Wealth Effects and Multiple Growth Regimes: The Role of Monetary Policy*

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Abstract

In order to explain multiple growth regimes, one of the most popular working hypotheses is based on initial conditions along with assumptions such as nonlinearities of production, subsistence consumption and heterogeneous agents/savings behavior. This paper argues that a standard optimal growth model with a wealth-as-status effect *a la* Veblen (1899), Weber (1905) and Friedman (1953) establishes multiple growth regimes without reliance on other assumptions. With a welfare-as-status effect, the resulting equilibrium distribution is characterized by a group with a lower level of income and another group with a higher level of income. Globally, a sufficiently strong monetary policy may be an instrument in order for an economy in a poverty trap to take off and become wealthy in the long run. Locally, our model sheds light on the relationship between money/inflation and capital in the long run that, given general cash-in-advance constraints on investment relative to consumption, is determined by the curvature of the utilities of wealth and consumption.

Keywords: one-sector growth model, wealth effect, CIA constraint, development trap, takeoff.

JEL classification: E13, E52, O11.

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1 Introduction

Multiple growth regimes have been a popular topic of research in an effort to explain large income differentials across countries. One school of thoughts concerning the working hypotheses in the establishment of multiple growth regimes is that countries are different in initial conditions leading toward different levels of per capita income in the long run. Existing studies in this line of research need to rely on other assumptions in order to generate multiple growth regimes. For example, Azariadis and Drazen (1990) and Galor and Weil (2000) assumed nonlinearities of production or consumption functions with subsistence levels at different levels/stages of capital, and Galor (1996) assumed heterogeneous agents/savings behavior.

The purpose of this paper is to study a growth model in support of this line of hypothesis without the reliance of nonlinearities of production, subsistence consumption or heterogeneity of agents or other assumptions. We consider a wealth-as-status effect in an otherwise standard growth model. Agents derive utility both from consumption and his wealth. Wealth is a vehicle for achieving social status, and people do care about their social status.[1] The notion that an individual might care about wealth has a long history and traditionally viewed possession of wealth as a standard of success and a measure of status in a society. An early exposition of the idea of wealth-as–status effect was Veblen (1899), and the argument of "the continued accumulation not only for the material reward that it brings, but also for its own sake" was put forward by Weber (1905). A formal account of wealth in a utility was offered by Friedman (1953) who analyzed individuals' choice and found the resulting distribution effect with a group having a lower level of wealth while the other group having a higher level of wealth.[2]

Kurz (1968) has formally incorporated the wealth effect in a utility in a dynamic growth model. Following Kurz (1968), the inclusion of wealth in a utility has then been widely adopted in dynamic growth models. While most studies using this type of utility focused on the properties of uniqueness and stability in the 1970s, the 1980s have seen many other economic applications. For example, in a small open economy with wealth in the utility, Fried (1984) studied the effects of changes in terms of trade with on welfare with the result dependent on the

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[1] Wealth and preference are connected through many reasons. A wealthy agent can afford a house in an expensive district like Beverly Hill and Belle Air in the City of Los Angels. In an economy with imperfect capital market, an agent with access to wealth is easier to obtain loans because of collateral (Stiglitz and Weiss, 1983) and is easier to become an entrepreneur who monitors workers (Banerjee and Newman, 1993). Moreover, in political economy, wealth can be used to buy either a power in politics or an ownership power in a firm through share holdings (Bowles and Gintis, 1992).

[2] Robson (1992) provided a micro foundation for the Friedman formulation and compared the models with and without the relative standing of wealth in a society.

substitutability between wealth and human capital. This type of utility has become popular recently. In finance and business cycles, Bakshi and Chen (1996) found that the wealth-as-status effect is a driving force behind stock-market volatility and economic growth while Kamihigashi (2008) uncovered the wealth-as-status effect to be important in the explanation of the phenomenon where a sharp output decline follows the bursting of a bubble. In international finance, Zou (1997) established an unambiguous Harberger-Laursen-Metzer effect only if there was a wealth-as-status effect. Indeed, a number of studies have recently revealed that, only with the inclusion of wealth in a utility, their model can obtain results consistent with data. For example, De Nardis (2004) found that only by the inclusion of a voluntary wealth as a bequest in the utility, his model can quantitatively explain why the richest households hold a large amount of wealth, even during very old age, and generate lifetime savings profiles consistent with the data. Using models with wealth in the utility, Lehmiji and Palokangas (2007) can explain an increase followed by a decrease in population growth after trade liberalization and increases in income, and Pestieau and Thibault (2007) can find a wealth distribution with social segregation. See also the study of issues in relation to relative wealth as a social norm effect (Corneo and Jeanne, 1997) and endogenous growth (Zou, 1994; Futagami and Shibata, 1998).

This paper studies multiple growth regimes in a monetary optimal growth model with wealth as a status device in the utility function. Money is introduced for the role of transaction and only capital is considered as wealth in our model. We use a utility that is separable in consumption and wealth. Without money, an optimal growth model with a separable utility cannot establish multiple steady states as there is no direct interaction between consumption and wealth, as shown by Bose (1971). However, the inclusion of real balances as the role of transaction brings in an interaction between consumption and wealth indirectly through the shadow price of real balance holdings, the shadow price of cash constraints on transactions and the substitution between wealth and real balances. Then, under an appropriate degree of preferences for wealth, there are two saddle-stable steady states separated by a threshold determined by the total wealth-as-status effect. The total wealth-as-status effect depends positively on the initial level of capital. When initial capital is low, the total wealth-as-status effect is smaller than the threshold and the economy moves toward the steady state with a low level of capital. When initial capital is high, the total wealth-as-status effect is large and the economy moves toward the steady state with a high level of capital. As a result, our model establishes multiple steady states without relying on the assumptions of nonlinearities of production or consumption functions at different levels/stages of capital, or heterogeneous agents/savings behavior.

In our model otherwise identical countries except different levels of initial capital per capita end up in different long-run growth regimes. Locally, a monetary policy cannot generate an effect to elude poverty traps. Globally, a sufficiently strong monetary policy may be an instrument in order for an economy in a poverty trap to take off and become wealthy in the long run. Conversely, however, a strong monetary policy in an opposite direction may also lead a wealthy economy to have an irreversible downturn and stagnation. Existing studies paid no attention to this role of monetary policy.[3]

Our local analysis will shed light on the role of the curvature of utility on the local relationship between money/inflation and capital in the long run, an old but ongoing debate made popular by Tobin (1965), Sidrauski (1967), Lucas (1980) and Stockman (1981). Inclusion of wealth as a status device allows us to study how the curvature of wealth relative to the curvature of consumption affects the equilibrium outcome. As will be seen below, our local effect of monetary supply/inflation on capital in the long run depends on the curvature of the utility induced by wealth relative to the curvature of the utility generated by consumption, as compared with a threshold that is affected by the CIA constraint on investment relative to consumption. Most existing studies paid attention to the importance of relative CIA constraints, but not to the role of the relative curvature of utility. Gong and Zou (2001) and Chang and Tsai (2003) considered the wealth effect in a model with a CIA constraint and re-examined the long-run relationship between monetary growth and capital. They found that the long-run relationship between money and capital is dictated by the CIA constraint on investment relative to consumption.[4]

The remainder of this paper is organized as follows. Section 2 sets up a model and studies the optimization and the equilibrium. Section 3 characterizes the steady-state equilibrium in a local and a global analysis. Finally, some concluding remarks are offered in Section 4.

2 The Model

The basic model is based on Friedman (1953), Kurz (1968) and Stockman (1981). The economy consists of a continuum of identical agents, each supplying labor inelastically. The

[3] Monetary policy has been found effective in a liquidity trap. In a dynamic general-equilibrium model with a liquidity trap, Auerbach and Obstfeld (2005) found that large-scale open market purchases of domestic government bonds can achieve a substantial welfare improvement.

[4] While Gong and Zou (2001) uncovered a negative relationship when the CIA constraint on investment relative to consumption was one, Chang and Tsai (2003) found a positive relationship when the CIA constraint on investment relative to consumption was sufficiently smaller than one. They did not pay attentions to the role of the curvature of the utility of wealth. As our findings of local relationships below indicate, the results in Gong and Zou (2001) and Chang and Tsai (2003) are special.

lifetime utility of the representative agent is

$$U = \int_0^{\infty} [u(c) + \beta v(w)]\, e^{-\rho t} dt, \tag{1}$$

where c is the agent's consumption, w is the agent's wealth, $\rho>0$ is the time preference rate and $\beta\geq 0$ is the degree of wealth on the preference relative to consumption. As explained in the Introduction, wealth and preference are connected through many reasons.

Felicity u has a standard strictly increasing and concave property; i.e., $u'(c)>0>u''(c)$. Moreover, felicity v is strictly increasing and concave; i.e., $v'(w)>0\geq v''(w)$. A concave utility of wealth was used in Kurz (1968) and was justified in a model with uncertainty by Robson (1992).[5]

Let $f(k)$ be an individual's output and thus income per capita, with $f(k)$ strictly increasing and strictly concave in capital per capita; i.e., $f'(k)>0>f''(k)$. The representative agent's budget constraint is

$$\dot{k} + \dot{m} = f(k) - c - \pi m - \delta k + T, \tag{2}$$

where π is the inflation rate, δ is the depreciation rate of capital and T is a real transfer per capita from the government. The budget constraint states that income and transfers not spent on consumption are used either to form capital or to hold real balances. Initial capital and nominal money are predetermined. Assume that money grows at a constant rate μ.

Denote I the gross investment per capita. The gross investment net of the depreciation then forms new capital in the way as follows.

$$\dot{k} = I - \delta k. \tag{3}$$

The representative agent faces the following general CIA constraint[6]

$$\varphi_c c + \varphi_I I \leq m,\ \ 0 \leq \varphi_c \leq 1,\ \ 0 \leq \varphi_I \leq 1. \tag{4}$$

The CIA constraint is very general and includes several special cases. (i) If $\varphi_c=1$ and $\varphi_I=0$, only consumption is liquidity constrained as assumed in Clower (1967) and Lucas (1980). (ii) If $\varphi_c=\varphi_I=1$, the CIA constraint on investment relative to consumption is one as employed in Stockman (1981) and Abel (1985). (iii) If $\varphi_c=1$ and $0<\varphi_I\leq 1$, the CIA constraint on investment is smaller than that on consumption as utilized in Wang and Yip (1992) and Palivos et al (1993). As will be seen, even with a general CIA constraint, the CIA constraint on investment relative to consumption will not dictate the long-run relationship between money and capital, except for

[5] Robson (1992) showed that the attitudes to risk in a strictly increasing and concave utility provide a natural explanation of the fundamental phenomenon addressed by Friedman and Savage (1948) that individuals may simultaneously purchase insurance and participate in lotteries.

[6] A general CIA constraint like (4) has been considered in an endogenous growth model by Chen and Guo (2007) in the analysis of local indeterminacy.

either φ_I=0 or φ_c=0. The curvature of the utility of wealth plays a significant role.

In our model, the agent's wealth only includes capital; i.e. $w=k$. Thus, an individual feels more satisfied if the value of houses and other forms of capital he owns is larger. Real balance is another asset in our model. An individual chooses to hold real balances only for the purpose of transactions and not for a store of value in our model. Thus, the agent may not perceive real balances as wealth. It is reasonable not to consider real balances as wealth.[7]

We assume a utility that is separable in consumption and wealth. With this type of utility and a positive discount rate in a model with a neoclassical technology, Bose (1971) showed that there is only a unique steady state. As we will see below, this is not the case when the transaction role of money is introduced. The wealth-as-status effect and the interaction of money and capital lead to multiple steady states.

2.1 Optimization

The representative agent's optimization problem is to maximize the lifetime utility by choosing between consumption, investment and real balances, all of which are subject to the constraints in (2)-(4). Let λ_k>0 and λ_m>0 be the co-state variables associated with capital and real balances, respectively, and ξ>0 be the Lagrange multiplier of the CIA constraint. The necessary conditions are

$$u'(c) = \lambda_m + \xi\varphi_c, \tag{5a}$$

$$\lambda_k = \lambda_m + \xi\varphi_I, \tag{5b}$$

$$\dot{\lambda}_k = (\rho+\delta)\lambda_k - \lambda_m f'(k) - \beta v'(k), \tag{5c}$$

$$\dot{\lambda}_m = (\rho+\pi)\lambda_m - \xi, \tag{5d}$$

and the transversality conditions $\lim_{t\to\infty} e^{-\rho t}\lambda_{kt}k_t = 0$ and $\lim_{t\to\infty} e^{-\rho t}\lambda_{mt}m_t = 0$.

In these conditions, (5a) equalizes the marginal utility of consumption to the marginal cost of consumption, the sum of the shadow price of real balances and the shadow price of the CIA constraint on consumption. Next, in (5b) optimal investment requires no arbitrage between capital and real balances. Thus, the shadow price of capital must equal the shadow price of real balances and the shadow price of the CIA constraint on investment. Finally, conditions (5c) and (5d) are the intertemporal no-arbitrage conditions which govern how each of the two Hamiltonian shadow prices changes over time.

[7] In a working version, we relaxed the assumption and considered real balances as wealth, in addition to capital. The results are qualitatively unchanged.

2.2 Equilibrium

In equilibrium, government real transfers are financed by the increase in monetary supply; thus, $T=\mu m$. The money and the goods markets are both clear; i.e.,

$$\dot{m} = (\mu - \pi)m, \tag{6a}$$

$$\dot{k} = f(k) - c - \delta k . \tag{6b}$$

Perfect-foresight equilibrium is a time path $\{c, m, k, \lambda_k, \lambda_m, \xi, \pi\}$. The path satisfies the agent's optimization, (5a)-(5d), the money and the goods market equilibrium, (6a)-(6b), and the binding CIA constraint (4).[8] Below, we explain how the equilibrium is determined.

First, if we substitute ξ in (5b) into (5a), we obtain

$$\lambda_k = \tfrac{\varphi_I}{\varphi_c} u'(c) + (1 - \tfrac{\varphi_I}{\varphi_c})\lambda_m \equiv \lambda_k(c, \lambda_m). \tag{7a}$$

Next, differentiating (5a) with respect to time, with the use of (5c) and (7a), yields

$$\dot{c} = \tfrac{-1}{u''(c)} \tfrac{\varphi_c}{\varphi_I} [\lambda_m f'(k) + \beta v'(k) - (\rho + \delta)\lambda_k(c, \lambda_m) - (\tfrac{\varphi_I}{\varphi_c} - 1)\dot{\lambda}_m], \tag{7b}$$

which is the Keynes-Ramsey condition.

Moreover, as (3) and (6b) indicate $f(k)=c+I$, the CIA constraint suggests $m=(\varphi_c-\varphi_I)c+\varphi_I f(k)$. If we differentiate this relationship and use (6a), we attain

$$\pi = \mu - \tfrac{(\varphi_c/\varphi_I - 1)\dot{c} + f'(k)\dot{k}}{(\varphi_c/\varphi_I - 1)c + f(k)}.$$

By substituting $\dot{c}$ in (7b) and $\dot{k}$ in (6b), along with $\dot{\lambda}_k$ in (5c) and $\dot{\lambda}_m$ in (5d), the above expression leads to the following relationship

$$\pi = \pi(c, k, \lambda_m). \tag{7c}$$

Finally, substituting ξ in (5b) into (5d), together with (7a) and (7c), yields

$$\dot{\lambda}_m = \lambda_m[\rho + \tfrac{1}{\varphi_I} + \pi(c, k, \lambda_m)] - \tfrac{\lambda_k(c, \lambda_m)}{\varphi_I}. \tag{7d}$$

Thus, the equilibrium system is simplified to three equations, (6b), (7b) and (7d). These equations determine the equilibrium paths of c, k and λ_m. The equilibrium paths of λ_k, ξ, π and m are in turn determined by (7a), (5b), (7c) and (4).

2.3 Steady State

In a steady state, $\dot{c} = \dot{k} = \dot{\lambda}_m = \dot{m} = 0$. Under $\dot{m} = 0$, then (6a) gives inflation as $\pi^* = \mu$.[9]

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[8] Following Lucas (1980) and Stockman (1981), we assume the CIA constraint is binding in equilibrium. In our continuous-time framework, this requires that the monetary growth rate be greater than or equal to the discounted marginal rate of substitution between consumption in two consecutive points in time.

[9] An asterisk is used to denote values in a steady state.

First, under $\dot{k} = 0$, (6b) is

$$f(k^*) - \delta k^* - c^* = 0, \tag{8a}$$

which is the long-run goods market equilibrium condition.

Next, if we substitute the expression in (7a), $\dot{c} = 0$ in (7b) becomes

$$\{(\rho+\delta)[1+\varphi_I(\rho+\mu)] - f'(k^*)\}\lambda_m(c^*) = \beta v'(k^*), \tag{8b}$$

in which, with the use of (7a) and $\dot{\lambda}_m = 0$ in (7d), $\lambda_m(c^*)$ is

$$\lambda_m(c^*) \equiv \tfrac{u'(c^*)}{1+(\rho+\mu)\varphi_c}. \tag{9}$$

As $v'>0$ and $\lambda_m>0$, consistency in (8b) requires

$$f'(k^*) < (\rho+\delta)[1+\varphi_I(\rho+\mu)].$$

which is a variant of the Brock-Gale condition that requires the marginal product of capital to be dominated by the sum of the time-preference and the discount rates in a steady state.

Equations (8a) and (8b) simultaneously determine the values of k^* and c^* in a steady state. In a (k, c) plane, it is easy to show that the $\dot{k} = 0$ locus is positively sloping for all k such that $f'(k)>\delta$ and negatively sloping for all k such that $f'(k)<\delta$.

For the shape of the $\dot{c} = 0$ locus, there are two cases with and without a wealth effect.

Case 1. $\beta=0$.

In this case, there is no status effect. Now, $\dot{c} = 0$ becomes

$$(\rho+\delta) - f'(k^*) + \varphi_I(\rho+\delta)(\rho+\mu) = 0. \tag{10a}$$

Then, the $\dot{c} = 0$ locus is a vertical line in the (k, c) plane. Obviously, there is a unique steady state. See E_3 in Figure 1.

[Insert Figure 1 here]

Case 2. $\beta>0$.

In this case, $\dot{c} = 0$ becomes

$$(\rho+\delta) - f'(k^*) + \varphi_I(\rho+\delta)(\rho+\mu) = \tfrac{\beta v'(k^*)}{u'(c^*)}[1+\varphi_c(\rho+\mu)]. \tag{10b}$$

It is easy to show the lefthand side of (10b) is increasing in k, while the righthand side of (10b) is decreasing in k and increasing in c. Thus, the $\dot{c} = 0$ locus is positively sloping in the (k, c) plane. As a result, there may be multiple steady states, as illustrated by E_1, E_2 and E_3.

For the three steady states in Figure 1, E_2 is a source, while E_1 and E_3 are saddles and are thus locally stable. See an appendix for proof. If the initial level of capital is above k_2, the economy will converge to E_3 in a steady state. The economy becomes wealthy. Alternatively, if the initial level of capital is below k_2, the economy will converge toward E_1 in a steady state, and thus a poverty trap. There are thus multiple growth regimes and the initial history determines its eventual fate. Otherwise identical economies become poor or wealthy in the long run depending on the initial conditions. There is a set of countries in poverty traps along with another set of countries in rich clubs.

In the case without a CIA constraint, $\xi=0$. As wealth does not include real balances in our model, money has no utility and thus $\lambda_m=0$. Our model without money is reduced to that of Kurz (1968). Bose (1971) showed that in the Kurz (1968) model where the utility is non-separable in consumption and wealth, there was a unique steady state if the effect of wealth on the marginal utility of consumption was sufficiently small.[10] As the utility is separable in c and k in our model, the effect of wealth on the marginal utility of consumption is zero and there is thus a unique steady state. Even with a separable utility in our model, the inclusion of the transaction role of money brings in an interaction between consumption and wealth. The interaction is made possible indirectly through the shadow price of cash constraints on transactions ($\xi>0$), the shadow price of real balance holdings ($\lambda_m>0$) and the substitution between capital and real balances. As a result of the interaction between capital and real balances, our model establishes three steady states in a utility that is separable in consumption and wealth.[11]

The mechanism for multiple growth regimes here is the *internal* status effect in a concave utility. Intuitively, the representative agent obtains utility form holding wealth in a concave fashion in a similar way to what consumption gives utility. On optimality in the Keynes-Ramsey condition, a higher level of consumption comes with a higher level of wealth. If an agent chooses to accumulate more capital, the marginal utility of wealth goes down. This raises the growth rate of the shadow price of capital in terms of consumption (cf. (5c)). The representative agent needs to increase the level of consumption so the shadow price of capital in terms of consumption decreases to a constant in a steady state (cf. (5a) and (5b)). As a result, when an agent optimally chooses to hold more capital, he will choose to consume more.

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[10] Multiple steady states may be obtained in models with a utility non-separable in consumption flows and durable good stock, as shown in Shimomura (2004) and Bond and Driskill (2007) in two-sector, two-country models without capital. Their result of multiple steady states also requires a negative cross-partial derivative of durable goods on the marginal utility of consumption is negative; i.e., a negative income effect of durable goods.

[11] Chang, et al (2000, p. 544) made an appendix noting the possibility of multiple equilibria but left unexploited by focusing on the long-run local relationship between money and capital in a setting with CIA constraint on consumption only. Gong and Zou (2001, p. 290) made a footnote about the possibility of multiple equilibria but ruled it out by restricting to a class of utility so only one steady state is a saddle and the other two are sources.

In our paper, a standard monetary growth model with a wealth-as-status effect in a concave utility establishes multiple growth regimes and initial conditions determine the steady state. Our mechanism is different from and complements to those in existing literature that established multiple growth regimes based working hypotheses in differences in initial conditions (e.g., Azariadis and Drazen, 1990; Galor and Weil, 2000).[12] Existing studies in this line of research incorporate some forms of market imperfections or heterogeneities, which generate multiple steady states. Among the additional assumptions, external effects in technologies were made in some studies (e.g., Krugman, 1987; Azariadis and Drazen, 1990), while heterogeneous agents/savings behavior were assumed in others (e.g., Galor and Ryder, 1989; Galor, 1992, 1996). Some other works assumed imperfect capital market (e.g., Galor and Zeira, 1993; Benabou, 1996), imperfect financial intermediations (Cooper and Ejarque, 1995; Becsi, et al., 1999), and binding subsistence consumption constraint at a low initial level of capital (e.g., Galor and Weil, 2000). Other than the cash-in-advance constraint due to the transaction purpose, there is no heterogeneity and no market imperfection in our model, yet the resulting equilibrium capital/wealth distribution may be inefficient.

With the emergence of a poverty trap like E_1 in Figure 1, it is interesting to investigate policies in order to help the economy out of the trap and take off. Although monetary policies have been found to be effective in a liquidity trap in Auerbach and Obstfeld (2005), attention has never been paid to their role as a mechanism for a takeoff from a development trap. We investigate such a possibility in Section 3.

2.4 A Numerical Example

Before we characterize multiple growth regimes, we now offer a numerical example to illustrate our results. The technology takes the Cobb-Douglas form, $f(k)=Ak^{\eta}$. We take $u(c)=[c^{(1-\sigma)}-1]/(1-\sigma)$; the utility of consumption has a constant intertemporal elasticity of consumption that is consistent with economic growth. The parameters are set at $\sigma=1.5$, $\rho=0.04$, $A=0.3$, $\eta=0.6$, $\delta=0.05$, $\varphi_c=\varphi_I=1$and $\mu=200\%$.[13] We will consider two function forms for the wealth-as-status utility $v(k)$ as follows.

First, we consider a quasi-linear utility of the form $u(c)+\beta k$ and thus, $v(k)=k$. According to Varian (1992, P.165), such a quasi-linear utility indicates that consumption has only a price effect

[12] There are two other hypotheses: differences in one or more fundamental aggregate features (e.g., Barro and Sala-i-Martin, 1995; Mankiw et al., 1992), and differences in expectations (Matsuyama, 1991; Chen and Shimomura, 1998). See a survey by Azariadis (1996).

[13] We use a capital share $\eta=0.6$ on reasons as follows. A capital share between 0.3-0.6 for 20 OECD economies in 1960-2000 has been documented by Jones (2003). Moreover, if it is broadly interpreted, capital includes both physical as well as human capital.

and capital has only an income effect. Under this utility function, when β=0, there is no wealth-as-status effect and our model is a standard growth model with a CIA constraint as studied by Stockman (1981). In this case, there is a unique steady state at k=0.3511. When there is a positive but small wealth-as-status effect, the steady state remains unique with a higher capital per capita. Our exercises show that the number of steady states remains unique for the value of β below 0.099. When the value of β is in [0.099, 0.246], there are three steady states with a low level of capital and a high level of capital that are both saddles and a middle level of capital that is a source.[14] For example, at β=0.1, the three steady states are k_1=0.4201, k_2=17.7936 and k_3=26.4461, with k_1 and k_3 locally stable while k_2 a source. When the value of β is above 0.246, the steady state is unique. For example, the unique steady-state capital is k=62.1790 when β=0.247.

Next, it is possible that a wealth-as–status utility has a substitution effect. We consider the utility function $u(c)+\beta ln(k)$ and thus, $v(k)=ln(k)$. Under this utility function, when β=0, there is a unique steady state at k=0.3511. When the value of β is in [0.177, 0.252], there are three steady states with a low level of capital and a high level of capital that are both saddles and a middle level of capital that is a source.[15] At β=0.2, for example, k_1=0.6392, k_2=5.7617 and k_3=29.0604 are the three steady states with k_1 and k_3 locally stable while k_2 a source. When the value of β is above 0.252, the steady state is unique. For example, the unique steady-state capital is k=40.6000 when β=0.253.

Our numerical exercises suggest that when there is no or a very small degree of wealth-as-status effect, the level of capital is unique and very low in steady state. The reason is that an agent does not care or cares very little about his wealth status. His incentive to accumulate capital is little and therefore, regardless of the initial capital, the economy moves toward a low level of capital stock in a steady state. When the degree of wealth-as-status effect is a sufficiently high, the agent cares a lot about his wealth status and has a lot of incentive to accumulate capital; therefore, no matter what the initial capital is, the economy moves toward a high level of capital stock in a steady state.

However, when the wealth-as-status effect is not that high that lies in between the two regions, there are two saddle-stable steady state separated by a threshold determined by the total

[14] With this utility, our exercises show that when $0.099 \leq \beta \leq 0.246$, there are always three steady states for all other parameters varying in the following ranges: $0.3 \leq A \leq 0.38$, $0.03 \leq \delta \leq 0.05$, $0.017 \leq \rho \leq 0.044$, $0.98 \leq \varphi_c \leq 1$ and $0.6 \leq \varphi_I \leq 1$.

[15] With this utility, our quantitative results indicate that when $0.177 \leq \beta \leq 0.252$, there are always three steady states for all other parameters varying in the following ranges: $0.29 \leq A \leq 0.32$, $0.044 \leq \delta \leq 0.052$, $0.032 \leq \rho \leq 0.049$, $0.83 \leq \varphi_c \leq 1$ and $0.87 \leq \varphi_I \leq 1$.

wealth-as-status effect. The total wealth effect depends positively on the initial level of capital. When initial capital is low, the total wealth-as-status effect is smaller than the threshold. The economy moves toward the steady state with a low level of capital. Alternatively, when the initial level of capital is so high, the total wealth-as-status effect is larger than the threshold and the economy moves toward the steady state with a high level of capital.

3. Characterization of Equilibrium

Suppose that there are multiple steady states and the initial steady-state equilibrium is at E_1 in Figure 1. Implicitly we assume that the initially endowed capital per capita is below the level of k_2 in Figure 1. As a result, the economy ends up in a poverty trap at E_1. We analyze the effects of monetary growth on capital accumulation in the long run. We start by a local analysis, followed by a global analysis.

3.1 Local Analysis

When the monetary growth rate is increased (i.e., a higher μ) and thus inflation is increased, the $\dot{k}=0$ locus is not affected. However, holding c constant, the $\dot{c}=0$ locus is shifted in the direction of k as follows.

$$\left.\frac{\partial k}{\partial \mu}\right|_{\dot{c}=0} = \frac{1}{\Omega}[\varphi_I(\rho+\delta)-\varphi_c \frac{\beta v'}{u'}] \underset{\geq}{\leq} 0 \;\; if \;\; \frac{v'}{u'} \underset{\geq}{\leq} \frac{\varphi_I}{\varphi_c}\frac{\rho+\delta}{\beta} \equiv \hat{\xi}, \tag{11}$$

where $\Omega \equiv f'' + \frac{\beta v''}{u'}[1+\varphi_c(\rho+\mu)] < 0.$

Obviously, the $\dot{c}=0$ locus may shift leftward or rightward. If the $\dot{c}=0$ locus shifts leftward, capital decreases in the long run (see $E_1^{'}$ in Figure 2). Alternatively, if the $\dot{c}=0$ locus shifts rightward, capital increases in the long run (see $E_1^{''}$ in Figure 2).

[Insert Figure 2 here]

Whether the $\dot{c}=0$ locus shifts leftward or rightward depends on the ratio of the marginal utility of wealth to the marginal utility of consumption, v'/u', as compared to a threshold, $\hat{\xi}$. Thus, given the threshold, the curvature of the utility induced by wealth relative to the curvature of the utility generated by consumption is crucial in the determination of the long-run effect of monetary supply on capital.

In the situation where the marginal utility of wealth is sufficiently large relative to the marginal utility of consumption, a higher monetary growth rate leads the agent to substitute away from consumption toward investment. As a result, the level of capital is larger in the long run. Intuitively, when the marginal utility of wealth is sufficiently large relative to the marginal utility of consumption, in response to a higher monetary growth rate and thus a lower real balance the representative agent lower consumption and raise investment in order to decrease the marginal utility of wealth. Alternatively, under the condition where the marginal utility of wealth is sufficiently small relative to the marginal utility of consumption, consumption goes up and investment goes down in response to a higher growth rate of monetary supply. Thus, capital is reduced in the long run.

In characterizing the threshold, it decreases in the degree of wealth on the preference relative to consumption and increases in the liquidity constraint on investment relative to consumption. For a given positive degree of wealth on the preference relative to consumption (i.e., $\beta>0$), a higher CIA constraint on investment relative to consumption (i.e., higher φ_I/φ_c) raises the threshold and thus lowers the likelihood of a positive effect of money on capital accumulation. A smaller CIA constraint on investment relative to consumption (i.e., lower φ_I/φ_c) decreases the threshold, and thus increases the likelihood of a positive effect of money on capital accumulation. There are some special cases.

1 $\varphi_c=1$, $\varphi_I=0$: (Lucas, 1980) then (11) becomes $-\beta v'/(\Omega u')>0$ if $v'>0$.

2 $\varphi_c=1$, $\varphi_I=1$: (Stockman, 1981) then (11) becomes $(\rho+\delta-\beta v'/u')/\Omega\leq(\geq)0$ if $v'\leq 0(v'/u'\geq(\rho+\delta)/\beta)$.

3 $\varphi_c=1$, $\varphi_I<1$: (Wang and Yip, 1992) then (11) becomes $[\varphi_I(\rho+\delta)-\beta v'/u']/\Omega\leq(\geq)0$ if $v'\leq 0(v'/u'\geq [\varphi_I(\rho+\delta)/\beta])$.

4 $\varphi_c=0$, $\varphi_I=1$: then (11) becomes $\varphi_I(\rho+\delta)/\Omega<0$.

Only two stringent cases is the relationship unambiguously determined: $\varphi_I=0$ and $\varphi_c=0$. The relationship between money and capital is unambiguously positive in the case when $\varphi_I=0$, while the relationship is unambiguously negative in the case when $\varphi_c=0$. With a wealth effect, our results suggest neither the outcome of a neutral relationship between monetary growth and capital when $\varphi_c>1$ and $\varphi_I=0$, as conceived by Lucas (1980), nor the outcome of a positive relationship between monetary growth and capital when $\varphi_I/\varphi_c>0$ is very small and close to 0, as posited by Gong and Zou (2001), nor the conclusion of a negative relationship between monetary growth and capital when φ_I/φ_c is 1 or close to 1, as put forward by Stockman (1981), Wang and Yip (1992) and Chang and Tsai (2003). The curvature of the utility of wealth relative to consumption is important in the determination of the long-run relationship between money and capital when there is a wealth effect.

Given a threshold, the relationship between the long-run effect of monetary growth on capital and the ratio of the marginal utility of wealth to the marginal utility of consumption is thus positive (Figure 3). The relationship shifts upward if β is higher and downward if φ_I/φ_c is larger.

[Insert Figure 3 here]

3.2 Global Analysis

In the former subsection, the effect of a monetary policy is local. As a result, starting from a poverty trap and with a monetary policy, the economy remains in the poverty trap. However, a monetary policy could boost a global effect as analyzed below.

Suppose that in the neighborhood of a poverty trap (E_1 in Figure 4), the marginal utility of wealth relative to the marginal utility of consumption is larger than threshold $\hat{\xi}$. Now, suppose that the monetary growth rate is increased. If the growth rate of money is increased sufficiently strong the $\dot{c}=0$ locus may shift rightward so much so that the only steady state is at E_3'. The economy eventually joins the rich-country club. Intuitively, because of high inflation, real balances are reduced sufficiently and are substituted away from consumption and toward capital sufficiently. The equilibrium then moves gradually from E_1 and eventually toward E_3'. The economy under study therefore takes off from a poverty trap and becomes prosperous.

[Insert Figure 4 here]

Alternatively, suppose that the marginal utility of wealth relative to the marginal utility of consumption is smaller than threshold $\hat{\xi}$. Now, the marginal utility of wealth is relatively smaller than the marginal utility of consumption. Thus, if the growth rate of money is reduced sufficiently, the $\dot{c}=0$ locus may shift rightward. Then, the only steady state is E_3'. As a result, the level of capital increases from initial k_1 toward k_3'. This situation often emerges in an economy where credit markets are imperfect and new currencies are issued to stop hyperinflation.

3.3 A Numerical Example

Using the numerical example in Section 2.4, under the quasi-linear utility, at β=0.1, there are two steady states that are saddles, k_1=0.4201 and k_3=26.4461, separated by the steady state that is a source, k_2=17.7936. If the central bank increases the growth rate of monetary supply to μ=210%, the two saddle points corresponding to k_1 and k_3 are decreased locally. Alternatively, if the growth rate of money is decreased to μ=190%, capital per capita is increased locally.[16] See Table 1. In Table 1, we also quantify changes in other parameter values that have only local effects.

[Insert Table 1 here]

Now, suppose that the government changes monetary supply sufficiently strong by reducing

[16] Capital per capita increases to k_2=19.1947 under μ=210% and decreases to k_2=16.6699 under μ=190%. Yet, k_2 is unstable and thus the equilibrium will diverge from it.

the growth rate of money from μ=200% to μ=50%.[17] Then, there is only one steady state with k_3=40.6170. If the growth rate of money is tightened to μ=20%, then capital is increased further to k_3=44.7364. Sufficiently tight monetary policy thus causes a big push.

Alternatively, suppose that the central bank changes monetary supply sufficiently by increasing the growth rate of money from μ=200% to μ=300%.[18] In this case, there is only a steady state with k_1=0.1888. If the economy is originally at k_3, then loosening money supply too much brings about a big downturn and stagnation.

For a robustness check, we investigate the alternative case with the wealth-as-status utility with a substitution effect. At β=0.2, there are two steady states that are saddles, k_1=0.6392 and k_3=29.0604, separated by the steady state that is a source, k_2=5.7617. If the central bank increases the growth rate of monetary supply to μ=210%, the two saddle points corresponding to k_1 and k_3 are decreased locally. Alternatively, if the growth rate of money is decreased to μ=190%, capital per capita is increased locally.[19] See Table 2.

[Insert Table 2 here]

When the government changes monetary supply sufficiently strong by reducing the growth rate of money from μ=200% to μ=100%. Then, there is only one steady state with k_3=34.5155. Alternatively, if the central bank changes the growth rate of monetary supply sufficiently by increasing the growth rate of money from μ=200% to μ=500%, there is only a steady state with k_1=0.0723.[20]

To summarize quantitative effects, a sufficiently strong monetary policy may be an instrument in order for an economy in a poverty trap to take off and become wealthy in the long run. However a strong monetary policy in an opposite direction may also lead a wealthy economy to have an irreversible downturn and stagnation.

3.4 Some Experiences

In this subsection, we use some experiences in East Asia and Latin America to shed lights on the role of monetary policies in economic development. To illustrate, successful takeoffs have been made in several East Asian economies where the “four tigers” (Hong Kong, Singapore,

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[17] The threshold is μ=82%, at and below which there is only a steady state.

[18] The threshold is μ=219%, at and above which there is only a steady state.

[19] Capital per capita increases to k_2=6.2004 under μ=210% and decreases to k_2=5.2907 under μ=190%. Yet, k_2 is unstable and thus the equilibrium will diverge from it.

[20] The threshold is μ=152%, at and below which there is only a steady state and μ=475%, at and above which there is only a steady state.

S. Korea and Taiwan) have joined the rich-country club and now so too with China. One example was the experiences of Taiwan during 1945-1952 when Taiwan was poverty stricken. During this period the monetary supply was used as the inflationary taxes with over 70% of the revenue remitted to the government or its enterprises. As a result, the monthly inflation rate of whole sale prices was over 16.5%, or equivalently over 500% per annum.[21] Several actions were taken in order to stabilize the economy at the end of 1949. In particular, the old currency was replaced by a new currency and the growth of monetary supply was strictly controlled. Thus, if the curvature of utility in the Taiwan economy is akin to point B in Figure 3, then by tightening the monetary growth rate sufficiently the locus $\dot{c}=0$ shifts rightward. Moreover, by issuing new currencies, people are more willing to hold currency. As a result of these policies, people in Taiwan held currency for longer periods and were more willing to deposit their money in banks.[22] In the decades that followed, the Taiwan economy stabilized, grew rapidly by the 1960s and became industrialized in the 2000s.

On the contrary, an expansionary monetary policy has driven an initially rich country to stagnation as experienced in some Latin American countries in the post-WWII era. This outcome is especially obvious in Argentine which experienced an unprecedented boom since the turn of the twentieth century but was persistently retardated after WWII.[23] Along with other policies, Argentina had a high growth rate of money supply that led to high inflation for long periods. The annual inflation rate was 30.3% in 1950-59, 23.3% in 1960-69, 132.3% in 1970-79 and 750.4% in 1980-89.[24] Such high rates of inflation lead the economy originally at equilibrium with high income at E_3 to move to $E_1^{'}$ (in Figure 4). An irreversible big downturn and stagnation thus emerges. Capital is de-accumulated and the economy is in a poverty trap.

4 Concluding Remarks

In order to explain why many countries are in poverty traps and there are multiple growth

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[21] See Tsiang (1980) and Makinen and Woodward (1989) for accounts of hyperinflation in Taiwan. Korea had a similar experience during 1945-48, with an average monthly inflation rate over 11.1%, or equivalently over 250% per annum. See Campbell and Tullock (1957) and Kim and Kim (1996) for accounts of South Korean hyperinflation.

[22] These were accompanied by the policy of a "Preferential Interest Rate" (at 7% per month or 125% per annum) established for time deposits and the outward-looking, export-expansion policy.

[23] According to Taylor (1994, Table 1), Argentina used to have more than 75% of average GDP per capita of 28 OECD countries before WWII, but declined to 65% by 1950 and further to 32% by 1987.

[24] These numbers are taken from Cavallo (1996), a former minister of Economy and Public Works, Republic of Argentina. The monetary policy came with the inward-looking, import-substitution policy and nationalist government before 1970 and the external debt policy in 1979-1982. See detailed accounts in Diaz-Alejandro (1984) for Latin American debt.

regimes, several working hypotheses are proposed in the literature. Among these is the one based upon initial conditions. Existing studies whose working hypotheses are initial conditions also rely on other assumptions such as nonlinearities of production or consumption functions at different levels/stages of capital and heterogeneous agents/savings behavior. Using a standard optimal growth, this paper obtains insights on multiple growth regimes based on initial conditions without dependence on these additional assumptions.

Our model departs by considering a status effect represented by wealth. The wealth effect has been used to analyze individuals' choice and dates back to Friedman (1953). With a wealth effect, the resulting equilibrium distribution is characterized by a group with a lower level of income and another group with a higher level of income. Thus, otherwise identical economies end up in different convergence clubs if the initial levels of capital are different.

We characterize monetary policies as an instrument for a takeoff. Locally, monetary policies only have a small effect and countries in poverty traps remain poor. Globally, a sufficiently strong monetary policy may be used as an instrument in order for an economy in a poverty trap to take off and becomes wealthy in the long run. Alternatively, however, a strong monetary policy in a contrary direction may also lead a wealthy economy to fall behind and even stagnate. We offered experiences in Taiwan that have taken off using a sufficiently tightening monetary supply in the late 1940s and the early 1950s. We also provided experiences in Argentina that have fallen behind in the post WWII era, especially after 1970, because of too loose monetary policies.

Our model also sheds light on the local relationship between money/inflation and capital in the long run. Although very general CIA constraints on investment relative to consumption are considered, the local relationship between money/inflation and capital in the long run is not determined by the relative CIA constraint and thus different from the findings offered by existing studies. Given a CIA constraint on investment relative to consumption, the local relationship between money/inflation and capital is determined by the curvature of utility between wealth and consumption.

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Appendix: The local stability property of the model is proved as follows.

The equilibrium dynamic system, (6b), (7b), and (7d), involves one variable whose initial value is predetermined and two control variables which may adjust instantaneously. A steady state is a saddle and thus, the dynamic equilibrium path toward the steady state is unique, if the characteristic function associated the equilibrium dynamic system has only one negative eigenvalue; the dynamic equilibrium path diverges from the steady state if there is no negative eigenvalue.

If we take Taylor's expansion of the dynamic system (6b), (7b), and (7d) in the neighborhood of a steady state, we obtain

$$\begin{bmatrix} \dot{c} \\ \dot{k} \\ \dot{\lambda}_m \end{bmatrix} = \begin{bmatrix} J_{11} & J_{12} & J_{13} \\ -1 & J_{22} & 0 \\ J_{31} & J_{32} & J_{33} \end{bmatrix} \begin{bmatrix} c - c^* \\ k - k^* \\ \lambda_m - \lambda_m^* \end{bmatrix}, \tag{A1}$$

where $J_{11} = \frac{1}{u''(c^*)}(1 - \frac{\varphi_c}{\varphi_I})J_{31} + \rho + \delta$,

$$J_{12} = \frac{1}{u''(c^*)}[(1 - \frac{\varphi_c}{\varphi_I})J_{32} - \frac{\varphi_c}{\varphi_I}\lambda_m f''(k^*) - \frac{\varphi_c}{\varphi_I}\beta v''(k^*)],$$

$$J_{13} = \frac{1}{u''(c^*)}[(1 - \frac{\varphi_c}{\varphi_I})J_{33} + \frac{(\rho+\delta)(\varphi_c - \varphi_I)}{\varphi_I} - \frac{\varphi_c}{\varphi_I} f'(k^*)],$$

$$J_{22} = f'(k^*) - \delta,$$

$$J_{31} = -[1 + \frac{\lambda_m^*(\varphi_c - \varphi_I)^2}{x^* u''(c^*)\varphi_I}][\frac{u''(c^*)}{\varphi_c}] - \frac{\lambda_m^*(\varphi_c - \varphi_I)(\rho+\delta)}{x^*} + \frac{\lambda_m^* \varphi_I f'(k^*)}{x^*},$$

$$J_{32} = \frac{\lambda_m^*(\varphi_c - \varphi_I)\varphi_c\{f''(k^*)\lambda_m^* + \beta v''(k^*)\}}{x^* u''(c^*)\varphi_I} - \frac{\lambda_m^* \varphi_I f'(k^*)[f'(k^*) - \delta]}{x^*},$$

$$J_{33} = (\rho + \mu + \frac{1}{\varphi_c})[1 + \frac{\lambda_m^*(\varphi_c - \varphi_I)^2}{x^* u''(c^*)\varphi_I}] - \frac{\lambda_m^*(\varphi_c - \varphi_I)\varphi_c}{x^* u''(c^*)\varphi_I}[(\rho + \delta)(1 - \frac{\varphi_I}{\varphi_c}) - f'(k^*)],$$

$$x^* = (\varphi_c - \varphi_I)c^* + \varphi_I f(k^*) + \tfrac{(\varphi_c - \varphi_I)\lambda_m^*}{u''(c^*)}(1 - \tfrac{\varphi_c}{\varphi_I}),$$

$$z^* = \mu[(\varphi_c - \varphi_I)c^* + \varphi_I f(k^*)] - \tfrac{(\varphi_c - \varphi_I)}{u''(c^*)}(1 - \tfrac{\varphi_c}{\varphi_I})[(\rho + \tfrac{1}{\varphi_I})\lambda_m^* - \tfrac{\lambda_k^*}{\varphi_I}].$$

The determinant of the Jacobean matrix in (A1), denoted as *Det J*, is

$$DetJ = [f'(k^*) - \delta](J_{11}J_{33} - J_{13}J_{31}) + J_{12}J_{33} - J_{13}J_{32} = \tfrac{1}{u''(c^*)}\tfrac{\varphi_c}{\varphi_I}[1 + \tfrac{\lambda_m^*(\varphi_c - \varphi_I)^2}{x^* u''(c^*)\varphi_I}]\{\Phi\} \underset{>}{\overset{<}{}} 0 \text{ if } \Phi \underset{<}{\overset{>}{}} 0,$$

where $\Phi \equiv \tfrac{u''(c^*)[f'(k^*)-\delta]}{\varphi_c}[(\rho+\delta)(\varphi_I(\rho+\mu)+1) - f'(k^*)] - f''(k^*)\lambda_m^*(\rho+\mu+\tfrac{1}{\varphi_c}) - \beta v''(k^*)[\rho+\mu+\tfrac{1}{\varphi_c}].$

Differentiating (8b) or (10b) with respect to *c* and *k* obtains a positive slope as follows,

$$\left.\tfrac{dc}{dk}\right|_{\dot{c}=0} = \tfrac{\Xi}{\Gamma} > 0, \tag{A2}$$

where $\Gamma \equiv \beta[u''(c^*)\tfrac{v'(k^*)}{u'(c^*)^2}]\{1 + \varphi_c(\rho + \mu)\} < 0,$

$\Xi \equiv f''(k^*) + \beta v''(k^*)\tfrac{1}{u'(c^*)}\{1 + \varphi_c(\rho + \mu)\} < 0.$

Differentiating (8a) with respect to *c* and *k* obtains

$$\left.\tfrac{dc}{dk}\right|_{\dot{k}=0} = f'(k) - \delta > 0, \tag{A3}$$

which is also positively sloping.

First, for the steady states E_1 and E_3 in Figure 1, the slope of the $\dot{c} = 0$ locus is lager than the slope of the $\dot{k} = 0$ locus. This indicates the following condition: $\Xi<[f'(k^*)-\delta]\Gamma$. Using the relationship in (8a), this condition is exactly the same as $\Phi>0$. Therefore, *Det J*<0 for the steady states E_1 and E_3 in Figure 1 which indicates one or three negative eigenvalues for the steady states E_1 and E_3. Moreover, the trace of the Jacobean in (A1) is positive,

$$\text{Trace } J = J_{11} + J_{22} + J_{33} = [\rho + \mu + \tfrac{1}{\varphi_I} + f'(k^*)][1 + \tfrac{\lambda_m^*(\varphi_c - \varphi_I)^2}{x^* u''(c^*)\varphi_I}] + \rho > 0, \tag{A4}$$

which rules out the possibility of three negative eigenvalues. As a result, the steady states E_1 and E_3 are saddle.

Second, for the steady states E_2 in Figure 1, the slope of the $\dot{c} = 0$ locus is smaller than the slope of the $\dot{k} = 0$ locus. This indicates the condition of $\Xi>[f'(k^*)-\delta]\Gamma$ which implies $\Phi<0$ and thus *Det J*>0. There are either zero or two negative eigenvalues for the steady state E_2. As Trace *J*>0 according to (A4), a zero negative eigenvalue and two negative eigenvalues are both possible. Thus, E_2 is be a source when there is a zero negative eigenvalue. Theoretically, we cannot rule out the possibility of a sink, but in our quantitative exercises, E_2 is always a source.

Table 1. Quantitative effects when agent's utility of wealth is linear

	k_1	k_3	local effects on k
benchmark	0.420130	26.44609	
μ=210%	0.382120	25.05868	decrease
μ=190%	0.464060	27.55203	increase
μ=50%	disappear	40.61702	big push
μ=300%	0.188794	disappear	big downturn
A=0.31	0.469782	40.28249	increase
δ=0.045	0.509601	58.57841	increase
φ_c=0.99	0.419512	25.12851	decrease
φ_I=0.99	0.429223	27.68178	increase
ρ=0.035	0.508941	33.52673	increase

Parameters: β=0.1, ρ=0.04, σ=1.5, θ=0.2, A=0.3, η=0.6, δ=0.05, φ_c=φ_I=1 and μ=2.

Table 2. Quantitative effects when agent's utility of wealth is logarithmic

	k_1	k_3	local effects on k
benchmark	0.639211	29.06037	
μ=210%	0.559793	28.63545	decrease
μ=190%	0.740150	29.50058	increase
μ=100%	disappear	34.51546	big push
μ=500%	0.072307	disappear	big downturn
A=0.31	0.808665	37.93911	increase
δ=0.045	0.995765	52.74239	increase
φ_c=0.99	0.634362	28.62620	decrease
φ_I=0.99	0.663125	29.57077	increase
ρ=0.035	0.931869	33.04341	increase

Parameters: β=0.2, ρ=0.04, σ=1.5, θ=0.2, A=0.3, η=0.6, δ=0.05, φ_c=φ_I=1 and μ=2.

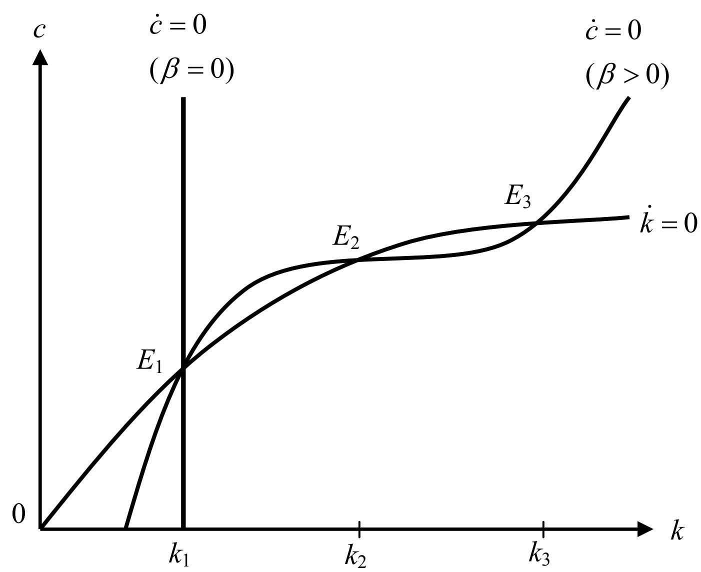

Figure 1. Multiple steady states

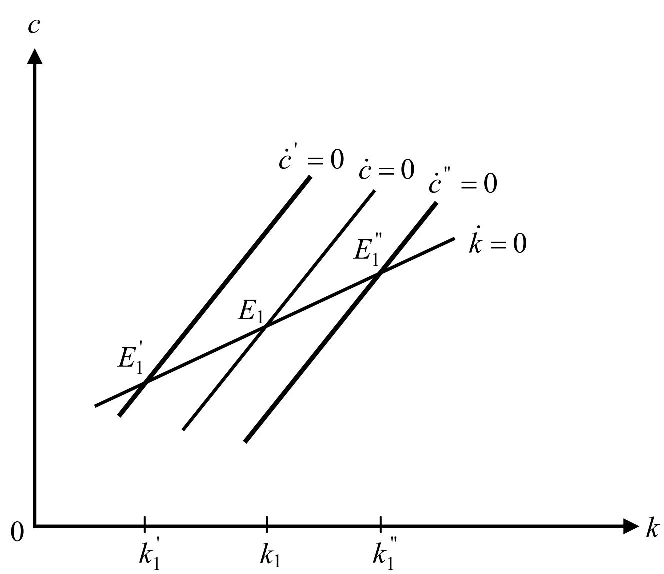

Figure 2. Local effects of inflation

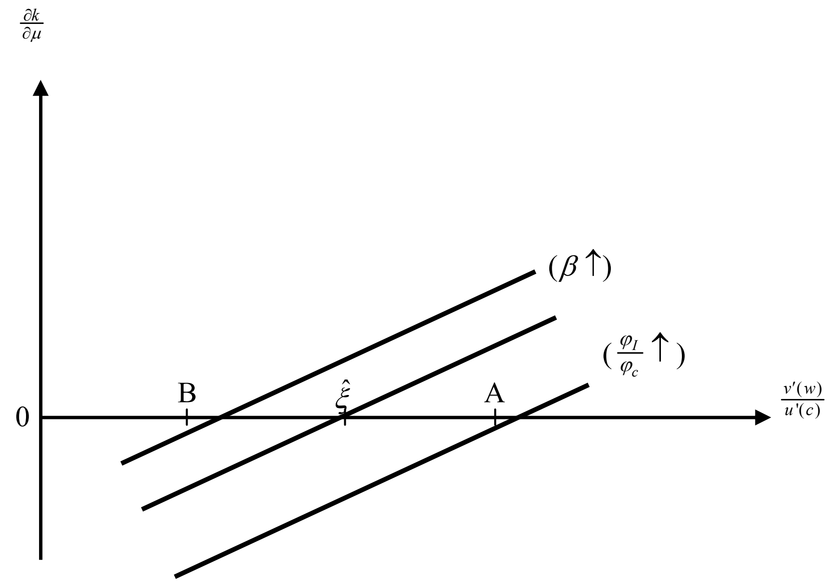

Figure 3. Wealth effect and the effects of inflation

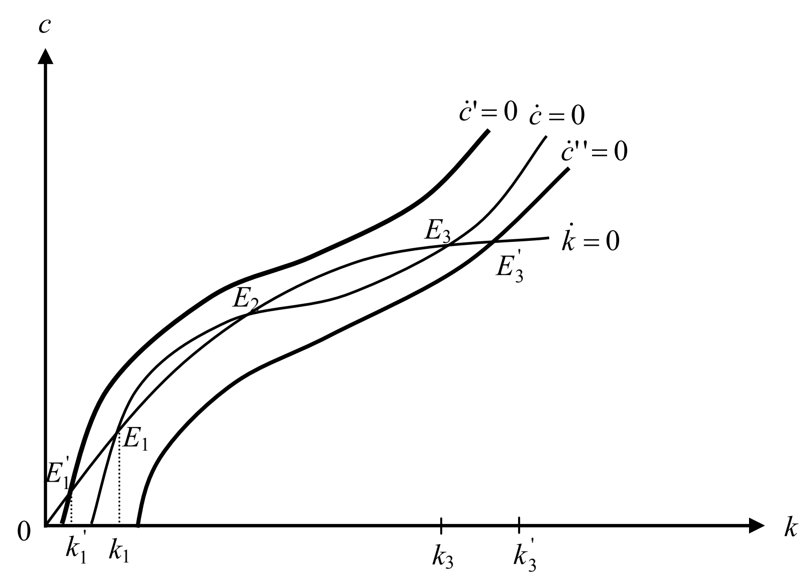

Figure 4. Global effect of inflation: a trap or a big push