frac{1}{l^*} \underbrace{\left[\phi - \rho + \tfrac{k(1+\eta_c i)}{\Psi}(C/Y)^*\right]}_{=\mathcal{P}>0} < 0.$$

Finally, $1 + \omega \mathrm{B}_1 > 0$ by Lemma 2 and, thus, $\det J < 0$. This implies the eigenvalues are real and of opposite sign: there is exactly one stable eigenvalue. Therefore a unique one-dimensional stable manifold passes through each N_0 onto which $x_0 = C_0/Y_0$ jumps. The equilibrium is locally determinate.

B Effects of monetary policy on long-run growth

The nominal interest rate enters equations (A9)–(A10) in only two ways: through the spirit of capitalism wedge Λ, and through the entry cost $\beta(1 + \eta_r i)$ that appears in the leading coefficient of equation (A10) and in the first term of $\mathcal{Q}$.

Because Λ enters $\mathcal{P}$ and $\mathcal{Q}$ one for one, the response of g^* to a change in the wedge, holding the entry cost fixed, is

$$\frac{\partial g^*}{\partial \Lambda} = 1 + \frac{\alpha(1-\theta)}{\theta\beta(1+\eta_r i)} \frac{\mathcal{Q} - \mathcal{P}}{\mathcal{Q}^2}, \qquad \mathcal{Q} - \mathcal{P} = \frac{(1-\alpha)(1-\theta)}{\theta\beta(1+\eta_r i)} - \phi. \tag{B1}$$

It is positive whenever $\mathcal{Q} - \mathcal{P} \geq 0$, i.e., whenever $\frac{(1-\alpha)(1-\theta)}{\theta\beta(1+\eta_r i)} \geq \phi$. Next, we present the proof of Proposition 2

Proof of Proposition 2. The rate i affects g^* only through Λ and through the entry cost $\beta(1 + \eta_r i)$, so by the chain rule, $\partial g^*/\partial i = (\partial g^*/\partial \Lambda)(\partial \Lambda/\partial i) + (\partial g^*/\partial i)|_\Lambda$, where the last

term holds Λ fixed. Equation (28) follows by differentiating equation (A10) with respect to Λ and using $\partial\mathcal{P}/\partial\Lambda = \partial\mathcal{Q}/\partial\Lambda = 1$, so that $\partial(\mathcal{P}/\mathcal{Q})/\partial\Lambda = (\mathcal{Q}-\mathcal{P})/\mathcal{Q}^2$. For the term at fixed Λ, only the leading coefficient $\frac{\alpha(1-\theta)}{\theta\beta(1+\eta_r i)}$ and the first term of $\mathcal{Q}$ depend on the entry cost. First, we write $g^* - (\Lambda - \rho) = \frac{\alpha(1-\theta)}{\theta}\frac{\mathcal{P}}{\beta(1+\eta_r i)\,\mathcal{Q}}$ and differentiate it with respect to $\beta(1+\eta_r i)$. The derivative of $\beta(1+\eta_r i)\,\mathcal{Q}$ with respect to $\beta(1+\eta_r i)$ (at fixed Λ) equals $\mathcal{Q} - \frac{(1-\alpha)(1-\theta)}{\theta\beta(1+\eta_r i)} = -\rho + \Lambda = \mathcal{P} - \phi$. This expression gives the entry-cost channel after multiplying it by $\partial[\beta(1+\eta_r i)]/\partial i = \beta\eta_r$. Finally, equation (29) is the derivative of $\Lambda = \frac{k(1+\eta_c i)}{1+k+k\eta_c i}\big(\rho + \frac{1-\theta}{\Psi}\big)$, whose two terms collect the dependence through $k(1+\eta_c i)$ and through $\Psi = \beta(1+\eta_r i)\theta^2$. □

The usefulness of the decomposition in equation (27) is that it generalizes our model to previous results as special cases. This is summarized in the Corollary below.

Corollary 1. *The growth effect in equation* (27) *satisfies:*

(a) No spirit of capitalism, no entry cash-in-advance *($k = 0$, $\eta_r = 0$, $\eta_c > 0$):* $\partial g^*/\partial i = 0$ *exactly.*

(b) Consumption cash-in-advance only *($\eta_r = 0$, $k > 0$, $\eta_c > 0$):*

$$\frac{\partial g^*}{\partial i} = \frac{\partial g^*}{\partial \Lambda}\,\frac{\big(\rho + \frac{1-\theta}{\Psi}\big)k\eta_c}{(1+k+k\eta_c i)^2},$$

which is positive whenever $\partial g^*/\partial\Lambda > 0$.

(c) Entry cash-in-advance only, no spirit of capitalism *($k = 0$, $\eta_r > 0$):*

$$\frac{\partial g^*}{\partial i} = \beta\eta_r\,\frac{\alpha(1-\theta)}{\theta}\,\frac{\rho(\phi-\rho)}{[\beta(1+\eta_r i)]^2\,\mathcal{Q}^2}, \qquad \operatorname{sign}\Big(\frac{\partial g^*}{\partial i}\Big) = \operatorname{sign}(\phi-\rho).$$

Proof. All three follow from equation (27). In (a), $k = 0$ gives $\Lambda \equiv 0$ and $\partial\Lambda/\partial i = 0$ (both terms of equation (29) carry k), while $\eta_r = 0$ removes the entry-cost channel and both channels vanish. In (b), $\eta_r = 0$ removes the entry-cost channel, and the second term of $\partial\Lambda/\partial i$ in equation (29) vanishes, leaving the stated expression. In (c), $k = 0$ gives $\partial\Lambda/\partial i = 0$ so the wedge channel vanishes, and $\Lambda = 0$ makes $\mathcal{P} = \phi - \rho$ and $\mathcal{P} - \phi = -\rho$; the entry-cost channel then equals $-\beta\eta_r\frac{\alpha(1-\theta)}{\theta}\frac{(\phi-\rho)(-\rho)}{[\beta(1+\eta_r i)]^2\mathcal{Q}^2} = +\beta\eta_r\frac{\alpha(1-\theta)}{\theta}\frac{\rho(\phi-\rho)}{[\beta(1+\eta_r i)]^2\mathcal{Q}^2}$. □

Proof of Proposition 3. Under (i) and (iii) the spirit of capitalism wedge channel $(\partial g^*/\partial\Lambda)(\partial\Lambda/\partial i) \le 0$ is nonpositive. Under (ii), $\mathcal{P} - \phi = \Lambda - \rho \ge 0$ and $\mathcal{P} > 0$, so the bracketed term in the entry-cost channel of Equation (27) is non-negative and, entering with a minus sign, makes that channel non-positive. It is zero when $\Lambda = \rho$. Since at least one of (ii)–(iii) holds strictly, at least one channel is strictly negative, and hence $\partial g^*/\partial i < 0$. In the entry regime ($\eta_c = 0$), (iii) holds strictly and automatically, so $\Lambda \ge \rho$ alone suffices. The equivalence in (ii) follows from $\Lambda = \frac{k(1+\eta_c i)}{1+k+k\eta_c i}\big(\rho + \frac{1-\theta}{\Psi}\big) \ge \rho \iff \frac{k(1+\eta_c i)}{1+k+k\eta_c i} \ge \frac{\rho}{\rho+(1-\theta)/\Psi} \iff k(1+\eta_c i) \ge \frac{\rho\Psi}{1-\theta}$.

□

C Effects of monetary policy on social welfare

Proof of Proposition 4. $\partial U/\partial i = \frac{1}{\rho} W_{\text{static}} + \frac{1+k}{\rho^2} \partial g^*/\partial i$. In case (a), both terms are non-positive (the second strictly, since $\partial g^*/\partial i < 0$ under a strong spirit of capitalism), so the sum is negative. In case (b), $\partial U/\partial i \leq 0$ is equivalent, after multiplying by $\rho^2 > 0$ and rearranging, to equation (40). □

Online Appendix

D Data and Empirical Results

This appendix provides further support for the main results presented in Section 3. For the main sample, we use unbalanced panel data for 81 countries, for the period 1981–2014. The data are averaged based on the available observations for each of the variables in accordance with the six waves provided by the World Values Survey (WVS). Whenever there is only one observation per wave, this observation is taken as the representative data point for the respective variable, country, and wave. There is a gap in the data collection process of the proxy for absolute wealth preferences for the period 1985 - 1989. Table 17 provides an overview of the countries and the presence of data for each country-wave data point.

The task of obtaining data for wealth preferences is challenging, and availability of such data is limited. The WVS started collecting data since 1981, and it is a collective effort across many countries to measure people's values and perceptions on different issues. It consists of nationally representative surveys that use a common questionnaire. The samples in each country (and over time) differ both in size and in their composition due to the varying characteristics of each country. The samples are representative of all people aged 18 or older and the sampling method is either full probability or a combination of full probability and stratified, depending on each country. The variable that measures wealth preferences is constructed following Pan, Zhang and Zou (2018) and Chu, Fan and Wang (2020) by using as a proxy the share of respondents that select *thrift saving money and things* as important in the WVS aggregated to the national level, for each country-wave. This measure is a percentage that represents the fraction of individuals who regard wealth as important, and its range lies in [0, 1]. The data on all other variables are collected from the Penn world table (version 10.01) and the World Bank database. The accompanying results of Figure 1 from the main text are presented in Table 11.

Potential endogeneity problems persist, which might stem from the fact that wealth preferences are derived from a combination of dummy variables and that inflation may be endogenous to economic growth. To address these concerns, we follow Guiso, Sapienza and Zingales (2006) in instrumenting the k_{it} variable with dummies of religious denominations for each country, while inflation is instrumented using the predetermined weighted central bank independence index of Garriga (2016). The latter is measured in the year preceding each survey wave. The religious dummy variables consist of the following denominations: Catholic, Protestant, Orthodox, Jewish, Muslim, Hindu, Buddhist, and other affiliations. The data for these instrumental variables are retrieved from the WVS. The value of these dummy variables is equal to 1 if the percentage of people belonging to this denomination is highest relative to other denominations in the respective country.

We omit other affiliations. Since both inflation and wealth preferences are treated as endogenous, we additionally instrument their interaction using interactions between predetermined central bank independence and the religious denomination indicators.[4] The results are presented in Table 12 and the accompanying marginal effects in Figure 8. At the bottom of Table 12, identification diagnostics are provided. Although the estimated interaction remains negative across specifications, the identification diagnostics suggest potential weak-instrument problems, and the underidentification tests do not reject their null hypothesis. Moreover, the exclusion restrictions cannot be established conclusively. We therefore interpret these findings as suggestive evidence of the robustness of the observed relationship, without making causal claims.

The definition of the wealth-preferences variable leaves it vulnerable to measurement error, as wealthier people tend to exclude themselves from participation in such questionnaires. Thus, whether the proxy used for wealth preferences captures the true meaning of the variable, remains an issue. Pan, Zhang and Zou (2018) provide an alternative proxy, which is the averaged fraction of respondents who agree or even strongly agree with the view: *people who don't work turn lazy in each country*. One issue with the use of this proxy is that the previous question is addressed only in waves 4 and 5 such that less data are available, which might affect the quality of the obtained results. We present these results in Table 13 and the accompanying marginal effects in Figure 9.

Finally, we provide three additional robustness exercises that provide a cross-country analysis of the effect and exploit the heterogeneity of the sample (developed and developing countries). The data is averaged for each country across the entire sample period. The results of this exercise and the accompanying marginal effects are presented in Table 14 and Figure 10, respectively. The sample is heterogeneous as it includes both developed and developing countries and covers a wide geographical area. This heterogeneity is addressed further by dividing the main sample into high and below-and-middle income countries, in accordance with the World Bank classification, and examining the sensitivity of the main results for each of these sub-samples. The results are presented in Tables 15 - 16 and the accompanying marginal effects in Figures 11 and 12.

[4]We also consider alternative predetermined central bank independence indices, including unweighted and extended measures, as well as a specification in which only wealth preferences and their interaction with inflation are instrumented. Although the results vary in magnitude and statistical significance, the main qualitative conclusions remain unchanged. The detailed first-stage regression results and additional robustness checks are available upon request.

Table 11: Status Preference, Inflation, and Economic Growth

	(1) GDP growth	(2) GDP growth	(3) GDP p.c. growth	(4) GDP p.c. growth
Wealth preference (SoC)	0.699*	0.716**	0.647*	0.579**
	(0.363)	(0.331)	(0.358)	(0.280)
Inflation	0.145	0.141	0.139	0.111
	(0.122)	(0.113)	(0.118)	(0.089)
Wealth preference (SoC) × Inflation	-0.700*	-0.713**	-0.646*	-0.588**
	(0.361)	(0.330)	(0.357)	(0.281)
Controls	No	Yes	No	Yes
Country FE	Yes	Yes	Yes	Yes
Wave FE	Yes	Yes	Yes	Yes
Observations	177	168	167	158
Countries	81	75	81	75
Within R^2	0.158	0.176	0.137	0.213

Notes: This table reports the relationship between inflation and economic growth in the presence of wealth preference (SoC). In Columns 1 and 2, the dependent variable is GDP growth. In Columns 3 and 4, the dependent variable is GDP growth per capita. Columns 1 and 2 and Columns 3 and 4 include two-way fixed effects and the following control variables: degree of openness, government consumption share of GDP and a human capital index, respectively. The marginal association reported in Figure 1 depicts the $\beta_2 + \delta k_{it}$ parameter. Standard errors, clustered at the country level, are reported in parentheses. ***, **, * denote that estimates are statistically significant at the 1%, 5%, and 10% levels, respectively.

Table 12: Instrumental-Variables Estimates

	(1) GDP growth	(2) GDP growth	(3) GDP p.c. growth	(4) GDP p.c. growth
Wealth preference (SoC)	1.783*	2.319*	1.389	1.521
	(1.010)	(1.218)	(0.928)	(1.156)
Inflation	0.572	0.767*	0.371	0.382
	(0.361)	(0.450)	(0.357)	(0.443)
Wealth preference (SoC) × Inflation	-1.711*	-2.270*	-1.297	-1.460
	(0.969)	(1.179)	(0.893)	(1.125)
Controls	No	Yes	No	Yes
Country FE	No	No	No	No
Wave FE	Yes	Yes	Yes	Yes
Observations	165	161	155	151
Kleibergen–Paap Wald F	8.64	4.92	8.98	3.75
Underidentification p-value	0.310	0.225	0.517	0.293
Hansen J p-value	0.259	0.269	0.251	0.269

Notes: This table reports the relationship between inflation and economic growth in the presence of wealth preference (SoC). We estimate a 2SLS regression, instrumenting inflation using the predetermined weighted Garriga central bank independence index and status-seeking using religious affiliation indicators motivated by Guiso, Sapienza and Zingales (2006): Catholic, Protestant, Orthodox, Jewish, Muslim, Hindu, Buddhist, and other affiliations. We omit other affiliations. The interaction between inflation and wealth preference is instrumented using interactions between predetermined central bank independence and Catholic, Protestant, Orthodox, Muslim, and Buddhist affiliations. In Columns 1 and 2, the dependent variable is GDP growth. In Columns 3 and 4, the dependent variable is GDP growth per capita. Columns (1-4) include only wave fixed effects and the following control variables: degree of openness, government consumption share of GDP and a human capital index, in columns 2 and 4, respectively. The marginal association reported in Figure 8 depicts the $\beta_2 + \delta k_{it}$ parameter. The identification diagnostics indicate potential weak-identification concerns. Standard errors, clustered at the country level, are reported in parentheses. ***, **, * denote that estimates are statistically significant at the 1%, 5%, and 10% levels, respectively.

Table 13: Alternative Measure of Status Preference

	(1) GDP growth	(2) GDP growth	(3) GDP p.c. growth	(4) GDP p.c. growth
Alternative wealth preference	2.620	2.524	2.730	2.718
	(2.404)	(2.647)	(2.395)	(2.591)
Inflation	-0.514	-0.528	-0.564	-0.624
	(0.874)	(1.000)	(0.873)	(0.980)
Alternative wealth preference × Inflation	-2.489	-2.397	-2.592	-2.591
	(2.373)	(2.636)	(2.364)	(2.581)
Controls	No	Yes	No	Yes
Country FE	Yes	Yes	Yes	Yes
Wave FE	Yes	Yes	Yes	Yes
Observations	72	68	72	68
Countries	57	53	57	53
Within R^2	0.632	0.704	0.618	0.696

Notes: This table reports the relationship between inflation and economic growth in the presence of wealth preference (SoC). In Columns 1 and 2, the dependent variable is GDP growth. In Columns 3 and 4, the dependent variable is GDP growth per capita. Columns 1 and 2 and Columns 3 and 4 include two-way fixed effects and the following control variables: degree of openness, government consumption share of GDP and a human capital index, respectively. Wealth preference is measured with an alternative proxy, which is the average fraction of respondents who strongly agree or agree with the view: people who don't work turn lazy in each country. The marginal association reported in Figure 9 depicts the $\beta_2 + \delta k_{it}$ parameter. Standard errors, clustered at the country level, are reported in parentheses. ***, **, * denote that estimates are statistically significant at the 1%, 5%, and 10% levels, respectively.

Table 14: Cross-Country Robustness

	(1) GDP growth	(2) GDP growth	(3) GDP p.c. growth	(4) GDP p.c. growth
Inflation	0.426***	0.404*	0.466***	0.268
	(0.121)	(0.224)	(0.156)	(0.216)
Wealth preference (SoC)	1.047***	1.006*	1.165***	0.594
	(0.269)	(0.572)	(0.420)	(0.585)
Wealth preference (SoC) × Inflation	-1.034***	-0.997*	-1.130***	-0.571
	(0.259)	(0.563)	(0.412)	(0.578)
Controls	No	Yes	No	Yes
Countries	81	75	81	75
R^2	0.125	0.304	0.155	0.120

Notes: This table reports the relationship between inflation and economic growth in the presence of wealth preference (SoC), averages across countries. In Columns 1 and 2, the dependent variable is GDP growth. In Columns 3 and 4, the dependent variable is GDP growth per capita. Columns 2 and 4 include the following control variables: degree of openness, government consumption share of GDP and a human capital index, respectively. The marginal association reported in Figure 10 depicts the $\beta_2 + \delta k_{it}$ parameter. Heteroskedasticity-robust standard errors are reported in parentheses. ***, **, * denote that estimates are statistically significant at the 1%, 5%, and 10% levels, respectively.

Table 15: Developed Countries

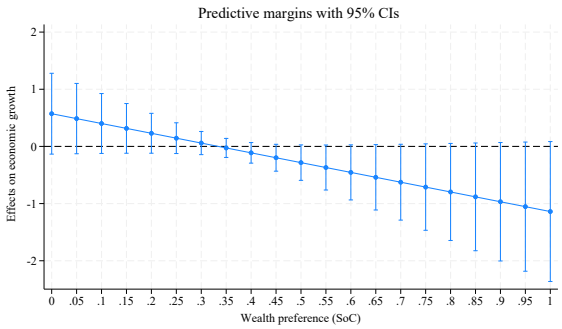
	(1) GDP growth	(2) GDP growth	(3) GDP p.c. growth	(4) GDP p.c. growth
Inflation	0.816*	0.794**	0.929**	0.809***
	(0.405)	(0.322)	(0.373)	(0.279)
Wealth preference (SoC)	1.616	1.458	1.786	1.387
	(1.255)	(1.003)	(1.189)	(0.892)
Wealth preference (SoC) × Inflation	-1.644	-1.505	-1.824	-1.448
	(1.242)	(0.988)	(1.175)	(0.875)
Controls	No	Yes	No	Yes
Country FE	Yes	Yes	Yes	Yes
Wave FE	Yes	Yes	Yes	Yes
Observations	80	78	76	74
Countries	36	35	36	35
Within R^2	0.261	0.301	0.321	0.364

Notes: This table reports the relationship between inflation and economic growth in the presence of wealth preference (SoC) for the developed countries in the sample. In Columns 1 and 2, the dependent variable is GDP growth. In Columns 3 and 4, the dependent variable is GDP growth per capita. Columns 1 and 2 and Columns 3 and 4 include two-way fixed effects and the following control variables: degree of openness, government consumption share of GDP and a human capital index, respectively. The marginal association reported in Figure 11 depicts the $\beta_2 + \delta k_{it}$ parameter. Standard errors, clustered at the country level, are reported in parentheses. ***, **, * denote that estimates are statistically significant at the 1%, 5%, and 10% levels, respectively.

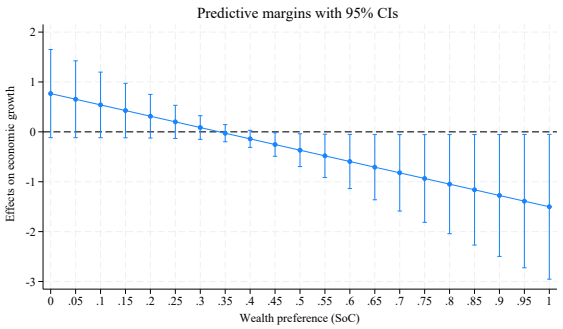
Table 16: Developing Countries

	(1) GDP growth	(2) GDP growth	(3) GDP p.c. growth	(4) GDP p.c. growth
Inflation	0.087	0.076	0.066	0.048
	(0.054)	(0.054)	(0.043)	(0.042)
Wealth preference (SoC)	0.581***	0.499**	0.510***	0.377**
	(0.174)	(0.189)	(0.133)	(0.160)
Wealth preference (SoC) × Inflation	-0.585***	-0.461**	-0.505***	-0.340**
	(0.171)	(0.178)	(0.136)	(0.153)
Controls	No	Yes	No	Yes
Country FE	Yes	Yes	Yes	Yes
Wave FE	Yes	Yes	Yes	Yes
Observations	97	90	91	84
Countries	45	40	45	40
Within R^2	0.450	0.525	0.452	0.524

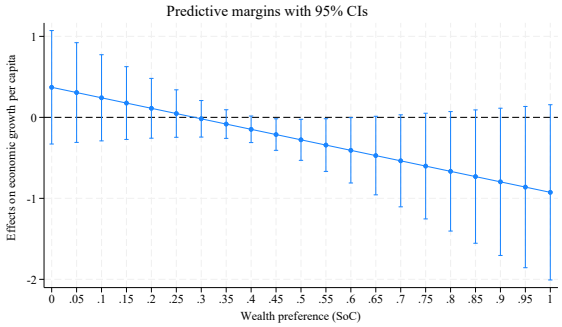
Notes: This table reports the relationship between inflation and economic growth in the presence of wealth preference (SoC) for the developing countries in the sample. In Columns 1 and 2, the dependent variable is GDP growth. In Columns 3 and 4, the dependent variable is GDP growth per capita. Columns 1 and 2 and Columns 3 and 4 include two-way fixed effects and the following control variables: degree of openness, government consumption share of GDP and a human capital index, respectively. The marginal association reported in Figure 12 depicts the $\beta_2 + \delta k_{it}$ parameter. Standard errors, clustered at the country level, are reported in parentheses. ***, **, * denote that estimates are statistically significant at the 1%, 5%, and 10% levels, respectively.



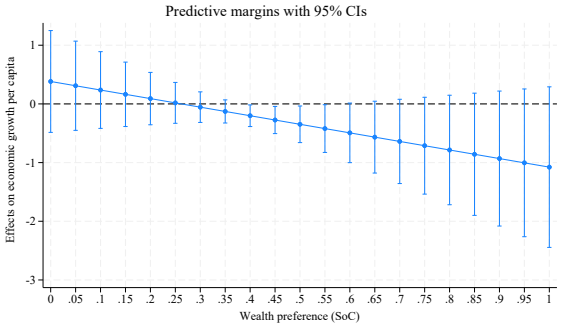
(a) Real GDP growth-baseline



(b) Real GDP growth - with controls

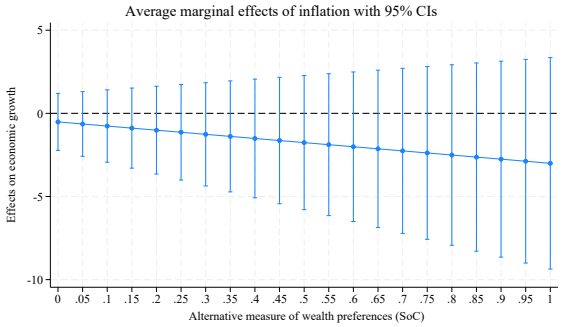


(c) Real GDP growth per capita - baseline

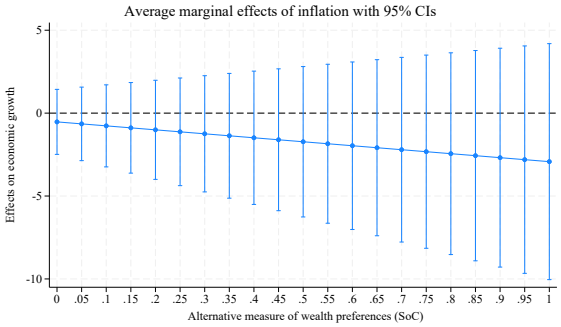


(d) Real GDP growth per capita - with controls

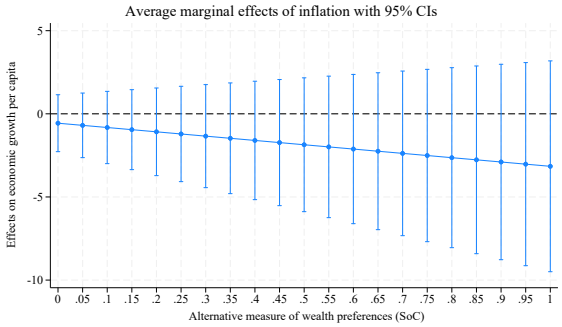
Figure 8: Association between inflation and economic growth across levels of the spirit of capitalism - IV regressions



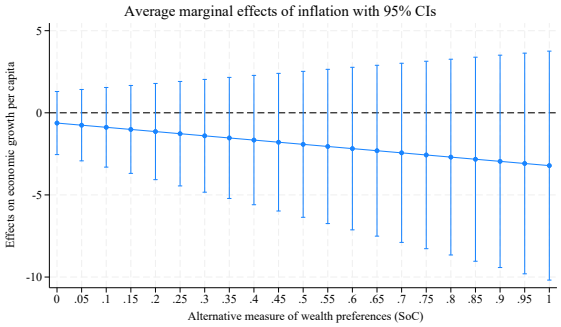
(a) Real GDP growth-baseline



(b) Real GDP growth - with controls

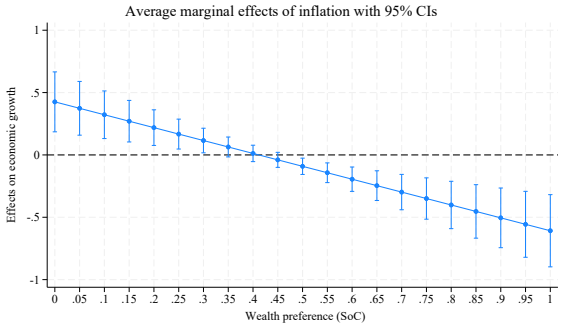


(c) Real GDP growth per capita - baseline

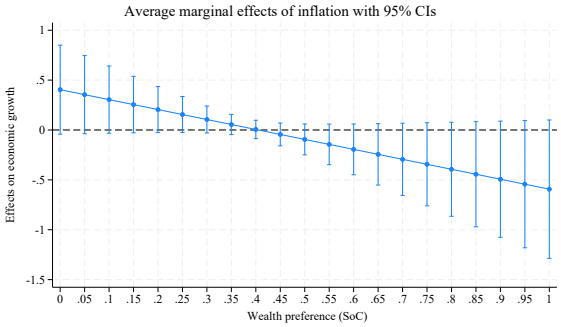


(d) Real GDP growth per capita - with controls

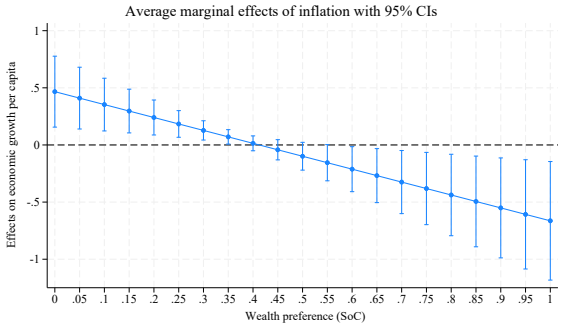
Figure 9: Association between inflation and economic growth across levels of spirit of capitalism - alternative measure of the effect



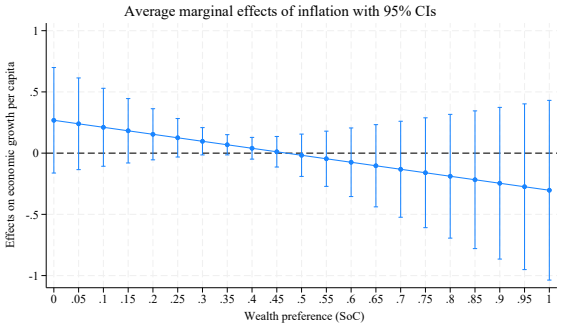
(a) Real GDP growth-baseline



(b) Real GDP growth - with controls

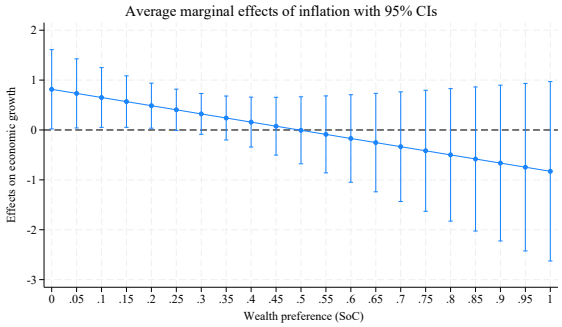


(c) Real GDP growth per capita - baseline

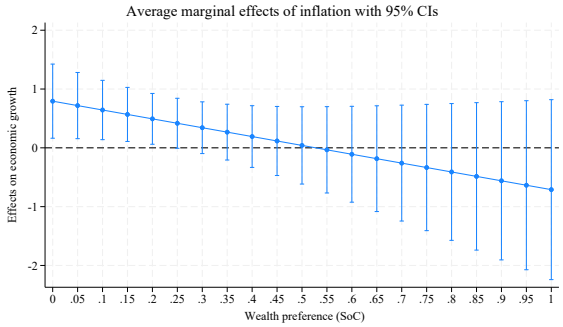


(d) Real GDP growth per capita - with controls

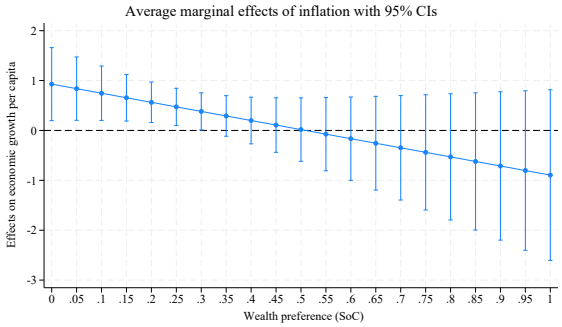
Figure 10: Association between inflation and economic growth across levels of the spirit of capitalism - cross-country analysis



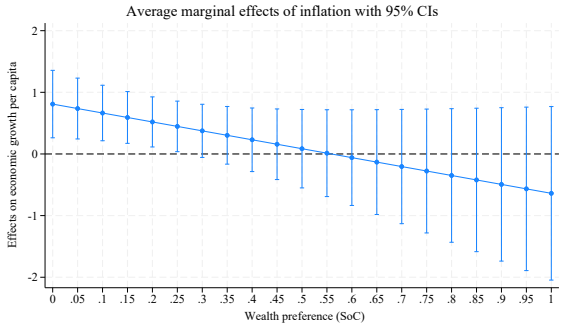
(a) Real GDP growth-baseline



(b) Real GDP growth - with controls

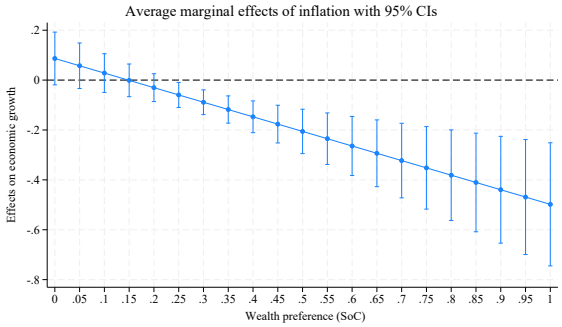


(c) Real GDP growth per capita - baseline

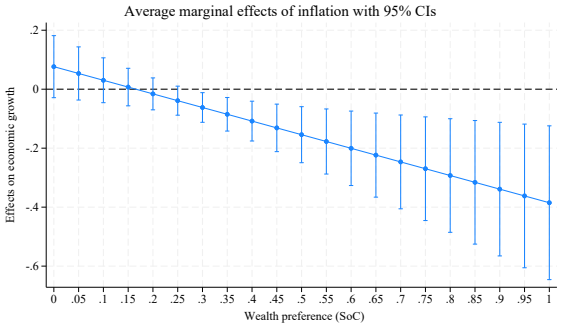


(d) Real GDP growth per capita - with controls

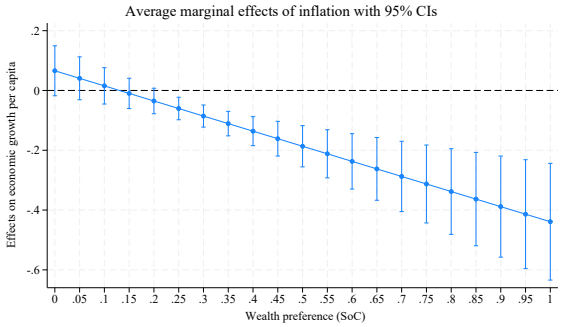
Figure 11: Association between inflation and economic growth across levels of the spirit of capitalism - developed countries



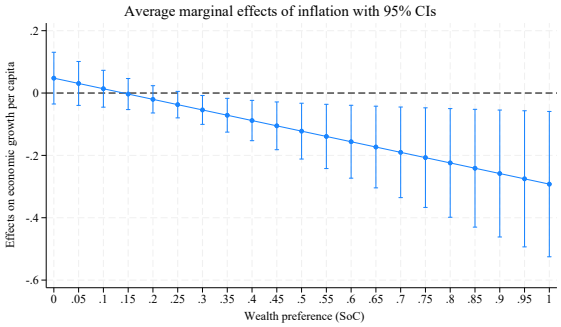
(a) Real GDP growth-baseline



(b) Real GDP growth - with controls



(c) Real GDP growth per capita - baseline



(d) Real GDP growth per capita - with controls

Figure 12: Association between inflation and economic growth across levels of spirit of capitalism - developing countries

Table 17: List of countries and respective waves

country	1981-1984	1990-1994	1995-1998	1999-2004	2005-2009	2010-2014
Albania			x	x		
Argentina	x	x	x	x	x	x
Armenia			x			x
Australia	x		x		x	
Azerbeijan			x			x
Burkina Faso					x	
Bangladesh			x	x		
Bulgaria			x		x	
Bosnia & Herzegovina				x		
Belarus		x	x			x
Brazil		x	x		x	x
Canada				x	x	
Switzerland		x	x		x	
Chile		x	x	x	x	x
China		x	x	x	x	x
Colombia			x		x	x
Cyprus					x	x
Czech Rep.		x	x			
Dominican Rep.			x			
Algeria				x		x
Egypt				x	x	x
Spain		x	x	x	x	
Estonia			x			x
Ethiopia					x	
Finland	x		x		x	
France					x	
UK			x		x	
Georgia			x		x	x
Germany			x		x	x
Ghana					x	
Guatemala					x	
Croatia			x			
Hungary	x		x		x	
Indonesia				x	x	
India		x	x	x	x	x
Iran				x	x	
Iraq				x	x	x
Israel				x		
Italy					x	
Jordan				x	x	x
Japan	x	x	x	x	x	x
Kyrgyzstan				x		x
Lithuania			x			
Latvia			x			
Morocco				x	x	x
Moldova			x	x	x	
Mexico	x	x	x	x	x	x
Mali					x	
Montenegro			x	x		
Malaysia					x	x
Nigeria		x	x	x		x
Netherlands					x	x
Norway			x		x	
New Zealand			x		x	
Pakistan			x	x		x
Peru			x	x	x	x
Philippines			x	x		x
Poland		x	x		x	x
Puerto Rico			x	x		
Romania			x		x	x
Russia		x	x		x	x
Rwanda					x	x
Saudi Arabia				x		
Singapore				x		x
El Salvador			x			
Serbia			x	x	x	
Slovakia		x	x			
Slovenia			x		x	x
Sweden	x		x		x	x
Thailand					x	x
Trinidad & Tobago					x	x
Turkiye		x	x	x	x	x
Taiwan			x		x	x
Uganda				x		
Ukraine			x		x	x
Uruguay			x		x	x
United States	x		x	x	x	x
Vietnam				x	x	
South Africa	x	x	x	x	x	x
Zambia					x	
Zimbabwe				x		x

E Household's Dynamic Optimization

The optimization problem in Subsection 4.1 in the main text is solved by defining the following current-value Hamiltonian function

$$\begin{aligned} J_t = & \ln C_t + k \ln A_t + \gamma \ln(L - l_t) \\ & + \lambda_t \left[r_t A_t + w_t l_t + i_t B_t - C_t - \pi_t M_t + \tau_t \right] \\ & + \upsilon_t \left[M_t - \eta_c C_t - B_t \right], \end{aligned} \tag{B1}$$

where the co-state variables are denoted by λ_t and υ_t. The Arrow condition is sufficient for the first-order conditions to be a solution of this problem subject to equation (2), the Cash-in-Advance constraint, and the initial conditions ($A_0 > 0$ and $M_0 > 0$). Using Pontryagin's maximum principle, Equation B1 yields the following first-order conditions

$$\frac{\partial J_t}{\partial C_t} = 0 \ \Rightarrow \frac{1}{C_t} = \lambda_t + \eta_c \upsilon_t, \tag{B2}$$

$$\frac{\partial J_t}{\partial l_t} = 0 \ \Rightarrow \lambda_t w_t = \gamma \frac{1}{L - l_t}, \tag{B3}$$

$$\frac{\partial J_t}{\partial B_t} = 0 \ \Rightarrow \lambda_t i_t = \upsilon_t, \tag{B4}$$

$$\rho \lambda_t - \dot{\lambda}_t = \frac{\partial J_t}{\partial A_t} \ \Rightarrow \rho \lambda_t - \dot{\lambda}_t = k \frac{1}{A_t} + \lambda_t r_t, \tag{B5}$$

$$\rho \lambda_t - \dot{\lambda}_t = \frac{\partial J_t}{\partial M_t} \ \Rightarrow \rho \lambda_t - \dot{\lambda}_t = -\lambda_t \pi_t + \upsilon_t. \tag{B6}$$

Substituting equation (B4) into (B2) yields

$$\frac{1}{C_t} = (1 + \eta_c i_t) \lambda_t. \tag{B7}$$

Dividing both sides of equation (B5) by λ_t and substituting equation (B7) yields

$$-\frac{\dot{\lambda}_t}{\lambda_t} = r_t - \rho + k \frac{(1 + \eta_c i_t) C_t}{A_t}. \tag{B8}$$

In the presence of a constant nominal interest rate ($i_t = i$), log-differentiating equation (B7) with respect to time yields $-\frac{\dot{\lambda}_t}{\lambda_t} = \frac{\dot{C}_t}{C_t}$. Therefore, equation (B8) becomes the consumption Euler equation, which is presented in equation (7) in the main text. In addition, the Fisher equation in the presence of the spirit of capitalism is $r_t = i_t - \pi_t - k(1 + \eta_c i_t) C_t / A_t$.

F Incumbent firms' dynamic optimization problem

The current-value Hamiltonian for incumbent firm j in the intermediate goods sector is

$$J_t(j) = \Pi_t(j) + \chi_t(j)\dot{Z}_t(j), \tag{C1}$$

where the j-th firm chooses the quantity of intermediate goods supplied and the degree of investment for in-house R&D. The first-order conditions of this optimization problem are

$$\frac{\partial J_t(j)}{\partial X_t(j)} = 0 \;\Rightarrow \frac{\partial \Pi_t(j)}{\partial p_t(j)} = 0, \tag{C2}$$

$$\frac{\partial J_t(j)}{\partial R_t(j)} = 0 \;\Rightarrow \chi_t(j) = 1, \tag{C3}$$

$$r_t\chi_t(j) - \dot{\chi}_t(j) = \frac{\partial J_t(j)}{\partial Z_t(j)}. \tag{C4}$$

From equation (C2), the equilibrium price is

$$p_t(j) = \frac{1}{\theta}, \tag{C5}$$

and solving equation (C4) yields

$$r_t\chi_t(j) - \dot{\chi}_t(j) = \alpha\theta(1-\theta)\frac{[Z_t^{\alpha}(j)Z_t^{1-\alpha}\frac{l_t}{N_t}]^{1-\theta}X_t^{\theta}(j)}{Z_t(j)}. \tag{C6}$$

Substituting equations (C3) and (C5) in equation (C6) and imposing the symmetric equilibrium condition yields the return to in-house R&D

$$r_t^I = \alpha(1-\theta)\theta^{\frac{1+\theta}{1-\theta}}\frac{l_t}{N_t}. \tag{C7}$$

G Further robustness checks

G.1 Exogenous entry of firms through population growth

We allow for population growth, $L_t = L_0e^{nt}$, where $n \geq 0$. For maximal conceptual clarity, we keep the extension as close as possible to the original model. This implies that we continue to work with aggregate variables and explicitly account for population growth. Preferences are dynastic,

$$U = \int_0^{\infty} e^{-\rho t}L_t\left[\ln(C_t/L_t) + k\ln(A_t/L_t) + \gamma\ln(1-l_t/L_t)\right]\,dt, \tag{G1}$$

where $\rho > n$. The household maximizes equation (G1) subject to the same budget

constraint in equation (2) and cash-in-advance constraints on consumption and market-entry financing in equation (3). The modified Fisher equation remains exactly the same, while the Euler equation becomes

$$\frac{\dot{C}_t}{C_t} - n = r_t - \rho + k\frac{(1+\eta_c i)C_t}{A_t}. \tag{G2}$$

Nothing changes substantially on the production side. Under symmetry, the aggregate production function remains

$$Y_t = \theta^{\frac{2\theta}{1-\theta}} Z_t l_t. \tag{G3}$$

Equilibrium labor in equation (19) survives exactly, except L is now growing. This implies that labor dynamics becomes

$$\frac{\dot{l}_t}{l_t} = n - \frac{L_t - l_t}{L_t}\left(\frac{\dot{C}_t}{C_t} - \frac{\dot{Y}_t}{Y_t}\right). \tag{G4}$$

The return to in-house R&D remains the same in equilibrium. As such, equation (21) which denotes the equilibrium growth rate of aggregate quality, remains unchanged, except L is replaced with L_t. This happens because the population growth parameter in aggregate consumption growth is canceled with the same parameter appearing in aggregate employment growth.

The two-dimensional system of this economy can therefore be written as

$$\frac{\dot{C}_t}{C_t} - \frac{\dot{Y}_t}{Y_t} = n + \frac{1}{\Psi}\left[(1+k+k\eta_c i)\frac{C_t}{Y_t} - (1-\theta) - \frac{\Psi\eta_r i}{(1+\eta_r i)}\frac{\dot{N}_t}{N_t}\right] - \rho, \tag{G5}$$

$$\frac{\dot{N}_t}{N_t} = \frac{1}{\beta(1+\eta_r i)}\left[\frac{1-\theta}{\theta} - \left(\phi + \frac{\dot{Z}_t}{Z_t}\right)\theta^{-\frac{2}{1-\theta}}\frac{N_t}{l_t}\right] - \rho + \frac{k(1+\eta_c i)}{\Psi}\frac{C_t}{Y_t} + n - \left(\frac{\dot{C}_t}{C_t} - \frac{\dot{Y}_t}{Y_t}\right). \tag{G6}$$

The main conceptual difference with respect to the model in Section 4 is that L_t grows. We define the modified stationary variable N_t/L_t. Then $\frac{d}{dt}\ln(N_t/L_t) = \frac{\dot{N}_t}{N_t} - n$. Now, we can rewrite these expressions in the transformed notation used in Appendix A. The first expression can be written as

$$\frac{\dot{C}_t}{C_t} - \frac{\dot{Y}_t}{Y_t} = \mathcal{A}_0 + (1-\omega)n - \omega\frac{d}{dt}\ln(N_t/L_t), \tag{G7}$$

where $\mathcal{A}_0$ remains exactly as defined in Appendix A. The second expression becomes

$$\frac{d}{dt}\ln(N_t/L_t) = \mathrm{B}_0 + \mathrm{B}_1\left(\frac{\dot{C}_t}{C_t} - \frac{\dot{Y}_t}{Y_t}\right), \tag{G8}$$

where again B_0 and B_1 retain the exact form as in Appendix A. The counterpart of Proposition 1 and the proof in Appendix A hold here as well. The steady-state value of the consumption-to-output ratio is

$$\left(\frac{C}{Y}\right)^* = \frac{\beta(1+\eta_r i)\theta^2\rho + (1-\theta) - \beta\theta^2 n}{1+k+k\eta_c i}. \tag{G9}$$

Setting $n = 0$ recovers equation (24). Equations (25) and (26) remain identical as in Section 4, except that the interpretation is now changed to per-capita growth output. The equivalent decomposition expression to equation (30) in this economy is

$$\frac{\partial g^*}{\partial i} = \underbrace{\underbrace{\frac{\partial g^*}{\partial \Lambda}\left[\left(\rho + \frac{1-\theta-\beta\theta^2 n}{\Psi}\right)\frac{k\eta_c}{(1+k+k\eta_c i)^2}\right]}_{\text{consumption-CIA wedge channel}} - \underbrace{\frac{\partial g^*}{\partial \Lambda}\left[\frac{k(1+\eta_c i)}{1+k+k\eta_c i}\frac{(1-\theta-\beta\theta^2 n)\beta\eta_r\theta^2}{\Psi^2}\right]}_{\text{entry-CIA wedge channel}}}_{\text{SoC wedge channel}}$$

$$- \underbrace{\beta\eta_r \frac{\alpha(1-\theta)}{\theta}\frac{P(P-\phi)}{[\beta(1+\eta_r i)]^2 Q^2}}_{\text{direct entry-cost channel}}.$$

So P, Q, $\partial g^*/\partial\Lambda$ and the direct entry-cost channel keep exactly the same functional form as in the original model. Population growth enters through the two components of the spirit of capitalism wedge. The consumption cash-in-advance wedge channel remains positive because an interior balanced growth path requires $\rho + \frac{1-\theta-\beta\theta^2 n}{\Psi} > 0$. The second channel has $-\text{sign}(1-\theta-\beta\theta^2 n)$. Hence, when $n < \frac{1-\theta}{\beta\theta^2}$, the entry cash-in-advance wedge channel is negative.

At the calibrated parameters, the bound on n is $(1-\theta)/(\beta\theta^2) = 0.77$. With $n = 0.01$ and the benchmark parameters held fixed, $1-\theta-\beta\theta^2 n$ is 1.3 percent below $1-\theta$, $\Lambda = 0.0395$, and $\partial g^*/\partial i = -0.0110$. The spirit of capitalism wedge channel contributes -0.0110 and the entry-cost channel $+0.00001$. The Friedman rule remains optimal. Recalibrating to the same five moments, with growth measured per capita, gives $\Lambda = \rho$ exactly and $\partial g^*/\partial i = -0.0111$. With $\dot{N}_t > 0$ on the balanced growth path, entry borrowing is positive and the cash-in-advance constraint gives $M_t/C_t = \eta_c + B_t/C_t$. At $n = 0.01$, B_t/C_t is about 0.006, which leaves the calibration of η_c unaffected at two decimals.

G.2 Exogenous exit of firms

We extend our model by including a constant Poisson death hazard for each incumbent ($\zeta > 0$), with zero salvage value. With a continuum of firms, aggregate exits occur deterministically at flow ζN_t. Therefore

$$\underbrace{\dot{N}_t}_{\text{net change}} = \underbrace{(\dot{N}_t + \zeta N_t)}_{\text{gross entry}} - \underbrace{\zeta N_t}_{\text{gross exit}}. \tag{G10}$$

The household problem remains identical as in Subsection 4.1. Firm value has to adjust for the new property, and the modified expression is $V_t(j) = \int_t^\infty e^{-(\int_t^u (r_s+\zeta)\,ds)} \Pi_u(j)\,du$. The incumbent now solves a slightly different dynamic optimization problem than in Appendix F. The return to in-house R&D is

$$r_t + \zeta = \alpha(1-\theta)\,\theta^{\frac{1+\theta}{1-\theta}}\,\frac{l_t}{N_t}. \tag{G11}$$

The free-entry condition remains exact. However, the HJB equation has the form $r_t^e = \Pi_t/V_t + \dot{V}_t/V_t - \zeta$. To ensure internal consistency on the equilibrium path, the two conditions $B_t = \eta_r \beta X_t(\dot{N}_t + \zeta N_t)$ and $Y_t = C_t + N_t(X_t + \phi Z_t + R_t) + \beta X_t(\dot{N}_t + \zeta N_t)$ need to hold.

The aggregate production function in equation (18), the equilibrium labor condition in equation (19), and the labor dynamics remain exact. The two-dimensional system of this economy can be therefore written as

$$\frac{\dot{C}_t}{C_t} - \frac{\dot{Y}_t}{Y_t} = \frac{1}{\Psi}\left[(1+k+k\eta_c i)\frac{C_t}{Y_t} - (1-\theta) - \frac{\Psi\eta_r i}{(1+\eta_r i)}\left(\frac{\dot{N}_t}{N_t} + \zeta\right)\right] - \rho, \tag{G12}$$

$$\begin{aligned}\frac{\dot{N}_t}{N_t} = {} & \frac{1}{\beta(1+\eta_r i)}\left[\frac{1-\theta}{\theta} - \left(\phi + \frac{\dot{Z}_t}{Z_t}\right)\theta^{-\frac{2}{1-\theta}}\frac{N_t}{l_t}\right] - \rho - \zeta + \frac{k(1+\eta_c i)}{\Psi}\frac{C_t}{Y_t} \\ & - \left(\frac{\dot{C}_t}{C_t} - \frac{\dot{Y}_t}{Y_t}\right).\end{aligned} \tag{G13}$$

We can again rewrite these expressions in the transformed notation used in Appendix A. The first expression is then

$$\frac{\dot{C}_t}{C_t} - \frac{\dot{Y}_t}{Y_t} = \mathcal{A}_0 - \omega\left(\frac{\dot{N}_t}{N_t} + \zeta\right), \tag{G14}$$

where $\mathcal{A}_0$ remains exactly as defined in Appendix A. The second expression becomes

$$\frac{\dot{N}_t}{N_t} = \mathrm{B}_0 + \mathrm{B}_1\left(\frac{\dot{C}_t}{C_t} - \frac{\dot{Y}_t}{Y_t}\right), \tag{G15}$$

where

$$\mathrm{B}_0 = \frac{(1-\alpha)(1-\theta)}{\theta\beta(1+\eta_r i)} - \rho - \zeta + \frac{k(1+\eta_c i)}{\Psi}\frac{C_t}{Y_t} - \frac{\theta^{-\frac{2}{1-\theta}}}{\beta(1+\eta_r i)}\frac{N_t}{l_t}\left[\phi - \rho - \zeta + \frac{k(1+\eta_c i)}{\Psi}\frac{C_t}{Y_t}\right],$$

and B_1 retains the exact form as in Appendix A. The equilibrium remains locally saddle-path stable and determinate on the economically relevant arm $P > \zeta$ and $Q > \zeta$. Thus, Proposition 1 survives with stronger existence restrictions. The solution of this system is

$$\begin{bmatrix} \frac{d}{dt}\ln\frac{C_t}{Y_t} \\ \frac{\dot{N}_t}{N_t} \end{bmatrix} = \begin{bmatrix} \frac{\mathcal{A}_0 - \omega\mathrm{B}_0 - \omega\zeta}{1+\omega\mathrm{B}_1} \\ \frac{\mathrm{B}_0 + \mathrm{B}_1(\mathcal{A}_0 - \omega\zeta)}{1+\omega\mathrm{B}_1} \end{bmatrix}, \tag{G16}$$

where the denominator $1+\omega \mathrm{B}_1$ remains the same and strictly positive. The steady-state value of the consumption-to-output ratio is

$$\left(\frac{C}{Y}\right)^* = \frac{\beta(1+\eta_r i)\theta^2\rho + (1-\theta) + \beta\eta_r i\theta^2\zeta}{1+k+k\eta_c i}. \tag{G17}$$

Setting $\zeta = 0$ recovers equation (24). Maintaining the definitions of Λ, P, and Q throughout, the steady-state firm-to-labor ratio becomes

$$\frac{N^*}{l^*} = \beta(1+\eta_r i)\,\theta^{\frac{2}{1-\theta}}\,\frac{\mathcal{Q}-\zeta}{\mathcal{P}-\zeta}, \tag{G18}$$

and the long-run growth rate is given by

$$g^* = \frac{\alpha(1-\theta)}{\theta\,\beta(1+\eta_r i)}\,\frac{\mathcal{P}-\zeta}{\mathcal{Q}-\zeta} + \mathcal{P} - \phi - \zeta. \tag{G19}$$

Before we present the equivalent expression of the decomposition of the general effect of changes in permanent nominal interest rates on long-run growth, the expression

$$\frac{\partial g^*}{\partial \Lambda} = 1 + \frac{\alpha(1-\theta)}{\theta\beta(1+\eta_r i)}\,\frac{\mathcal{Q}-\mathcal{P}}{(\mathcal{Q}-\zeta)^2} \tag{G20}$$

changes slightly from equation (28), but the same sufficient condition for the positive effect remains. As such we can decompose the general effect into the same channels

$$\frac{\partial g^*}{\partial i} = \underbrace{\underbrace{\frac{\partial g^*}{\partial \Lambda}\left[\left(\rho + \frac{1-\theta}{\Psi} + \omega\zeta\right)\frac{k\eta_c}{(1+k+k\eta_c i)^2}\right]}_{\text{consumption-CIA wedge channel}} - \underbrace{\frac{\partial g^*}{\partial \Lambda}\left[\frac{k(1+\eta_c i)}{1+k+k\eta_c i}\frac{(1-\theta-\beta\theta^2\zeta)\beta\eta_r\theta^2}{\Psi^2}\right]}_{\text{entry-CIA wedge channel}}}_{\text{SoC wedge channel}}$$

$$\underbrace{-\,\beta\eta_r\frac{\alpha(1-\theta)}{\theta}\frac{(P-\zeta)(P-\phi-\zeta)}{[\beta(1+\eta_r i)]^2\,(Q-\zeta)^2}}_{\text{direct entry-cost channel}}.$$

Setting $\zeta = 0$ retrieves the original equation (30). For the direct-entry channel to be nonpositive, we now require the condition $\Lambda \geq \rho + \zeta$ to hold.

With all benchmark parameters held fixed, an admissible balanced growth path exists only for $\zeta < 0.017$. The exit hazard lowers the real return one for one, $r = r^I - \zeta$, and a larger hazard drives long-run growth below zero. We therefore set ζ from the literature and re-solve the same five-moment system. The closest counterpart is the exogenous destruction rate estimated by Acemoglu et al. (2018). At this $\zeta = 0.037$, matching $g^* = r^*$ still gives $\Lambda = \rho$ exactly, but the threshold of the entry-cost channel is now $\rho+\zeta$, so that channel turns positive. The spirit of capitalism wedge channel contributes -0.0131 and the entry-cost channel $+0.0032$, so that $\partial g^*/\partial i = -0.0099$, against -0.0111 in the benchmark. The Friedman rule remains optimal. Across the range of their robustness estimates, $\zeta \in [0.030, 0.049]$, the growth effect lies between -0.0105 and -0.0082. The

limitation of this result is the growth of the entry-cost channel, and the growth effect changes sign at $\zeta = 0.071$. At the value used by Bilbiie, Ghironi and Melitz (2012), $\zeta = 0.025$ per quarter, or an annual hazard of 0.101, the effect is therefore reversed. That value is calibrated to total job destruction, including product destruction driven by competition and innovation, and is an upper bound that treats all exit as exogenous.

G.3 Welfare along the transition

Suppose that the economy is on the balanced growth path with a calibrated nominal interest rate $i_H = 0.05$. At $t = 0$, the nominal interest rate decreases, unexpectedly and permanently, to $i' < i_H$. The number of firms and the level of technology are predetermined, with N_0 equal to its steady-state value under i_H and $Z_0 = 1$, while the consumption–output ratio C_t/Y_t is free to jump. After the change, the economy evolves according to equation (A7) evaluated at i'. Following Proposition 1, the new balanced growth path is a saddle point, so a unique initial value of C_0/Y_0 places the economy on the path that converges to it. The transition results concern cuts from the calibrated nominal interest rate, whereas the balanced-growth comparison of Subsection 6.5 applies to all rates.

We compute the saddle path by reverse shooting. Starting arbitrarily close to the new balanced growth path along its stable eigendirection, we integrate the system backward in time until the number of firms reaches its initial value. This traces the nonlinear stable manifold, and reversing time yields the transition, with the value of C_t/Y_t at that point as the initial jump. Technology then follows from integrating equation (21) along the path.

We measure the change in lifetime utility relative to the counterfactual in which the nominal interest rate remains at i_H forever. Variables on that path are denoted by a superscript H. Since $C_t = (C_t/Y_t)\, Y_t$, $A_t = \Psi Y_t$, and $Y_t = \theta^{\frac{2\theta}{1-\theta}} Z_t l_t$, the difference in flow utility at date t is

$$\ln \frac{C_t/Y_t}{(C_t/Y_t)^H} + (1+k)\left[\ln \frac{Z_t}{Z_t^H} + \ln \frac{l_t}{l_t^H}\right] + k \ln \frac{\Psi(i')}{\Psi(i_H)} + \gamma \ln \frac{L - l_t}{L - l_t^H}.$$

The four terms capture, in turn, the composition of output, the levels of technology and employment, the valuation of wealth, and leisure. The welfare change is the discounted integral of this difference. It is computed numerically until the economy has converged to the new balanced growth path. The remainder is evaluated in closed form, since from then on, the difference grows linearly at rate $(1+k)\big[g^*(i') - g^*(i_H)\big]$. We report the result as the permanent percentage increase in consumption along the counterfactual path, holding wealth and leisure fixed, that yields the same gain in lifetime utility.

Several checks confirm the computation. First, when the economy starts directly on the new balanced growth path, the procedure reproduces the balanced-growth welfare

comparison based on (34) exactly. Second, at an interior rate, $i' = 0.025$, where the stable manifold is not vertical, an independent forward-shooting solution delivers the same initial jump. Third, the goods-market clearing condition holds along the computed paths. Finally, the welfare results are insensitive to the numerical tolerances.

Under the Friedman rule, productivity growth rises from 1.80 percent to 1.863 percent on impact before settling at its new long-run rate of 1.857 percent. On impact, labor moves to its new steady-state level, while the number of firms has not yet adjusted, so market size per firm, and with it the return to in-house R&D, temporarily exceeds its new steady-state value. Table 18 reports the welfare gains. They exceed the balanced growth comparison slightly at every rate because of this overshooting, and they decline strictly as the new rate rises from 0 to 5 percent, so the largest gain is obtained at the Friedman rule.

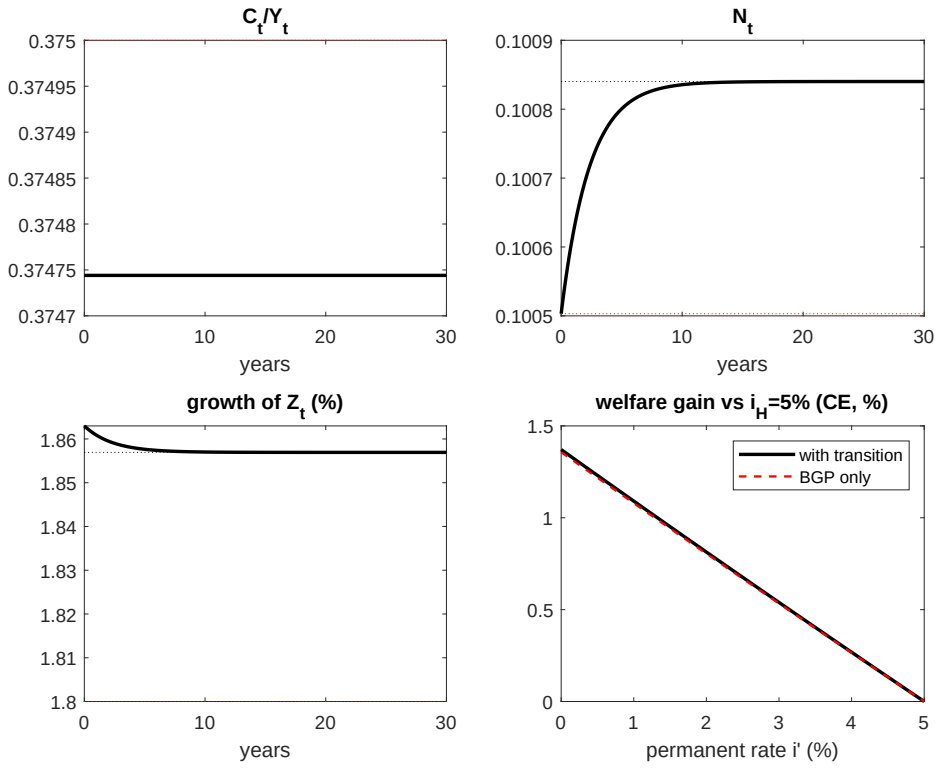


Figure 13: Transition after an unanticipated, permanent cut in the nominal interest rate from 5 percent to the Friedman rule. Top panels: the consumption–output ratio jumps at once to its new steady-state value, while the number of firms rises gradually through entry. Bottom left: productivity growth overshoots its new long-run rate on impact and then converges. Bottom right: welfare gain relative to remaining at 5 percent, in consumption equivalents, as a function of the new permanent rate, including the transition (solid) and comparing balanced growth paths only (dashed). Dotted lines mark the initial (red) and new (black) balanced growth paths.

Table 18: Welfare gains from a permanent cut in the nominal interest rate from 5 percent (consumption equivalents, percent)

New nominal rate i'	0%	1%	2%	3%	4%
Including the transition	1.371	1.091	0.813	0.539	0.268
Balanced growth paths only	1.357	1.079	0.805	0.533	0.265

G.4 Relative wealth and positional preferences

Next, we extend our model by taking status-preferences into account. The setup of the extension is chosen to nest our main framework in Section 4. Let there be a unit continuum of atomistic households in $h \in [0,1]$. Each household has a wealth level of $A_{h,t}$ and average wealth is $\bar{A}_t = \int_0^1 A_{h,t} dh$. Let $\chi \in [0,1]$ denote the fraction of the wealth motive that is positional. Lifetime utility of household h is

$$U_h = \int_0^\infty e^{-\rho t} \left[\ln C_{h,t} + k(1-\chi) \ln A_{h,t} + k\chi \ln(A_{h,t}/\bar{A}_t) + \gamma \ln(1-l_{h,t}) \right] dt. \quad \text{(G21)}$$

Two polar cases follow. When $\chi = 0$, the lifetime utility remains exact as in equation (1). When $\chi = 1$ the middle term in equation (G21) becomes $k \ln(A_{h,t}/\bar{A}_t)$ which denotes status. Each household is infinitesimal and takes the average wealth as given when making its own choices. This implies that

$$\frac{\partial u_h}{\partial A_h} = \frac{k}{A_h} \qquad \text{for every } \chi \in [0,1]. \quad \text{(G22)}$$

Hence, whether wealth utility is absolute or relative changes the level of utility, but not the private marginal incentive to accumulate own wealth. All of the remaining positive analysis that follows in Section 4, and Subsection 5.1 holds exactly. However, this extension matters in important ways for the welfare analysis.

On the balanced growth path, the welfare function can be written as

$$U_\chi = \frac{1}{\rho} \Big[\ln C_0 + k(1-\chi) \ln A_0 + \gamma \ln(L - l^*) \Big] + \frac{1 + k(1-\chi)\, g^*}{\rho^2}. \quad \text{(G23)}$$

Setting $\chi = 0$, we obtain the exact version of equation (34). At the other extreme, we obtain $U_{\chi=1} = \frac{1}{\rho} \Big[\ln C_0 + \gamma \ln(L - l^*) \Big] + \frac{g^*}{\rho^2}$. Thus, under pure relative wealth, the wealth motive continues to affect household behavior and therefore equilibrium growth through the full k, but wealth itself provides no direct social welfare gain along the symmetric equilibrium.

Differentiating equation (G23) and using equation (35), the interest-rate effect on balanced-growth-path welfare can be again decomposed into a static and a growth part:

$$\frac{\partial U}{\partial i}(\chi) = \underbrace{\frac{1}{\rho} \left[\frac{\partial \ln C_0}{\partial i} + k(1-\chi) \frac{\partial \ln A_0}{\partial i} + \gamma \frac{\partial \ln(L - l^*)}{\partial i} \right]}_{W_{static}} + \underbrace{\frac{1 + k(1-\chi)}{\rho^2} \frac{\partial g^*}{\partial i}}_{W_{growth}}. \quad \text{(G24)}$$

This equation has a similar structure to equation (36). The only difference is the welfare weights that change from k to $k(1-\chi)$. Finally, we can express the static part as

$$W_{\text{static}}(\chi) = \underbrace{\frac{\partial \ln(C/Y)^*}{\partial i}}_{\text{composition of } C/Y} + \underbrace{k(1-\chi)\frac{\eta_r}{1+\eta_r i}}_{\text{wealth level}} + \underbrace{\left[(1+k(1-\chi)+\gamma)\lambda - (1+k(1-\chi))\right]\frac{\partial \ln \Upsilon}{\partial i}}_{\text{labor: scale loss + leisure gain}},$$

where equation (37) remains exact. Allowing for pure relative wealth ($\chi = 1$), eliminates the direct social welfare effect from the level of wealth and reduces the social welfare weight attached to growth.

Does greater preference for status strengthen or weaken the case for low nominal interest rates? The answer is ambiguous analytically as there are two effects that pull in opposite directions. The new preference for status removes the social value of higher wealth that a higher nominal interest rate produces in the baseline welfare case. On the other hand, the preference for status reduces the welfare cost of the slower growth effect that a higher nominal interest rate produces. To answer this question quantitatively, we run a simple calibration using our baseline strategy and values.

Since the positional share χ does not affect the decentralized equilibrium, it is not identified by the five targeted moments, and the calibrated economy is unchanged for every $\chi \in [0,1]$. We therefore keep all parameters at their benchmark values and vary χ only in the welfare evaluation, where the weight on wealth is $k(1-\chi)$. Positionality affects the welfare slope in two opposing ways. A higher nominal interest rate raises the initial level of wealth. At the benchmark, $\partial \ln A_0/\partial i = 0.315$. Removing the social value of this wealth makes a higher rate more costly, and contributes -0.414 to the derivative of $\partial U/\partial i$ with respect to χ. At the same time, the higher rate lowers growth, $\partial g^*/\partial i = -0.0111$, and removing the weight k on wealth growth makes that loss less costly, contributing $+0.366$. The first effect dominates, so the derivative is -0.048. Positionality makes a higher nominal interest rate slightly more costly. At the benchmark rate, $\partial U/\partial i$ falls from -6.590 under absolute wealth ($\chi = 0$) to -6.638 under pure status ($\chi = 1$). The Friedman rule remains optimal for every $\chi \in [0,1]$, and the welfare gain from moving from 5 percent to a zero nominal rate rises from 1.357 to 1.366 percent of consumption, as χ increases from zero to one.

G.5 Liquidity constraints on in-house R&D

Finally, we extend the baseline model in the direction of Chu and Cozzi (2014). We allow for incumbents to prefund a share $\eta_I \in [0,1]$ of their in-house R&D with funds borrowed from households at the nominal interest rate. Due to the high nonlinearity of

the dynamic system, we evaluate the stability of the balanced growth path numerically. The profit flow from equation (13) becomes

$$\Pi_t(j) = [p_t(j) - 1]X_t(j) - \phi Z_t - (1 + \eta_I i_t)R_t(j), \tag{G25}$$

and borrowing becomes $B_t = \eta_r \beta X_t \dot{N}_t + \eta_I N_t R_t$, which now enters the cash-in-advance constraint in equation (3). The household problem remains exact. The interest on incumbents' borrowing is a transfer to households, so the goods-market clearing condition is unchanged. The return to in-house R&D in equation (15) becomes

$$r_t(1 + \eta_I i) = \alpha(1 - \theta)\theta^{\frac{1+\theta}{1-\theta}} \frac{l_t}{N_t}. \tag{G26}$$

The dynamics of this economy can still be represented by a two-dimensional system in C_t/Y_t and N_t. The law of motion from equations (A1) and (A2) becomes

$$\begin{aligned}\left[1 - \frac{i\eta_I \theta^{-\frac{2}{1-\theta}}}{\beta(1 + \eta_r i)} \frac{N_t}{L}\right] \left(\frac{\dot{C}_t}{C_t} - \frac{\dot{Y}_t}{Y_t}\right) + \omega \frac{\dot{N}_t}{N_t} = \mathcal{A}_0 - \frac{i\eta_I \alpha(1 - \theta)}{\theta\beta(1 + \eta_r i)(1 + \eta_I i)} \\ + \frac{i\eta_I \theta^{-\frac{2}{1-\theta}}}{\beta(1 + \eta_r i)} \frac{N_t}{l_t} \left[\rho - \frac{k(1 + \eta_c i)}{\Psi} \frac{C_t}{Y_t}\right],\end{aligned} \tag{G27}$$

and the entry equation keeps the form of equation (A4), $\dot{N}_t/N_t = \mathrm{B}_0 + \mathrm{B}_1(\dot{C}_t/C_t - \dot{Y}_t/Y_t)$, with

$$\begin{aligned}\mathrm{B}_0 = {} & \frac{(1 - \alpha)(1 - \theta)}{\theta\beta(1 + \eta_r i)} - \rho + \frac{k(1 + \eta_c i)}{\Psi} \frac{C_t}{Y_t} \\ & - \frac{\theta^{-\frac{2}{1-\theta}}}{\beta(1 + \eta_r i)} \frac{N_t}{l_t} \left[\phi + (1 + \eta_I i) \left(\frac{k(1 + \eta_c i)}{\Psi} \frac{C_t}{Y_t} - \rho\right)\right], \\ \mathrm{B}_1 = {} & \frac{(1 + \eta_I i)\, \theta^{-\frac{2}{1-\theta}}}{\beta(1 + \eta_r i)} \frac{N_t}{L} - 1.\end{aligned}$$

Setting $\eta_I = 0$ recovers equations (A1) and (A5)–(A6) exactly. The determinant of the system, $\left[1 + i(\eta_r - \eta_I)\frac{\theta^{-2/(1-\theta)}}{\beta(1+\eta_r i)} \frac{N_t}{L}\right]/(1 + \eta_r i)$, is positive whenever $\eta_I \leq \eta_r$, and at the calibration for every $\eta_I \leq 1$.

We retain the definitions of the three composite terms in equation (A9). The balanced-growth conditions then imply

$$\frac{N^*}{l^*} = \beta(1 + \eta_r i)\, \theta^{\frac{2}{1-\theta}} \frac{\mathcal{Q}}{}\phi + (1 + \eta_I i)(\Lambda - \rho), \tag{G28}$$

$$g^* = \Lambda - \rho + \frac{\alpha(1 - \theta)}{\theta\beta(1 + \eta_r i)\mathcal{Q}} \left[\Lambda - \rho + \frac{\phi}{1 + \eta_I i}\right]. \tag{G29}$$

The technical complications arise because unlike in the model in Section 4, the balanced-growth value of $(C/Y)^*$ is no longer obtained independently of Λ. Substituting the

balanced-growth conditions above into the definition of Λ in Equation (A9) yields the scalar equilibrium condition

$$F(\Lambda, i) \equiv \Lambda - \frac{k(1+\eta_c i)}{1+k+k\eta_c i}\Bigg[\rho + \frac{1-\theta}{\Psi} + i\eta_I\left(\frac{\alpha(1-\theta)}{\theta\beta(1+\eta_r i)(1+\eta_I i)} + \frac{\mathcal{Q}(\Lambda-\rho)}{\phi+(1+\eta_I i)(\Lambda-\rho)}\right)\Bigg] = 0. \tag{G30}$$

Thus, Equation (A9) defines the spirit of capitalism wedge Λ, while Equation (G30) determines its equilibrium value in this extension.

We proceed by calibrating this model. The Euler equation is unchanged, so matching $g^* = r^*$ again implies $\Lambda = \rho$. The last term in Equation (G30) then vanishes and the calibration is in closed form. This simplification provides these expressions for the following parameters: $\alpha = \frac{(1+\eta_I i)\,(R\&D/GDP)}{\theta(1-\theta)}$, $\phi = g^*\frac{1-\alpha}{\alpha}(1+\eta_I i)$, and $\left(\frac{C}{Y}\right)^* = (1-\theta)\left[1+\frac{\alpha\theta\eta_I i}{1+\eta_I i}\right]$, where β, γ and k are pinned by $(C/A)^*$, l^* and $\Lambda = \rho$ as in the baseline.

Due to the presence of the liquidity constraint on in-house R&D, in this extension, the growth effect from a permanent change in the nominal interest rate is decomposed into three channels: the spirit of capitalism wedge channel, the direct entry-cost channel, and a direct incumbent-R&D channel. At the calibration, the entry-cost channel is zero because $\Lambda = \rho$, and the incumbent-R&D channel takes the simple form

$$\left.\frac{\partial g^*}{\partial(1+\eta_I i)}\right|_{\Lambda} \eta_I = -g^*\frac{\eta_I}{1+\eta_I i} < 0. \tag{G31}$$

The counterpart of η_I is the share of incumbents' R&D expenditure financed by interest-bearing borrowing. Debt plays a relatively limited role in financing R&D, which relies predominantly on internal funds and, in some settings, external equity (Hall, 2002; Hall and Lerner, 2010). Among R&D-performing Italian manufacturing firms during the 1992–2000 period, loans financed 9.4 percent of R&D expenditure, against 81.6 percent from internal funds (Benfratello, Schiantarelli and Sembenelli, 2008). Because the Italian financial system is bank-based, and because market-based economies rely more on equity for R&D (Brown, Fazzari and Petersen, 2009), we treat 0.094 as an upper bound and report results for $\eta_I \in [0, 0.094]$.

We recalibrate the model to the same five moments for each value of η_I and report the results in Table 19. In every case, the balanced growth path is unique and locally determinate, with Jacobian eigenvalues of about $+0.80$ and -0.42. The incumbent-R&D channel adds to the negative growth effect, while the spirit of capitalism wedge channel weakens only marginally. The total effect becomes monotonically stronger in η_I, reaching -0.0126 at the upper bound against -0.0111 in the baseline. Welfare is decreasing in the nominal interest rate for every η_I, so the Friedman rule remains optimal. Incumbents' borrowing raises transaction balances on the balanced growth path such that $M_t/C_t = \eta_c + B_t/C_t$. At the calibrated value of $\eta_I = 0.094$, this lowers the consumption

intensity implied by the measured M1–consumption ratio from 0.160 to 0.154, which moves the economy further into the region where inflation lowers growth.

Table 19: Growth effect of the nominal interest rate with liquidity needs of incumbents

η_I	0	0.025	0.050	0.075	0.094
SoC wedge channel	-0.0111	-0.0111	-0.0110	-0.0109	-0.0109
Entry-cost channel	0	0	0	0	0
Incumbent-R&D channel	0	-0.0004	-0.0009	-0.0013	-0.0017
Total $\partial g^*/\partial i$	-0.0111	-0.0115	-0.0119	-0.0123	-0.0126