Social Status and the Growth Effect of Money*

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Abstract

It has been shown that in a standard one-sector AK model of endogenous growth with wealth-induced preferences for social status, the economy's growth rates of real output and nominal money supply are positively related when the cash-in-advance constraint is applied solely to the household's consumption purchases. However, a positive output-growth effect of money/inflation is not consistent with the existing empirical evidence. We show that when gross investment must be financed by real money balances as well, this result is overturned, *i.e.* higher inflation is detrimental to economic growth, because of a dominating portfolio substitution effect.

Keywords: Social Status, Endogenous Growth, Cash-in-Advance Constraint.

JEL Classification: E52, O42.

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1 Introduction

Recently, there has been a growing literature that examines the macroeconomic effects of wealth-induced preferences for social status within dynamic general equilibrium models.[1] This is a valuable research subject not only for its theoretical significance, but also for its wide-ranging policy implications on promoting economic growth or improving social welfare. In the existing literature, Chang, Hsieh and Lai (CHL, 2000) show that in a prototypical one-sector AK model of endogenous growth where the representative household derives utilities from consumption as well as from its ownership of physical capital in the log-log specification, the economy's growth rates of real output and nominal money supply are positively related when the cash-in-advance (CIA) or liquidity constraint is applied solely to consumption purchases.[2] However, the result of a positive output-growth effect of money (or inflation) is not consistent with numerous empirical studies. For example, using random-effect regressions on two panel data sets of 170 countries from 1960 to 1992, Gylfason and Herbertsson (2001) present strong and robust evidence that higher inflation is detrimental to economic growth at all income levels, both across countries and over time. Moreover, the same empirical finding has been obtained by other researchers such as Levine and Renelt (1992), Roubini and Sala-i-Martin (1992), De Gregorio (1993), Barro (1995), Bruno and Easterly (1998), and Rousseau and Wachtel (2001), among many others.

Motivated by this inconsistency with international data, the CHL model is modified along two dimensions in our analysis. First, we consider a generalized CRRA utility function where the inverse of the intertemporal elasticity of substitution in both consumption and capital can be less than one. Second, in addition to consumption goods, the entire expenditures of gross investment are also subject to the CIA constraint (Stockman, 1981). We show that under Stockman's liquidity formulation, CHL's finding of a positive relationship between output growth and money/inflation is overturned, regardless of the coefficient of relative risk aversion in the household utility. Intuitively, the growth effect of money depends crucially on the relative strength of two opposing forces dubbed as the *portfolio substitution effect* (from real balances to capital) and the *intertemporal substitution effect* (from consumption to investment). When money holdings are required for all the consumption and investment purchases,

[1] See, for example, Zou (1994, 1998), Bakshi and Chen (1996), Corneo and Jeanne (1997, 2001), Gong and Zou (2001), Chang and Tsai (2003), Clemens (2004), and Fisher and Hof (2005), among many others.

[2] Under the consumption-only liquidity constraint, it is well known that money is "superneutral" in the growth-rate sense when households have no desire for social status.

an increase in the monetary growth rate leads to a dominating portfolio substitution effect, which in turn raises the relative shadow price of capital and reduces its net rate of return. As a consequence, the economy's output growth rate will fall, thus producing a negative growth effect of money/inflation that exhibits strong empirical support.

2 The Economy

We incorporate a generalized CRRA preference formulation and Stockman's (1981) cash-in-advance constraint into the one-sector AK model of endogenous growth with wealth-enhanced social status developed by Chang, Hsieh and Lai (CHL, 2000, section 4). Moreover, partial capital depreciation is considered for completeness of the analysis. To facilitate comparison, we maintain all other features as in CHL, including the assumption that the household's wealth does not consist of real money balances, and follow their notation as much as possible.

The economy is populated by a unit measure of identical, infinitely-lived households. Each household provides fixed labor supply and maximizes its discounted lifetime utility

$$U = \int_0^\infty \left[\frac{c_t^{1-\sigma} - 1}{1-\sigma} + \beta \frac{k_t^{1-\sigma} - 1}{1-\sigma} \right] e^{-\rho t} dt, \quad \beta > 0, \quad \sigma \geq 1, \tag{1}$$

where c_t and k_t are the individual household's consumption and capital stock, respectively, and $\rho \in (0,1)$ denotes the time discount rate. In addition to consumption goods, the household derives utilities from its social status represented by the level of capital ownership, and the parameter β measures the degree for "the spirit of capitalism".[3] On the other hand, to guarantee the existence of a balanced-growth equilibrium, we require that consumption and capital possess the same inverse of the intertemporal elasticity of substitution σ. Based on the empirical evidence for this preference parameter in the mainstream macroeconomics literature, the restriction of $\sigma \geq 1$ is imposed. Notice that CHL restrict their analysis to the specification with $\sigma = 1$, thus the household utility is logarithmic in c_t and k_t.

The budget constraint faced by the representative household is given by

$$c_t + i_t + \dot{m}_t = y_t - \pi_t m_t + \tau_t, \tag{2}$$

where i_t is gross investment, π_t is the inflation rate, m_t denotes the real money balances that are equal to the nominal money supply M_t divided by the price level P_t, and τ_t represents

[3] All the results in this paper are qualitatively robust to the modification that introduces the relative (not the individual) wealth $\frac{k_t}{K_t}$, where K_t the economy-wide level of capital stock, to the household's utility function (1).

the real lump-sum transfers that households receive from the monetary authority. Moreover, output y_t is produced by the technology

$$y_t = Ak_t, \ A > 0, \tag{3}$$

and the law of motion for the capital stock is

$$\dot{k}_t = i_t - \delta k_t, \ \ k_0 \ > 0 \ \text{given}, \tag{4}$$

where $\delta \in [0, 1]$ is the capital depreciation rate.

As in Stockman (1981), the representative household also faces the following cash-in-advance (CIA) or liquidity constraint:

$$c_t + i_t \leq m_t, \tag{5}$$

that is, all consumption and investment purchases must be financed by the household's real balances m_t. Notice that when $\sigma = 1$, together with $\delta = 0$ and the consumption-only liquidity constraint $c_t \leq m_t$, we recover the model that CHL have analyzed.

The first-order conditions for the representative household with respect to the indicated variables and the associated transversality conditions (TVC) are

$$c_t \ : \quad c_t^{-\sigma} = \lambda_{mt} + \gamma_t, \tag{6}$$

$$i_t \ : \quad \lambda_{kt} = \lambda_{mt} + \gamma_t, \tag{7}$$

$$k_t \ : \quad \dot{\lambda}_{kt} = (\rho + \delta)\lambda_{kt} - \beta k_t^{-\sigma} - A\lambda_{mt}, \tag{8}$$

$$m_t \ : \quad \dot{\lambda}_{mt} = (\rho + \pi_t)\lambda_{mt} - \gamma_t, \tag{9}$$

$$\text{TVC}_1 \ : \quad \lim_{t\to\infty} e^{-\rho t}\lambda_{kt}k_t = 0, \tag{10}$$

$$\text{TVC}_2 \ : \quad \lim_{t\to\infty} e^{-\rho t}\lambda_{mt}m_t = 0, \tag{11}$$

where λ_{mt} and λ_{kt} are the shadow prices (or utility values) of real money balances and physical capital, respectively; γ_t denotes the Lagrange multiplier associated with the CIA constraint (5) that is postulated to be strictly binding in equilibrium. Equation (6) equates the marginal benefit and marginal cost of consumption, which is the marginal utility of having an additional unit of real dollar. In addition, equations (7) and (8) together govern the evolution of physical capital over time, where the term $\beta k_t^{-\sigma}$ represents the marginal utility benefit of capital accumulation. Finally, equation (9) states that the marginal values of real money holdings are equal to their marginal costs.

We postulate that the nominal money supply is growing at a constant rate $\mu > 0$, hence the resulting seigniorage returned to households as lump-sum transfers are $\tau_t = \mu m_t$. Furthermore, clearing in the goods and money markets imply that

$$c_t + i_t = y_t, \tag{12}$$

and

$$\dot{m}_t = (\mu - \pi_t)\, m_t. \tag{13}$$

3 Balanced Growth Path

As in CHL, we focus on the economy's balanced growth path (BGP) along which output, consumption, physical capital and real money balances all grow at a common positive rate denoted as g. To facilitate the subsequent dynamic analyses, we adopt the following variable transformations: $p_t \equiv \frac{\lambda_{kt}}{\lambda_{mt}}$ and $z_t \equiv \frac{c_t}{k_t}$. With these transformations, the model's equilibrium conditions can be re-written as the following autonomous dynamical system:

$$\frac{\dot{p}_t}{p_t} = p_t - \frac{A}{p_t} - \beta z_t^{\sigma} - z_t + A - \mu - 1, \tag{14}$$

$$\frac{\dot{z}_t}{z_t} = \frac{1}{\sigma}\left(\frac{A}{p_t} + \beta z_t^{\sigma} - \rho - \delta\right) - A + \delta + z_t. \tag{15}$$

Therefore, a balanced-growth equilibrium is characterized by a pair of positive real numbers (p^*, z^*) such that $\dot{p}_t = \dot{z}_t = 0$. It is straightforward to derive from (14) and (15) that p^* is the solution to the quadratic equation

$$p^* = \frac{A}{p^*} + \beta\,(z^*)^{\sigma} + z^* + \mu + 1 - A \equiv f\,(p^*)\,, \tag{16}$$

and that

$$\frac{dz^*}{dp^*} = \frac{A}{\sigma\,(p^*)^2\left[1 + \beta\,(z^*)^{\sigma-1}\right]} > 0. \tag{17}$$

To examine the existence and number of the economy's balanced growth path(s), we first note that equilibrium p^* can be found from the intersection(s) of $f(p^*)$ in (16) and the 45-degree line. Moreover, using $\frac{dz^*}{dp^*}$ from (17), we obtain that

$$f'\,(p^*) = \frac{A\,(1-\sigma)}{\sigma\,(p^*)^2\left[1 + \beta\,(z^*)^{\sigma-1}\right]} \lesseqgtr 0 \quad \text{when} \quad \sigma \gtreqless 1, \tag{18}$$

and

$$f''(p^*) = -f'(p^*) \underbrace{\left\{ \frac{2}{p^*} - \frac{\beta f'(p^*) \left[(z^*)^{\sigma-2} \right]}{1+\beta (z^*)^{\sigma-1}} \right\}}_{\text{positive}} \gtreqless 0 \quad \text{when} \quad \sigma \gtreqless 1. \tag{19}$$

As a result, $f(p^*)$ is either a downward-sloping and concave curve (when $\sigma > 1$) or a horizontal line (when $\sigma = 1$) that intersects the 45-degree line once in the positive quadrant. It follows that there exists a unique balanced growth path in our model economy.

In terms of the BGP's local dynamics, we compute the Jacobian matrix J of the dynamical system (14) and (15) evaluated at (p^*, z^*). The trace and determinant of the Jacobian are given by

$$Tr = p^* + \frac{A}{p^*} + \beta (z^*)^{\sigma} + z^* > 0, \tag{20}$$

$$Det = p^* z^* \left[1 + \beta (z^*)^{\sigma-1} \right] \underbrace{\left\{ 1 - \frac{A(1-\sigma)}{\sigma (p^*)^2 \left[1 + \beta (z^*)^{\sigma-1} \right]} \right\}}_{\left[1 - f'(p^*) \right] > 0} > 0. \tag{21}$$

The local stability properties of the BGP equilibrium is determined by comparing the eigenvalues of J that have negative real parts to the number of initial conditions in the dynamical system (14)-(15), which is zero because p_t and z_t are both jump variables. It turns out that our model's Jacobian matrix possesses a positive trace and a positive determinant (see equations 20 and 21), indicating the presence of two eigenvalues with positive real parts, hence the economy's balanced growth path exhibits saddle-path stability and equilibrium uniqueness.

4 Growth Effect of Money

In this section, we derive and examine the analytical expression that governs the output-growth effect of money or inflation.[4] Combining (3), (4) and (12) yields the common rate of economic growth g as follows:

$$g = A - \delta - z^*, \tag{22}$$

[4] On the balanced growth path, its inflation rate π^* is *ceteris paribus* positively related to the monetary growth rate μ because equation (13) implies that $\mu = \pi^* + g$.

thus the BGP's growth rate is negatively related to the transformed state variable z^* $\left(\frac{dg}{dz^*} < 0\right)$. We then take total differentiation on (22), and use the chain rule together with (16), (17) and (18) to find that the growth effect of money/inflation is given by

$$\frac{dg}{d\mu} = \underbrace{\frac{dg}{dz^*}}_{(-)} \underbrace{\frac{dz^*}{dp^*}}_{(+)} \frac{dp^*}{d\mu}, \tag{23}$$

where

$$\frac{dp^*}{d\mu} = \frac{\sigma (p^*)^2 \left[1 + \beta (z^*)^{\sigma-1}\right]}{\sigma (p^*)^2 \left[1 + \beta (z^*)^{\sigma-1}\right] + (\sigma - 1) A} = \frac{1}{1 - f'(p^*)} > 0. \tag{24}$$

It follows that in contrast to CHL, our model economy displays a negative relationship between the BGP's output growth and money/inflation $\left(\frac{dg}{d\mu} < 0\right)$. This result turns to be consistent with the international evidence reported in Gylfason and Herbertsson (2001), and many other empirical studies mentioned in the Introduction.

Generally speaking, within dynamic general equilibrium macroeconomic models, the sign for the growth effect of money depends crucially on the relative strength of two opposing forces. On the one hand, a rise in the monetary growth rate μ leads to a higher inflation, which in turn raises the cost of money holdings. As a result, the representative household substitutes out of real balances and into physical capital (the portfolio substitution effect). This will cause an increase in the relative shadow price of capital p^* because of a higher demand, thereby reducing its net rate of return and thus the BGP's growth rate. On the other hand, a higher monetary growth rate μ *ceteris paribus* induces the representative household to consume less and invest more today in exchange for higher future consumption (the intertemporal substitution effect).[5] This expands the supply of physical capital, hence reducing its relative shadow price p^*. In addition, agents' status-seeking motive further strengthens this supply effect through additional capital accumulation (see the term $\beta k_t^{-\sigma}$ in equation 8). It follows that the economy's output growth rate will rise. Our preceding analysis shows that when consumption and gross investment are both liquidity-constrained, the BGP's output growth and money/inflation are inversely related $\left(\frac{dg}{d\mu} < 0\right)$ in that the portfolio substitution effect outweighs the intertemporal substitution effect.

[5] Using (3), (4), (12) and (13), it is straightforward to show that $\pi_t = \mu - A + z_t + \delta$. Therefore, holding the inflation rate constant, an increase in μ leads to a lower consumption-capital ratio z_t. This requires an intertemporal substitution from current to future consumption, thus raising today's investment.

By contrast, CHL show that when $\sigma = 1$ and the CIA constraint is applicable only to the purchases of consumption goods, status preference generates a dominating intertemporal substitution effect (from consumption to investment) in response to an increase in μ. Therefore, the net rate of return on capital will rise because of a decline in its relative shadow price. This in turn leads to a positive relationship between the growth rates of real output and nominal money supply $\left(\frac{dg}{d\mu} > 0\right)$, a result that is not consistent with the existing econometric evidence.[6]

5 Conclusion

We have examined the interrelations between wealth-induced preferences for social status, the formulation of the cash-in-advance constraint, and the output-growth effect of money/inflation within the context of a standard AK model of endogenous growth. It turns out that in contrast to CHL, when real balances are required for all the purchases of consumption as well as investment goods, the economy's growth rates of real output and nominal money supply are inversely related due to a dominating portfolio substitution effect, regardless of the coefficient of relative risk aversion in the household utility. This result of a negative growth effect of money/inflation is strongly supported by the empirical evidence.

[6] It can be easily shown that this "positive relationship" result continues to hold when $\sigma > 1$.

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