Fundamental Paper Wealth and Monetary Policy*

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Abstract

This paper articulates three insights regarding asset prices and monetary policy: (1) Asset price appreciation due to monetary expansion, despite its "paper" wealth nature, tends to make current consumers as a whole wealthier; (2) the wealth effect of monetary policy (on consumption) is negatively correlated with Tobin's q effect (on investment), which positively depends on investment elasticity; and (3) the soundness of asset market performances does not depend on whether they are fundamental or not, but on their compatibility with the AD-AS balance in the long run. These basic insights and their implications reveal some limitations of monetary policy as a stabilization policy, clarify some misperceptions on fundamental asset prices, and provide a rationale for monetary policy to react directly to asset market performances.

1. Introduction

The impressive stock market booms in the United States (U.S.) during the 1990s have led to an entire body of literature as well as general discussion on the relationship between asset prices and monetary policy, in which we find three issues related to "fundamental paper wealth"—a concept we will define in the following—deserve some in-depth examination.

One issue is regarding the wealth effect (on consumption) of monetary policy. It seems straightforward that monetary expansion tends to cause asset price appreciation (by lowering the interest rate level) and hence increase the wealth of consumers who will accordingly increase their consumption.[1] However, as pointed out by Gramlich (2001), if asset price appreciation is merely the result of a decline in the interest rate (as the discount factor), "households are not expecting higher future returns but are simply discounting the same stream of returns at a different rate, so it is less clear that they are truly better off and should increase their consumption".

In essence, Gramlich wonders how a change in "paper wealth" (induced by monetary policy) affects consumption. The term "paper wealth (change)" is often used to describe changes in asset value for reasons other than changes in asset's underlying earnings (e.g. asset price bubbles). Since interest-rate-induced asset value variations are usually not taken as bubbles but as fundamental asset revaluations, we will call them as changes in "fundamental paper wealth" (FPW). Thus, the first issue addressed in this paper is the FPW effect of monetary policy (on consumption).

[1] To fix idea, we may discuss only the effects of monetary expansion; and those of monetary tightening are presumably the opposite.

Another related issue is the effect of monetary policy on asset prices or the "capacity" of monetary policy in creating (or destroying) paper wealth. Asset price appreciation is usually taken as a natural result of monetary expansion driving up asset demand; i.e., monetary expansion tends to create FPW. Yet, a conjecture under a general-equilibrium perspective is that the effect of monetary policy on asset prices depends also on the monetary effect on investments through the so-called Tobin's (1969) q effect. In short, the monetary effects on the price and quantity of assets tend to be correlated; in another word, the ability of monetary policy in creating "paper wealth" is correlated with its ability in creating (productive) capital as "concrete wealth". Following this conjecture, we attempt to examine the monetary effect on asset prices in a framework with both asset demand and supply incorporated, and investigate the interaction (and its implications) between the wealth effect and the q effect as two monetary policy transmission mechanisms.

Given the possible effect of monetary policy on asset prices, the third issue is whether monetary authorities should intervene in asset market performances (e.g. for controlling "bubbles"). A basic principle endorsed widely is that monetary authorities should not interfere with asset price movements driven by fundamentals. Based on this principle many observers argue against direct monetary responses to asset price movements on the ground that monetary authorities are hardly able to determine whether the movements are fundamental or not. However, conceptually, what kinds of asset price movements are fundamental? To be consistent with underlying (risk-adjusted) earnings is obviously one necessary condition for asset prices to be fundamental. However, given earnings, asset prices also depend on the interest rate. Then, what is the "fundamental" interest rate?

Would not fundamental factors (that change earnings) also tend to alter the fundamental interest rate? If so, would not monetary responses be necessary to accommodate underlying interest rate changes? These questions beg for some clarification of the concept and determination of fundamental asset prices, which we attempt to provide. The clarification sheds some light on the issue of whether inflation-targeting monetary policy should respond directly to asset market performances.

Before proceeding to address the above issues, we provide some qualifications regarding the perspective taken in the following analyses. First, we consider asset prices from a "net wealth" perspective by using the capital price (Tobin's q) as an aggregate proxy for asset prices. Second, we abstract the influence of (expected) inflation on asset prices by considering a situation where inflation expectations are well anchored by inflation-targeting monetary policy. Note that the abstraction of inflation trivializes the difference between real and nominal variables. Third, we abstract the influence of risk premium on asset prices by assuming risk-free capital incomes. Fourth, unless noted otherwise, *the* interest rate means the long-term (risk-free) interest rate.

The remainder of the paper is organized as follows. Section 2 provides some clarification to the (fundamental paper) wealth effect of monetary policy. Section 3 formally analyzes the effect of monetary policy on q and the interplay between the wealth effect and the q effect. Section 4 examines the concept and determination of fundamental asset prices from a macroeconomic perspective and addresses the issue of whether inflation targeting monetary policy should respond directly to asset market performances. Section 5 concludes the paper.

2. Fundamental Paper Wealth Effect

The nature of monetary-policy-induced FPW changes and its effect on consumption have been investigated decades before by the so-called interest-rate-induced wealth effect (IRIWE) literature (Hicks, 1939; Keynes, 1930, 1936; Leijonhufvud, 1968; Pesek and Savings, 1967; Sweeney, 1988; among others);[2] yet the insights provided by which are often overlooked in the current discussion on the wealth effect of monetary policy.[3]

A detailed review of the IRIWE literature is beyond the scope of this paper.[4] We focus on clarifying a casual but influential interpretation of the wealth effect of monetary policy in the current literature. We note that the essence of our clarification has been said or implied in one way or another by the IRIWE (or other) literature. Our contribution, if any, is to distill the essence and bring it to the attention of the current wealth-effect literature.

Most of the current research on the wealth effect of monetary policy is conceptually based on a life cycle consumption function suggested by Modigliani (1971):

$$C_0 = \xi W_0 \ , \tag{1}$$

which implies that current consumption (C_0) is positively (consumption propensity $\xi > 0$) related to the net worth (W_0) measured by the present value (PV) of lifetime incomes. Under the convenient assumption of unit elasticity of intertemporal substitution, a fall in the interest rate (due to monetary expansion) has no effect on ξ but increases W_0,

[2] We prefer the term "fundamental paper wealth" because it distinguishes the nature of the kind of wealth change examined here; whereas the term "interest-rate-induced" may not be appropriate from a general-equilibrium perspective under which asset prices and the interest rate tend to be jointly determined. Besides, as will be shown in the next section, a change in the interest rate could induce not only changes in asset prices as "paper wealth", but also changes in the capital stock as "concrete wealth".

[3] The IRIWE literature is insightful but unsystematic—the authors approach the issue from different perspectives and use different conceptual frameworks and terminologies; and their discussions are mostly narrative and embedded in their books with much broader agendas.

[4] See Leijonhufvud (1968) and Sweeney (1988).

which according to equation (1) implies a proportional increase in consumption despite the paper wealth nature—for clarification, we call such a *proportional* effect on consumption as the "FPW effect"(of monetary policy). Indeed, FPW increases are often casually referred to as increases in consumers' wealth or lifetime resources; and the FPW effects are accordingly called as the "wealth effect" (Mishkin, 1995; Modigliani, 1971, among many others). We clarify this casual interpretation in the following.

We first compare two methods of decomposing the interest-rate effect on consumption. Consider a Marshallian (current) consumption demand (function) $C_0(i, W_0)$ and the corresponding Hicksian demand $C_0^h(i, u^*)$, where the interest rate i measures the price of current consumption in terms of that in the future; and $u^*(i, W_0)$ is the indirect utility that measures the maximum achievable utility (or "wealthiness") under i and W_0.

A total differentiation of $C_0(i, W_0)$ gives

$$\frac{dC_0(i, W_0)}{di} = \frac{\partial C_0}{\partial i} + \frac{\partial C_0}{\partial W_0}\frac{dW_0}{di}, \tag{2}$$

in which the first term on the right-hand side (RHS) can be further decomposed via the well-known Slutsky decomposition:

$$\frac{\partial C_0(i, W_0)}{\partial i} = \frac{\partial C_0^h}{\partial i} - \frac{\partial C_0}{\partial W_0}\frac{\partial e_0(i, u^*)}{\partial i}, \tag{3}$$

where $e_0(i, u^*)$ is the expenditure budget in terms of current consumption. Substituting equation (3) into (2) we obtain a three-effect decomposition of the interest-rate effect on consumption:

$$\frac{dC_0}{di} = \left(\frac{\partial \overset{-}{C_0^h}}{\partial i} \right) + \left(- \frac{\partial \overset{+}{C_0}}{\partial W_0} \frac{\partial e}{\partial i} \right) + \left(\frac{\partial C_0}{\partial W_0} \frac{\overset{-}{dW_0}}{di} \right), \tag{4}$$

where the first, second and third terms on the RHS are usually termed respectively as substitution, income and wealth effects—theirs signs on their tops.[5]

Intuitively, the substitution effect measures the interest-rate effect on consumption given the original indirect utility level (u^*); the income effect measures the interest-rate effect on consumption through the lifetime consumption cost (e_0); and the wealth effect measures the interest rate effect on consumption through the net worth (W_0).

Most of the current discussion on the wealth effect of monetary policy is (explicitly or implicitly) based on this three-effect decomposition. Yet, a key point is that the wealth effect (or more precisely the interest-rate effect on W_0) is not a proper measure of the interest rate effect on *wealthiness*, because a fall in the interest rate tends to increase not only the net worth (W_0) but also the lifetime consumption cost (e_0). This is precisely the essence of the aforementioned "no richer" argument by Gramlich (2001).[6]

Indeed, a proper measure of the interest-rate effect on wealthiness is the sum of the wealth and income effects. This can be made clear by another two-effect decomposition, which is well known as the "Hicksian decomposition".

As opposed to the three-effect decomposition totally differentiating the Marshallian demand, the Hicksian decomposition totally differentiates the Hicksian demand:

$$\frac{dC_0\,(i,\, W_0)}{di} = \frac{\partial C_0^h}{\partial i} + \frac{\partial C_0^h}{\partial u^*} \frac{du^*}{di}. \tag{5}$$

[5] See Obstfeld and Rogoff (1996, pp. 28-45) for discussion on the three-effect decomposition in a two-period model.

[6] Keynes (1936, p.94) made a similar argument. See Hicks (1939, pp.232-235) and Leijonhufvud (1968, chapter IV) for detailed discussion.

Equation (5) implies that the interest-rate effect on consumption can be decomposed into the substitution effect (the first RHS term) and the "Hicksian wealthiness effect" (the second term).[7] While the substitution effect here is identical to the same effect in the three-effect decomposition, the (Hicksian) wealthiness effect measures the interest-rate effect on consumption through the wealthiness level (u^*). A comparison between equations (4) and (5) indicates that the income and wealth effects combined measures the interest rate effect on wealthiness.

With the difference between the wealth effect and the wealthiness effect clarified, we proceed to clarify the FPW effect. In the consumption function represented by equation (1), the substitution and income effects are captured by the interest-rate effect on ξ, while the wealth effect by that on W_0. Given unit elasticity of substitution, the substitution and income effects exactly offset each other (i.e., the interest rate effect on ξ is zero); thus the interest rate effect on consumption can be conveniently *measured* by the wealth effect. However, to *interpret* it as a wealth effect can be misleading. First, such an interpretation seems to suggest that a FPW increase raise consumption because it makes consumers wealthier. However, consumers who enjoy a FPW appreciation in W_0 could nonetheless become less wealthy because the accompanied increase in e_0 may outweigh the FPW appreciation; i.e., the income effect may dominate the wealth effect so that the wealthiness effect is negative despite the positive wealth effect. Second, the exact cancellation between the substitution and income effects is not equivalent to the case of

[7] The "Hicksian wealthiness effect" here is originally called as "income effect" by Hicks (1939) and sometimes also called as "wealth effect" by later users of the Hicksian Apparatus (e.g., Leijonhufvud, 1968; King, 1991; among others). Since the "wealth effect" and "income effect" in the three-effect decomposition have different economic meanings than the same terms used in the Hicksian decomposition, to avoid terminology confusions, we follow the terminologies in the three-effect decomposition but use the "Hicksian wealthiness effect" ("wealthiness effect" in short) to denote the income (or wealth) effect in the Hicksian decomposition.

zero substitution as well as income effect—an offset positive substitution effect (implied by the unit elasticity) is still positive. If the income effect and wealth effect happen to cancel out—which is essentially what Hicks (1939, pp. 232-235) argues for in an aggregate sense[8]—what is often called as the wealth effect of monetary policy can also (perhaps should) be called as the substitution effect. In a word, with the unit elasticity assumption, the FPW effect is attributable (at least) partly to the substitution effect.

If the substitution effect is zero,[9] a decline in the interest rate will increase W_0 but decrease ξ through the income effect. The balance of the two effects (i.e., the wealthiness effect) is ambiguous for individual consumers, depending on their income and consumption structures—the longer a consumer's income horizon relative to her consumption horizon, the more likely she becomes wealthier from a decline in the interest rate (Hicks 1939, pp. 232-235). However, according to Leijonhufvud (1968, pp. 258-259), a decline in the interest rate tends to make society (as a whole) wealthier because capital as the net wealth of society tends to have a longer income horizon than the consumption horizons of its owners. Based on the spirit of Leijonhufvud's arguments, we show in the following that a FPW change is essentially a process of wealth redistribution between current and future capital owners; and a FPW increase tends to make current consumers *as a whole* wealthier.

Suppose a monetary expansion lowers the interest rate from i to i' ($i' < i$) and hence raises the price of capital ownership (entitled to constant dividend r) from q ($= r/i$) to q'

[8] A decline in the interest rate tends to benefit borrowers but cost lenders. Hicks argues that, since a lending must correspond to a borrowing, without considering distributional effects, the benefits of the borrowers and the costs of the lenders tend to cancel out in aggregate. Thus, the interest rate effect on the aggregate wealthiness tends to be zero; i.e., the income and wealth effects cancel out in aggregate.

[9] The literature on the magnitude of the elasticity of intertemporal substitution is controversial. In general, empirical results indicate that the elasticity is less than unity; see Elmendorf (1996) for a survey.

$(=r/i')$. Then q dollar of current capital ownership will enjoy a FPW gain of the amount $r(i-i')/ii'$—it is a gain in the sense that, if sold instantaneously, the ownership can provide $r(i-i')/ii'$ amount of extra consumption. However, the gain is at the cost of future capital owners because the appreciation causes $r(i-i')/i$ amount of earning loss per q dollar of future capital ownership per period. The PV of all the losses in all periods will be $r(i-i')/ii'$, which is precisely equal to the FPW gain enjoyed by q dollar of current ownership.

In a word, a FPW change is a zero-summed wealth redistribution—the FPW gains enjoyed by current capital owners are in a sense "financed" by the earning losses of future owners.

With finite-living consumers, capital will eventually be owned by unborn consumers who thus will be potential victims of a FPW appreciation in the mean time. Since a FPW appreciation is a zero-summed wealth redistribution, that the *unborn* consumers are victims implies that the current *existing* consumers as a whole is a winner. In another word, a FPW appreciation tends to make current consumers as a whole wealthier, albeit not in the Pareto but compensational sense.[10]

Setting aside the distributional effects among the current consumers,[11] the wealthier current consumers will tend to consume more in aggregate. Therefore, besides the substitution effect, the (aggregate) FPW effect tends to also capture consumption increase

[10] Some current consumers (as net savers) might lose from assuming future capital ownerships (put plainly, from lower returns to savings); yet the net gain for current existing consumers is positive thanks to the (potential) loss of unborn consumers.

[11] By no means unimportant, the distributional effects among the current consumers are an empirical issue. There are two rough and arguable observations. On the one hand, the significance of the FPW effect could be enhanced by the fact that (non-human) wealth tends to be owned by consumers who have relative short consumption horizons and hence strong consumption propensity; on the other, the significance could be reduced by the fact that most of long-term assets are held by minority wealthy consumers whose marginal consumption propensity tends to be relatively small.

due to increase in wealthiness. In this sense, the casual "wealth effect" interpretation is not a complete misnomer.

In summary, the above discussion clarifies that despite being a revaluation of the same amount of underlying incomes, a FPW appreciation does tend to improve the wealthiness of current consumers as a whole and hence have a positive effect on the aggregate consumption. However, without the substitution effect, the increase in the aggregate consumption will be less than proportional to the FPW increase.

The clarification provides some insights. One rationale for low inflation being a monetary goal is to protect people from losing their hard-earned wealth. Yet, possible monetary effect on asset prices might imply a different way of losing wealth. Consider a situation of excessive aggregate demand. If monetary authorities are inactive, the resulting inflation will lead to wealth loss through the so-called "real balance effect" (Pigou, 1943). However, if monetary authorities choose to avoid inflation by tightening money, wealth could also be lost from decreases in asset prices. As opposed to FPW appreciation benefiting current capital owners at the cost of small earning losses of many future owners, FPW depreciation is a reverse redistribution that could cost the current owners dearly. Thus, as opposed to the wealth loss due to inflation being shared by all the consumers, that due to FPW loss tends to be shouldered by long-term asset owners only. Although society as a whole cannot avoid FPW variations, individuals can via holding liquid assets. Thus, the significance of FPW depreciation depends on who holds long-term assets. It might not matter much when long-term assets are held by consumers who can afford large variations in wealth; yet, it is a matter of concern if long-term assets are also non-trivially in the wealth portfolios of consumers who cannot afford substantial

capital losses, e.g., those in their retirements. As stock ownership becomes increasingly popular due to the 1990s stock market booms; and reforms in the U.S. social security system could further increase the popularity, the effect of monetary policy on asset prices could be or become a non-trivial issue. More implications of the FPW effect will be discussed in the next two sections.

3. Fundamental Paper Wealth vs. Concrete Wealth

The wealth effect of monetary policy depends on the effect of monetary policy on asset prices.[12] It is well known that monetary expansion can put upward pressure on asset prices by increasing asset demand. However, a nontrivial yet underappreciated point is that the pressure does not necessarily turn into asset price appreciation but can be dampened by increases in investments. In short, the effect of monetary policy on asset prices and hence the wealth effect are negatively correlated with the q effect. Therefore, a general equilibrium perspective that considers both capital demand and supply is apt for a more rigorous analysis of monetary effect on asset prices and the wealth effect.[13]

To model the wealth effect, an overlapping generations (OLG) framework will be used to capture the feature of finite consumption horizon. A parsimonious two-period OLG model will be used; yet the results can be generalized in a multi-period one such as Blanchard's (1985) model.

[12] In the sense that current consumers as a whole do become wealthier from a FPW increase, the term "wealth effect" (of monetary policy) is not quite a misnomer in aggregate analyses. With the FPW effect being clarified, we in the remainder of the paper will simply use the term "wealth effect" and use the term "FPW" when emphases needed.

[13] We are aware of no explicit study on the interplay between the wealth effect and the Tobin's q effect. The two effects are often listed as two monetary policy transmission mechanisms without the interplay being discussed—see Kuttner and Mosser (2002); Loayza and Schmidt-Hebbel (2002); and Mishkin (1995) for surveys of the literature on monetary transmission mechanisms. In general equilibrium models where q plays a major role, the wealth effect is either explicitly dismissed for empirical irrelevancy (Bernanke and Gertler, 1999) or implicitly trivialized by the use of infinite-horizon frameworks.

The Model

In a two-period OLG model, the private sector is composed of (young and old) consumers, firms and entrepreneurs.

The young consumers are the owners of human wealth who work and finance consumption by labor incomes, while the old consumers are the owners of non-human wealth who retire and finance consumption by asset holdings. Certainly consumers in the real world can own both human and non-human wealth; thus the young and old consumers in this model should be viewed as theoretical abstraction of consumers' characteristics based on their human and non-human wealth respectively. Without loss of generality, normalize the number of the young or old consumers as unity

While the firms engage in production that is a process of using capital and labor to produce consumption output, the entrepreneurs engage in investment that is a process of transforming consumption goods into new capital.

The public sector is composed of the fiscal and monetary authorities. The fiscal authority uses revenues from tax and/or government bond issuance to finance its expenditure. The monetary authority controls the money supply in the private sector through open market operations (OMO).

There are three kinds of assets: money, (government) bond and capital. Bond and capital are perfect substitutes. Besides being a store of value, money also provides liquidity services, which is modeled by money in utility function.

All of the four markets—(consumption) goods, money, bond and capital—are efficient.

In the following we first model the behaviors of the private and public sectors and then discuss the equilibrium in each market.[14] Our goal is to see the effects of monetary policy on asset prices as well as the consumption and investment components of AD through the interaction between the wealth effect and the *q* effect.

Consumption

A consumer has a two-period life cycle: at the beginning of period *t*, the *t*-period young consumer is born; she supplies inelastically one unit of labor during period *t* and receives real wage income (w_t) at the end of the period; after paying real tax (T_t), she consumes C_{1t} and saves in capital (K_{1t}), nominal government bond (D_{1t}), and/or money (M_{1t}); she carries over her assets into and retires during the next period *t*+1; and at the end of which she finishes her life cycle by cashing in and consuming (C_{2t+1}) the gross return to her savings. Assume no population growth and normalize the number of newborns as one.

The problem of the *t*-period young consumer is given by:

$$Max\, E_t(\log C_{1t} + \frac{1}{1+\theta}\log C_{2t+1} + \beta \log \frac{M_{1t}}{P_t}),$$

subject to:

$$C_{1t} + q_t K_{1t} + \frac{M_{1t}}{P_t} + \frac{D_{1t}}{P_t} = w_t - T_t \ ,$$

$$C_{2t+1} = E_t[r_{t+1}K_{1t} + q_{t+1}K_{1t} + \frac{M_{1t}}{P_{t+1}} + \frac{D_{1t}}{P_{t+1}}(1+i_{t+1})],$$

[14]The Walras' Law allows us to discuss only the equilibria in the goods, money and capital market.

where P_t is the consumption price at the end of period *t*; i_t is the rate of interest for government bond during period *t*; q_t is the real capital price at the end of period *t*; and r_t is the rate of capital income during period *t*. The consumer has intertemporally separable utility over consumption with time preference θ; and the real money balance provides liquidity services with β measuring the consumer's liquidity preference. We assume log utility for analytical convenience.

First order conditions give the young consumer's current consumption demand

$$C_{1t} = \xi(w_t - T_t) \tag{6}$$

and money demand

$$\frac{M_{1t}}{P_t} = \beta\xi\left(\frac{i_{t+1}}{1+i_{t+1}} + \frac{E_t P_{t+1} - P_t}{P_{t+1}}\right)^{-1}(w_t - T_t), \tag{7}$$

where $\xi = (1+\theta)[2+\theta+\beta(1+\theta)]^{-1}$.

The *t*-period old consumer will finance her consumption via the gross returns to her assets:

$$C_{2t} = r_t K_{1t-1} + q_t K_{1t-1} + \frac{M_{1t-1}}{P_t} + (1+i_t)\frac{D_{1t-1}}{P_t}. \tag{8}$$

Production

In every period, identical and perfectly competitive firms hire capital and labor to produce consumption goods with the standard Cobb-Douglas technology. With the inelastic unit labor supply, the aggregate production function is

$$Y_t = F(K_t) = A_t K_t^{\alpha}, \tag{9}$$

where K_t, Y_t, and A_t are, respectively, the capital stock, output and productivity parameter. Perfect competition and zero profit conditions make firms pay factors by their marginal products:

$$r_t = F'(K_t), \tag{10}$$

$$w_t = F(K_t) - KF'(K_t). \tag{11}$$

Investment

In every period, identical entrepreneurs engage in investments that transform consumption goods into new capital. At the end of period t, an entrepreneur j chooses the amount of investment (I_t^j) to maximize expected utility:

$$Max\, E\, U(\Pi_t^j)$$

where $\Pi_t^j = q_t I_t^j - c(I_t^j)$ is the entrepreneur j's profit from investment—$c(I)$ is the investment cost in terms of consumption. If any, entrepreneurs will hold investment profits earned at the end of period t in form of capital and sell them at the end of period t+1 for consumption. Aggregate investment

$$I_t = \sum_j I_t^j .$$

Without loss of generality, assume zero depreciation in capital. Thus,

$$K_{t+1} = K_t + I_t . \tag{12}$$

Fiscal policy

To abstract fiscal implications, assume balanced fiscal policies in every period. Thus, the outstanding government bond (D) is constant at $\overline{D}$. Assume that D is a one-period

bond.[15] At the end of every period, the fiscal authority pays off interest payments due and rolls over the principal at the interest rate determined by the current asset markets. The outstanding government bond $\overline{D}$ is either held by the private sector (D_t) or by the monetary authority (D_t^g):

$$D_t + D_t^g = \overline{D} \ . \tag{13}$$

Fiscal incomes include real tax on the young consumer[16] (T_t) and the interest income ($i_t D_t^g$) turned in by the monetary authority. Fiscal outlays include interest payments for the outstanding bond ($i_t \overline{D}$) and government consumption that is assumed to be zero without loss of generality. Thus, the balanced-budget policy implies $P_t T_t + i_t D_t^g = i_t \overline{D}$.

Monetary policy

The monetary authority determines the period t+1 money supply (M_{t+1}) in the private sector at the end of period t (or equivalently, the beginning of period t+1) through open market operations (OMO):

$$D_{t+1}^g - D_t^g = M_{t+1} - M_t , \tag{14}$$

which implies that the RHS change in the money supply is balanced by the change in the monetary authority's bond holding on the left-hand side (LHS). According to equations (13) and (14),

$$M_{t+1} + D_{t+1} = M_t + D_t , \tag{15}$$

[15] If D is a long-term bond with fixed coupon rates, monetary policy will have a wealth effect through affecting the bond price. We abstract this feature since it is in essence not much different than the wealth effect mechanism through the capital price q.

[16] The assumption of tax on the young consumer only is to avoid the complication of monetary policy affecting the PV of a consumer's lifetime tax liability, which is another kind of "wealth effect" yet irrelevant to the main issue here.

which implies that the total value of *M* and *D* held by the private sector is not affected by OMO. Therefore, the monetary policy so modeled will affect the net wealth of the private sector only through influencing the capital price *q*.

Identities:

The assets (capital, bond or money) held by the private sector in period *t* equals the corresponding assets acquired by the young consumer at the end of period *t*-1. Thus, $K_t = K_{1t-1}$; $D_t = D_{1t-1}$; and $M_t = M_{1t-1}$.

The Goods Market

The AD (for consumption goods) at the end of period *t* is composed of the young and old consumers' demand for consumption (equation (6) and (8) respectively) and the cost of the entrepreneur's investments [$c(I_t)$] that will be specified later.

We assume that (consumption) price is sticky in the short run (normalized to one): $E_t P_{t+1} = P_t = 1$. We also do not model adjustments in output, which is determined by the existing capital and labor [equation (9)]. The simplification in modeling the supply side (output and price) of the economy is for the purpose of clearly examining the core issue, i.e., the monetary effect on the AD through the interplay between the wealth effect and the *q* effect. A general view regarding monetary transmission is that monetary policy influences the AD, which in turn affects output and/or price, depending on the output potential and price adjustment mechanisms. The final effect of monetary policy thus depends not only on its shock on the AD but also on the subsequent real and nominal effects of the AD shock. To show the monetary effect on the AD only, we abstract the

complication that the affected AD could in turn influence output and/or price, which will feed back to the AD till the AD-AS balance is reached.[17]

According to equation (6),

$$dC_{1t} / dM_{t+1} = 0, \tag{16}$$

which implies that money has no effect on the young consumer's consumption demand. This is because in the model here monetary policy affects neither the young consumer's wealth, which is her current disposable income, nor her consumption propensity (ξ) due to the log utility.[18]

According to equation (8),

$$dC_{2t} / dM_{t+1} = (dq_t / dM_{t+1})K_t, \tag{17}$$

which captures the (non-human) wealth effect of monetary policy. Equation (17) together with (16) implies the following proposition:

Proposition 1 *The effect of monetary policy on the aggregate consumption demand is positively related to its effect on the capital price.*[19]

[17] See Bernanke, Gertler and Gilchrist (1999) for an example of studying monetary transmission mechanisms (the credit channel in the paper) in a business cycle context that includes further supply-side transmissions. Studying the wealth effect channel and its interaction with other channels in a business cycle context is an interesting topic for future research.

[18] On the one hand, the log utility assumption implies the existence of the substitution effect, without which money will negatively affect ξ. On the other, the two-period simplification abstracts future labor incomes as human wealth, with which money will have a positive "non-human wealth effect". Intuitively, a monetary expansion tends to increase human wealth owners' consumption through the substitution effect but decrease it through the Hicksian (human) wealthiness effect—the income horizons of human wealth tend to be shorter than the consumption horizons of its owners. Since the balance of the two effects cannot be determined *a priori*, equation (16), which implies that the two effects are exactly counterbalanced, is a neutral standing—after all, the core issue here is the non-human wealth effect.

[19] According to the discussion in the last section, this proposition tends to hold even when the assumptions of two-period horizon and log utility are relaxed.

The money market

Under the assumption of price rigidity, the (young consumer's) demand for money [equation (7)] becomes:

$$M_{t+1} = \left(\frac{1+i_{t+1}}{i_{t+1}}\right)\left[\beta\xi(w_t - T_t)\right], \tag{7'}$$

which implies,

$$\frac{di_{t+1}}{dM_{t+1}} < 0,$$

i.e., monetary expansion tends to reduce the short-term interest rate.

The Capital Market

The demand for capital comes from the young consumer's saving. Perfect substitution between capital and bond implies a no-arbitrage condition:

$$P_t q_t (1+i_{t+1}) = E_t[P_{t+1}(r_{t+1} + q_{t+1})], \tag{18}$$

where the LHS and RHS represent the returns to $P_t q_t$ (dollar) investment in bond and capital respectively. Equation (18) implies

$$q_t = \frac{1}{1+i_{t+1}}\left\{r_{t+1} + \sum_{s=t+2}^{\infty} \frac{E_t r_s}{\prod_{v=t+2}^{s}\left[(1+E_t i_v)(1+E_t \pi_v)^{-1}\right]}\right\}, \tag{19}$$

where $\pi_v\ (= P_v / P_{v-1} - 1)$ is the inflation rate in period *v*—note that π_{t+1} is equal to zero due to the price rigidity assumption. Equation (19) can be viewed as a capital demand function that relates the capital price (q_t) to the capital stock (K_{t+1}) implied by the capital income (r_{t+1}).

The supply of capital comes from two sources: one is the supply of existing capital by the old consumer; and the other is the supply of new capital through entrepreneurs' investments. While the finite horizon makes the old consumer's capital supply perfectly inelastic, q will tend to influence entrepreneurs' investments.

In a simple case, assume a constant marginal cost of investment (normalized to one): $c(I_t) = I_t$. Assume no uncertainty, thus the entrepreneurs' utility maximization problem is equivalent to maximizing the investment profit $\Pi_t^j = (q_t - 1)I_t^j$, which implies that capital market is cleared at

$$q_t = 1. \tag{20}$$

The capital supply function represented by equation (20) implies that investments are perfect elastic to q.

Perfect elastic investment is rare in reality; and many "impediments" could make investment less than perfect elastic (LTPE). For example, suppose the aggregate investment cost function is in the form of

$$c(I_t) = I_t(1 + \gamma I_t), \tag{21}$$

where $\gamma > 0$ implies convex adjustment costs.[20] Without uncertainty, the profit-maximizing investment behaviors imply that the capital market is cleared at

$$q_t = c'(I_t) = 1 + 2\gamma I_t. \tag{22}$$

With $\gamma > 0$, equation (22) implies that the aggregate investment is LTPE.

LTPE investment can also be due to entrepreneurs' risk aversion. Without loss of generality, suppose the risk is on the cost of capital:

[20] Following the literature of investment adjustment costs, we use a representative agent (entrepreneur) framework rather than the *n*-entrepreneur framework specified above. See Abel and Eberly (1997) for the investment cost functional form in equation (21).

$$c(I_t^j) = I_t^j(1+z_t^j), \tag{23}$$

where $z_t^j \sim N(0,\sigma^2)$ is a normally distributed random variable. Suppose entrepreneurs are risk averse with utility function:

$$U(\Pi) = -e^{-\varphi\Pi}, \tag{24}$$

which implies constant absolute risk aversion. According to the investment cost function [equation (23)] and the utility function [equation (24)], entrepreneur *j* chooses investment (I_t^j) to maximize expected utility

$$E_t U(\Pi_t^j) = -\int e^{-\varphi\Pi_t^j} f(\Pi_t^j) d\Pi_t^j = -e^{-\varphi[(q_t-1)I_t^j - \varphi I_t^{j\,2}\sigma^2/2]},$$

the solution to which gives *j*'s investment function: $q_t = 1+\varphi\sigma^2 I_t^j$. Thus, the aggregate investment function will be

$$q_t = 1+\frac{\varphi\sigma^2}{n} I_t, \tag{25}$$

which implies that under risky investments ($\sigma > 0$) and risk-averse entrepreneurs ($\varphi > 0$), the aggregate investment is LTPE. The riskier the investments are; or the more risk-averse the entrepreneurs are, the less elastic the aggregate investment is.

Suppose the number of entrepreneurs is large enough ($n >> 0$), then, according to the law of large numbers, the aggregate investment cost function would be

$$c(I_t) = \sum_j c(I_t^j) = I_t^j(n+\sum_{j=1}^{n} z_t^j) = I_t, \tag{26}$$

which implies a constant marginal cost for the aggregate investment. Despite constant marginal investment cost in aggregate, the increasing risk premia required by risk-averse entrepreneurs make the aggregate investment LTPE.

The capital supply functions (20), (22) and (25) can be generalized into

$$q_t = 1 + \eta I_t \tag{27}$$

With capital demand and supply specified, we will apply comparative statics to the simultaneous system composed of equations (7'), (10), (12), (19) and (27) to show the effect of a monetary shock (dM_{t+1}) on the (capital) market-clearing capital price (q_t^e).

First, we need to specify the effects of dM_{t+1} on the expectation terms ($E_t i_v$, $E_t \pi_v$ and $E_t r_s$) in equation (19), which is essentially the PV rule for asset valuation. For tractability, we assume that capital is valued by the young consumer according to a practically simplified version of the PV rule:

$$q_t = \frac{1}{1 + i_{t+1}} (r_{t+1} + \frac{\bar{r}}{\bar{i} - \bar{\pi}}), \tag{19'}$$

where $\bar{i}$, $\bar{\pi}$ and $\bar{r}$ are, respectively, the expected long-term interest rate, expected future inflation rate, and expected future (average) capital income. For analytical convenience, we make the following assumptions. We assume $d\bar{i} = \tau di_{t+1}$, where τ (>0) captures the effect of monetary policy on the slope of yield curve. Expectations on future inflations depend mainly on monetary authorities' inflation targets and the creditability of the targets. We assume that dM_{t+1} affects neither the targets nor their creditability; thus, $d\bar{\pi} / dM_{t+1} = 0$. Suppose the expected growth rate of the capital income is *g*, i.e., $\bar{r} = g r_{t+1}$. We assume dM_{t+1} is not expected to affect *g*; then, $d\bar{r} / \bar{r} = dr_{t+1} / r_{t+1}$.[21]

[21] The standard rational expectation paradigm is not applicable here since we focus on the monetary effect on AD and do not model the further interactions between AD and AS. Yet, the assumptions here on the expectations capture the standard features of asset price evaluation in reality. Since the main point here (as will be shown later) is that the elasticity of capital supply matters for the monetary effect on the equilibrium capital price, the above assumptions, which matter mainly for the monetary effect on capital demand, are to us acceptable compromises for analytical convenience.

With the expectations being pinned down, comparative statics analyses can be conducted to show the effects of dM_{t+1}. The results are:

(a) $dq_t^e / dM_{t+1} \begin{cases} = 0, \text{ if } \eta = 0 \\ > 0, \text{ if } \eta > 0 \end{cases}$;

(b) $\frac{\partial(dI_t / dM_{t+1})}{\partial \eta} < 0$; and

(c) $\frac{\partial(dq_t^e / dM_{t+1})}{\partial \eta} > 0$,

which imply the following propositions:

Proposition 2 *Under perfect elastic investments, monetary policy has no influence over the equilibrium q [result (a)]; thus the wealth effect of monetary policy is zero (Proposition 1).*

Proposition 3 *Under LTPE investment, monetary policy positively affects the equilibrium q [result (a)]. The more elastic the investment is, the stronger the q effect on investment [result (b)]; yet the weaker the monetary effect on the equilibrium q [result (c)]; and hence the weaker the wealth effect (Proposition 1).*

In general, the above analysis provides two insights. First, the effect of monetary policy on asset prices depends on the *q*-elasticity of investments; and monetary expansion tends to cause asset price appreciation because investments are usually LTPE.[22] Second, the

[22] Besides adjustment costs and risk aversion as two fundamental investment impediments, many other factors (such as uncertainty or institutional imperfections) can reduce the q-elasticity of investments. In the case of monetary contraction, investment irreversibility can be a "disinvestment impediments".

effect of monetary policy on consumption (demand) through the wealth effect channel is negatively correlated with that on investment through the q effect channel, which is positively determined by the q-elasticity of investments.

The insights reveal two limitations of monetary policy, one of which is related to financial stability. By reducing uncertainty, inflation-targeting monetary policy certainly helps to enhance financial stability. However, the policy itself can be a source of financial instability. This is because monetary policy for goods market stabilization essentially makes (long-term) asset markets a buffer against shocks on the economy, even when they are originated from outside of the asset markets. Since investment (or disinvestment) impediments make it difficult to absorb shocks on asset markets through adjustments in capital stock, asset price fluctuations tend to happen and endanger financial stability. This insight may shed some light on the "bubble" boom-bust cycle experienced by Japan in the 1980s and a similar one by the U. S. recently—we will come back to this in the next section.

The other limitation is related to (long-term) growth. Whether monetary authorities' AD targets are achieved through the q effect or the wealth effect is nontrivial from a growth perspective, because while the investment part of AD helps to accumulate national wealth, the consumption part decumulates it. We will show in the following that under inflation-targeting monetary policy, saving can be diverted back to consumption due to the wealth effect.

In the above model, suppose monetary authority credibly targets zero-inflation by keeping AD and AS in balance, i.e.,

$$F(K_t) = C_{1t} + C_{2t} + c(I_t) \tag{28}$$

The gross saving (GS) comes from the young consumer's saving: $GS_t \equiv w_t - T_t - C_{1t}$, whereas the net saving (NS) also depends on the old consumer's dissaving. In aggregate, what is not consumed must be saved; thus, $NS_t = F(K_t) - C_{1t} - C_{2t}$. Consider a decrease in the young consumer's consumption propensity ($d\xi$<0), which according to equation (6) tends to generate extra GS by the amount of $-(w_t - T_t)d\xi$. However, according to the simultaneous system composed of equations (6), (8), (27) and (28), the increase in the NS would be $-[(w_t - T_t)/(1+\eta K)]d\xi$, which could fall short of the extra GS if investments are LTPE (i.e., $\eta > 0$). It is not difficult to see that a large η (i.e., a low elastic of investment) will result in a large portion of the extra GL being diverted back to consumption.

During the end of 1990s, the already low U.S. personal saving rate plummeted further despite baby boomers at their prime saving ages. Policymakers attributed the fall to the wealth effect of the stock market booms (Greenspan 2000a, b). What factors drive the booms and how much the wealth effect contributes to the low saving are empirical issues in the end. Yet, the saving crowd-out mechanism (due to the wealth effect) implies conceptually that, if it is costly in the margin to transform the baby boomers' large savings (not mentioning abundant foreign savings provided by the favorable world capital market) into new capital as "concrete" wealth, paper wealth will be generated through asset price appreciation. The resulting low saving will then be not a result of spendthrifts but because of prosperity from paper wealth appreciation. Yet, such paper wealth prosperity will not only hinder the accumulation of concrete wealth but also could easily vanish when retired baby boomers start dissaving, or when U.S. assets lose their charm for some reason.

Fundamentally, the two limitations of monetary policy are due to the fact that monetary policy, by essentially using the interest rate as the policy instrument, tends to have "side effects" on asset prices. Alternative policies that use other instruments may be able to (in principle) avoid the side effects. For example, investment subsidies can be used to deal with "saving booms" without destabilizing asset prices.[23]

In a word, monetary policy may be suboptimal in dealing with instability caused by permanent and predictable shocks (e.g. demographic shocks) in the sense that alternative policies may be able to achieve more desirable outcomes such as simultaneous stabilization of both goods and asset markets. Yet, elements such as "dosage", timing, and flexibility (not mentioning various political economy factors) tend to make monetary policy the only suitable AD policy (at least) in dealing with transitory shocks. Therefore, asset price fluctuations caused or acquiesced by monetary policy might be something that has to be put up with; so might be the paper nature of wealth.

However, while monetary expansion (which tends to create paper wealth) is always welcomed by financial communities; monetary contraction (which tends to destroy it) often draw criticisms, especially when its purpose is perceived as to curb booming asset markets. In the next section, we look into the concept and determination of fundamental asset prices from a macroeconomic perspective and address the issue of whether monetary authorities should respond to asset market variations.

4. Fundamental asset prices: a macroeconomic perspective

[23] Unfortunately, a symmetric policy for dealing with consumption booms may not be possible due to investment irreversibility.

Asset price boom-bust cycles are currently under intensive research—see the articles in Hunter et al. (2003) for examples—among which one heatedly debated issue is whether inflation-targeting monetary policy should react directly to asset market performances (Bernanke and Gertler, 1999, 2001; Cecchetti et. al. 2000, 2003; among many others). In this line of literature as well as general discussion, asset price fluctuations are usually viewed under the perspective of "bubbles". Two of a few exceptions are Bordo and Jeanne (2002) who point out that asset price fluctuations can happen even when markets are efficient, and Borio and Lowe (2003) who suggest posing the issue of asset price fluctuations not as bubble booms-busts but as "financial imbalances" building up and unwinding.

We share these minority opinions and in the following attempt to examine the concept and determination of fundamental asset prices (i.e., the opposite of bubbles) from a macroeconomic perspective. The examination clarifies that the soundness of asset market performances depend on their compatibility with the AD-AS balance in the long run, irrespective of their underlying driving forces being fundamental or not.

We start with clarifying a commonly held view that asset price movements driven by fundamental factors should not be a concern of (let alone intervened by) monetary authorities. Based on this "no-intervention" principle, some observers argue that since monetary authorities are no better than market participants in detecting "bubbles", it would be better for them to leave asset markets alone.[24]

The no-intervention principle sometimes creates some communication problems between monetary authorities and financial communities. For example, for fear of a U.S.

[24] This view is popular in financial communities and also receives sympathy from central bankers and academia (CEPR, 1998; Bernanke and Gertler, 1999; among many others).

copy of Japan's experience in the 1980s, the U.S. Federal Reserve (the Fed) initiated a monetary contraction from mid-1999 till mid-2000. With no obvious signs of inflation, the tightening was officially justified as preemption over inflation pressure (Greenspan, 1999). Yet, financial communities in general interpreted it as Fed's act to curb then booming stock markets—an understandable suspicion after all the talks by Fed officials about "irrational exuberance" and "wealth effect"—and condemned it as a violation of the no-intervention principle because the stock market performances are consistent with future productivity potentials in a "New Economy", if not undervalued. Facing numerous public outcries, the Fed defended the tightening by claiming that it was not aimed at the stock markets *per se* but to prevent the wealth (and q) effects from destabilizing inflation.[25] Yet, such a circumventing explanation is hardly satisfactory: If the stock prices are fundamental, why worry about the wealth effects? In another word, do not Fed's concerns over the wealth effects imply unsound stock market performances? Apparently, a clarification is in demand, which we attempt to supply in the following.

The main point of our clarification is as follows: Fundamentals-driven asset price movements can nevertheless be misalignments that reflect changes in the underlying interest rate; thus monetary responses to such movements are not interventions but realignments for accommodating the interest rate changes.

To elaborate, we first examine the concept of fundamental asset prices. In general, asset prices consistent with future earnings are deemed as fundamental. Yet, since asset prices also depend on the interest rate, a question would be what the "fundamental" interest rate is. If one agrees that the clearance of all the markets is a fundamental state of the economy, the fundamental interest rate would be the so-called equilibrium (real)

[25] In Fed's vocabulary, the wealth and q effects are generally called as the "wealth effects".

interest rate (EIR). To distinguish between fundamental asset prices under the EIR and those under any other, we call the former as the "equilibrium fundamental asset prices" (EFAP).

With the concept of fundamental asset prices clarified, that fundamentals-driven asset price movements can also be misalignments is straightforward: Since changes in fundamentals tend to affect not only assets' underlying earnings but also the EIR, asset price movements reflecting the earning changes *only* will nevertheless be misalignments to the EFAP. A key point is that an EIR adjustment needs to be "facilitated" by monetary policy. Thus, (direct or indirect) monetary responses to fundamentals-driven asset price movements could be seemingly "interventions" but indeed endogenous monetary accommodations to changes in the EIR.

In light of the above clarification, Fed's policy rationale for the late 1990s tightening can be more understandably interpreted as follows. The "not aiming at stock markets *per se*" implies that the Fed do not judge whether there are non-fundamental elements behind the booms or not; and the "aiming at the wealth effects of the booms" implies that the Fed believe that the booms, fundamental or not, might have led to an increase in the underlying interest rate.

In general, a message to financial communities is that monetary responses to asset market performances do not necessarily imply monetary authorities' disagreement with markets over economic prospects; particularly, preemptive tightening does not necessarily imply monetary authorities' detection of bubbles. The appreciation of this message should save monetary authorities' trouble in explaining "not aiming at market performances *per se* but their impacts", which seems to us meaningless (if not confusing)

but may be necessary to avoid stirring the markets misled by the no-intervention principle.

The notion that fundamentals-driven asset price movements could cause misalignments to the EFAP naturally begs for an examination of the EFAP determination. Since many elements can influence the EIR, the commonly used PV rule is not an adequate conceptual foundation for the task; whereas a macroeconomic perspective whereby the determinations of the EFAP and EIR are considered together is. Despite its simplicity, the model presented in the last section is a handy tool for the examination, which provides some nontrivial insights.

In the model, the general equilibrium capital price (q_t^E),[26] as an aggregate proxy of the EFAP, can be determined by the simultaneous system composed of equations (6), (8), (11), (26), (27) and (28). In a reduced form,

$$q_t^E = q(K_t, M_t, D_t; \overset{+}{A_t}, \overset{-}{\xi}, \overset{+}{\eta}), \tag{29}$$

which provides two insights regarding the EFAP determination.

On the one hand, the EFAP is under the influence of current economic conditions and behaviors: q_t^E is positively influenced by the current productivity ($\partial q_t^E / \partial A_t > 0$), negatively by consumption propensity ($\partial q_t^E / \partial \xi < 0$), and negatively by investment elasticity ($\partial q_t^E / \partial \eta > 0$). On the other hand, contrary to conventional wisdom, *future* productivities may have little influence over the EFAP. Indeed, equation (29) implies zero influence of future productivities over q_t^E—the PV rule [equation (19)] is not even

[26] Note the difference between q^E and q^e in the last section: the former is the general-equilibrium q consistent with simultaneous equilibria in all the markets, while the latter merely needs to be consistent with equilibrium in the capital market.

in the simultaneous system that determines q_t^E. Intuitively, even though a rise in future productivities (by increasing *future* capital incomes) puts upward pressure on q, q will not rise in equilibrium because that would cause an excessive AD over AS—note that the AS in the model here is constrained by the *current* output. The excessive AD will drive the interest rate up till the upward pressure on q is completely released. Certainly, the "irrelevancy" of future productivities to the EFAP is not a general result.[27] Yet the point is that the effect of future productivities on the EFAP tends to be constrained by current economic conditions—so strong is the constraint in the model here that future productivities become irrelevant.

In summary, from the macroeconomic perspective, the link between assets' (equilibrium) fundamental prices and their underlying future earnings are not as tight as it seems to be from the point of view of the PV rule; rather, the EFAP tend to be "anchored" by current macroeconomic condition. This insight sheds some light on the current debates over whether inflation-targeting monetary policy should react directly to asset price movements.

Many opponents to direct monetary reaction ("the Opponents" in short) argue that monetary policy should not react directly to asset price movements (except for those signaling changes in expected inflation) because monetary authorities are not good at detecting asset price misalignments, at least not better than markets themselves (Bernanke and Gertler, 1999, 2001; among many others). Instead, they suggest that

[27] The irrelevancy is mainly due to the constrained AS (by the current output) in the simple model here. In an open economy where AS is not constrained completely by domestic output thanks to supplies in the world goods market, higher future productivities tend to increase q^E. However, since neither foreign supplies of goods nor foreign demands for domestic assets are perfectly elastic; besides, not all the goods are tradable, AS will be constrained to some extent. Therefore, the effect of future productivities on current asset prices will be constrained to some extent.

"[b]y focusing on the inflationary or deflationary pressures generated by asset price movements, a central bank effectively responds to the ***toxic side effects*** *of asset booms and busts without getting into the business of deciding what is fundamental and what is not*." (Bernanke and Gertler, 1999: p. 18; emphasis added).

Yet, a few proponents to direct reaction ("the Proponents") argue that identifying asset price misalignments, albeit difficult, is not impossible, or at least not more difficult than other tasks monetary authorities have already been doing, such as estimating output potential and the EIR (Cecchetti et. al. 2000, 2003). Therefore, they suggest that monetary policy should

"*set interest rates both in response to projected inflation and, to some degree, in response to the extent of estimated misalignments in the asset markets (equities, housing and the exchange rate). This is the case even if the inflation projection itself makes use of information in asset prices*." (Cecchetti et. al., 2000: p. 51).

It appears that a key to the opinion difference between the Opponents and Proponents is whether monetary authorities are able to identify asset price misalignments. To make life easier, we suppose they are, but ask two questions. First, how can monetary authorities correct asset price misalignments? Second, should monetary authorities bother to correct them—would not the task of keeping inflation on target already handle the "toxic side effects"?

To answer these two questions, we consider an economy state in which AD and AS are balanced under the short-term interest rate (i); whereas the equilibrium capital price (q^E) is sustained by expected future capital incomes ($\bar{r}$) too high to be reasonable. Put

plainly, we consider a situation of asset price bubbles in a benign macroeconomic environment, which is arguably the case for Japan during the late 1980s and the U.S. during the late 1990s. Under this situation, the Opponents may suggest no more duties for monetary authorities since the AD-AS balance indicates the "toxic side effects" have already been rid off; whereas the Proponents may insist monetary authorities taking care of the bubbles.

If monetary authorities follow the Proponents' advice, what should they do? A common suggestion would be monetary tightening. Yet, how tight? Or what is the "right" level for asset prices? Apparently, monetary authorities need to have confidence in their own predictions over future capital incomes.

Granted that monetary authorities know the future capital incomes; can tightening really help correcting the misalignments? It can certainly bring down the inflated asset prices through a rise in the interest rate; yet, the lowered asset prices will still be "bubbles" as long as $\bar{r}$ remains to be inconsistent with future fundamentals. In a word, changes in the interest rate *per se* cannot correct asset price misalignments due to non-rational expectations; put plainly, monetary policy cannot reach the bubbles in people's mind through conventional transmission mechanisms.

Monetary tightening might be able to correct $\bar{r}$ through signaling the existence of bubbles. Or simply suppose monetary authorities can correct the non-rational $\bar{r}$ by warning of irrational exuberance (i.e., the so-call "open mouth operations"); then the asset price bubbles would be deflated. However, asset prices lower than the original level (q^E) tend to cause an insufficient AD. To rebalance AD and AS, monetary authorities will

have to lower i to reflate asset prices back to q^E. Then the economy reaches a desirable non-bubbles state with the AD-AS balance still maintained.

Granted that such a "realignment" is achievable in reality, is it worthy—what is the difference between the non-bubble state and the original one with bubbles? There is not much difference; even the asset price level remains unaltered after the correction. The only difference is that $\bar{r}$ and i are both higher in the bubble state than in the non-bubble one. In this sense, the Opponents' argument is correct—with AD and AS in balance (in the original state), the "toxic side effects" of the bubbles in $\bar{r}$ have already been handled (by a higher interest rate level than it would have been without the bubbles).

The discussion so far seems to lend support to the Opponents' suggestion of no direct monetary reaction to asset price movements under normal situations. However, Japan's painful boom-bust experience makes such a suggestion hard to be accepted wholeheartedly.[28]

One key point is that the Opponent's prescription may not really get rid of the source of the "toxic side effects" but allow it to be latent and accumulating into a "cancer" that takes much more pain to cure. Another point is that this "cancer" development process can be completely due to fundamental factors. In the following we use a simple example to illustrate these two points.

Recall that the above analysis indicates that the EFAP are closely tied to the current economic condition and behaviors. This is because asset prices have a close tie to AD through the wealth, Tobin's q, and/or other effects. If the relationship between asset prices and AD is stable, monetary policy that stabilizes AD will indirectly stabilize asset

[28] In hindsight, the monetary authorities of Japan were often criticized for allowing the 1980s bubbles to develop in an easy-money environment. See Okina and Shiratsuka (2003) for discussion.

prices; and vice versa. However, asset price boom-bust cycles could happen if the relationship is not stable.

As an example, consider a (close-economy) case in which a positive shock on productivity growth increases the growth in the output (AS) potential. Suppose monetary policy devotes to keeping the AD and AS balanced in every period; then the increased growth in output potential needs to be balanced by an increase in the growth of AD, which may in turn need an increase in the growth of asset prices. In a word, the productivity shock tends to generate an asset market boom. We consider two different scenarios, respectively with and without a boom-bust cycle.

In scenario A, suppose the relationship between asset prices and AD is stable and regular. Then, asset prices will grow gradually, keeping pace with the growth of AD (or ultimately, the growth of output potential). Therefore, no boom-bust cycle tends to happen, as depicted by the asset price growth path A in Figure 1.

However, in scenario B, suppose asset price appreciation has a *delayed* effect on AD—this could happen, for example, because initially consumers and firms are yet to be convinced of a long-lasting boom.[29] Then, to induce enough AD to sustain the increased AS, the initial boom needs to be "inflated" relative to that in scenario A, as depicted by path B in Figure 1. As the boom is gaining momentum, consumers may eventually (at point c on path B) be convinced of the "concreteness" of the boom and start increasing consumption significantly; and firms be convinced of a New Economy and start investing significantly. Unfortunately, the boom inflated by unduly low consumption propensity (or

[29] Consumers may be "target savers", i.e., they change consumption behaviors only when wealth reaches targeted levels (Elmendorf, 1996). Investment uncertainty and irreversibility may make entrepreneurs adopt a "wait and see" strategy at the beginning of the boom–see Dixit and Pindyck (1994) for discussion on investment under uncertainty.

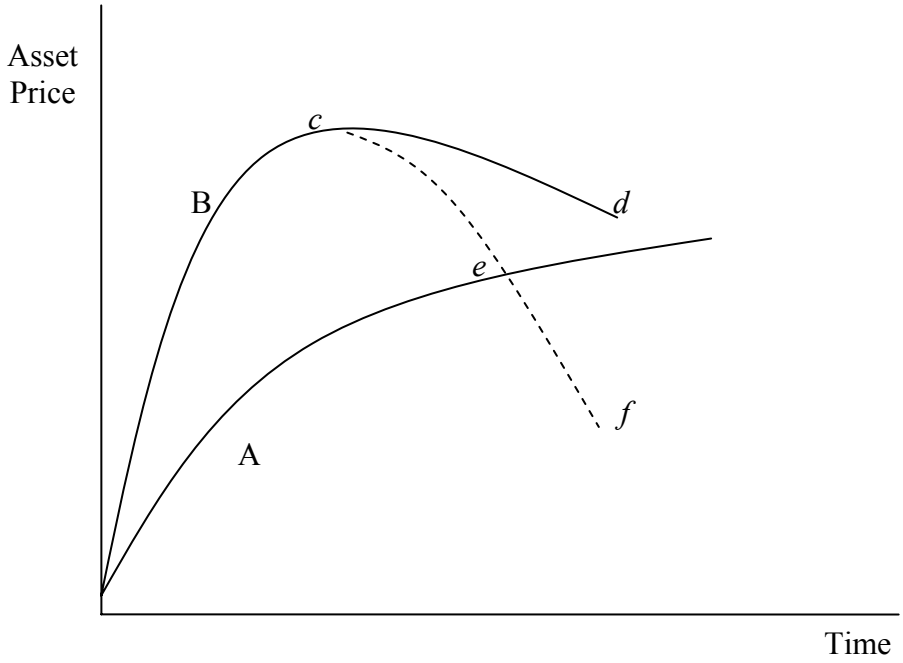

Figure 1

investment elasticity) will have to be deflated when the propensity (or elasticity) becomes normal—recall the negative relationship between consumption propensity (or investment elasticity) and the EFAP indicated in equation (29). The correction process could be a "soft-landing", as depicted by the portion *cd* on path B. However, if the boom has been inflated too much; and/or economic agents' reactions to the boom are too nonlinear, the correction could be severe by itself (the portion *ce*); not mentioning a possible full-scale bust (the portion *ef*) due to financial panics that are likely induced by the correction. In hindsight, such a boom-bust cycle tends to be taken as a case of bubbles boom-bust. Yet, the boom, despite eventually busted, is indeed fundamental under common criteria.[30]

[30] One may argue that the boom is not fundamental because rational economic agents should be able to expect that their irregular behaviors could cause the boom-bust cycle and hence avoid it. However, an individual agent, being a price-taker in asset markets, is not likely to have the "collective rationality" to take into account the effect on asset prices of her and her fellow agents' behaviors—the effect of her own

This simple example indicates that the absence of non-fundamental elements is not sufficient to avoid asset price boom-bust cycles. It also indicates that (temporary) AD-AS balance might seemingly be a sign of healthy booms but could indeed be peace before a latent storm.

In general, paper wealth accumulation due to rapid asset price appreciation, fundamental or not, contains potential inflation pressure. In the short run, the pressure might be absent because of economic agents' nonlinear reactions to the boom; or the existing pressure may not be overt yet because of short-term nominal rigidities. However, high and increasing asset prices are always impending and accumulating pressures on the AD-AS balance, which tend to eventually manifest themselves and have to be released through a downward correction of asset prices. A severe correction, by itself or accompanied by possible financial panics, could result in the bust of a "healthy" boom, which could severely disrupt the real economy through the wealth, Tobin's q, and various balance sheet effects.

In a word, from a macroeconomic perspective, the soundness of asset market performances does not depend on whether they are fundamental or not, but on whether they are compatible with the AD-AS balance in the long run.

Since fundamental asset market performances consistent with the *current* economic stability, if let alone, could still jeopardize the economic stability in the *future*, monetary authorities need to be at least concerned about asset market performances beyond the goal of the *present* AD-AS balance. Admittedly, many practical factors need to be taken into consideration before monetary authorities decide whether to intervene in asset

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behaviors tends to be infinitesimal; yet she might not have enough information to predict other agents' behaviors.

markets to preempt over inflation pressure;[31] yet, neither the inability in distinguishing between fundamental and non-fundamental, nor the absence of imminent inflation, should be taken as *a priori* argument against such intervention.

5. Concluding Remarks

This paper articulates three basic insights: First, changes in FPW (due to monetary policy) are essentially wealth redistributions between current and future asset holders; and a FPW increase tends to make current consumers as a whole wealthier. Second, the more elastic investment is, the stronger the q effect (of monetary policy); yet the weaker the wealth effect. Third, from a macroeconomic perspective, the soundness of asset market performances does not depend on whether the performances are driven by fundamentals or others; rather, it depends on whether they are compatible with the AD-AS balance in the long run.

These insights and their implications discussed above might not be novel to some readers in one way or another. Yet, in light of the current literature and general discussion regarding asset prices and monetary policy, we believe the above effort in articulating them is worthwhile.

[31] Monetary intervention in asset markets to preempt over future inflation pressure faces several practical difficulties. First, it is hard to know the magnitude and timing of the pressure of asset prices on AD-AS balances—to predict future AS is difficult enough, let alone to estimate the effect of asset prices on AD. Thus, it is difficult to determine when to intervene and by how much. Second, markets by themselves might be able to release the potential pressure through a soft-landing correction; thus preemptive monetary intervention might not be necessary. Most importantly, preemptive monetary intervention to handle elusive future AD-AS imbalances tends to nevertheless cause the imbalance at present. Having considered these elements against preemptive monetary intervention, the real economic cost of a bust suggests monetary authorities being less conservative in preemptive intervention.

To convey the basic ideas, we in some place adopt a narrative approach supported by simplified models. Yet, we believe that the arguments and conclusions should stand scrutiny.

As a conclusion, we provide a synthesizing summary of the main points offered by the paper.

The substance of wealth is the underlying incomes it represents, while its function is to provide purchasing powers. Even when monetary policy does not affect the substance, it can still affect the purchasing powers the substance can provide, which are what really matters for wealth holders. This is the essence of the wealth effect of monetary policy.

As investment elasticity tends to be LTPE due to investment (or disinvestment) impediments, monetary policy tends to have non-trivial effects on asset prices. Thus, the wealth effect channel is potentially a significant monetary policy transmission mechanism; and the significance can increase as stock ownership becomes more and more popular.

The monetary effect on asset prices makes monetary policy unable to simultaneously stabilize both goods and asset markets. Indeed, inflation-targeting monetary policy tends to make asset prices a buffer for economic fluctuations and hence make asset prices more volatile. This unpleasant feature does not negate the role of monetary policy as the most flexible and convenient AD policy for managing transitory shocks. Yet, it does indicate that monetary policy could be suboptimal in dealing with permanent and predictable shocks. For example, monetary policy could acquiesce to the development of excessive asset market booms (in an inflation-benign environment) that not only tend to crowd out savings but also may eventually collapse.

Whether an asset market boom is in danger of collapse does not depend on whether it is fundamental or bubble. Rather, it depends on whether the mass purchasing power potential generated by the boom is compatible with the AD-AS balance in the long run. Therefore, identifying bubbles is a non-issue for monetary policy. Rather, the issue is to identify inflated booms that contain latent inflation pressures, watch them vigilantly, and if necessary, help soft-landing them even when it takes preemptive interventions in asset markets *per se*.

Financial communities might never like asset market booms being curbed by monetary policy. Yet, the following clarifications might help to mitigate the resentment. First, since fundamental elements tend to influence the underlying interest rate, direct or indirect monetary responses to asset market performances for accommodating changes in the underlying interest rate are not interventions; rather, lack of which is. Second, asset market booms driven by fundamentals can also be excessive and eventually collapse for fundamental reasons. Thus, monetary preemption for deflating an excessive boom may be necessary to avoid a more damaging bust.

Keynes in his General Theory (1936, p.235) points out that monetary policy can pull the economy out of stagnation by satisfying people's desire for "the moon" (i.e., liquidity). During boom times people might want another moon, i.e., a vast amount of wealth that keeps growing. Monetary policy can help satisfying this desire as long as people only take the wealth as such. Yet, when people become wealthy enough and ready to unleash the purchasing powers seemingly in the wealth, they will soon find out that paper wealth can vanish overnight. Monetary policy cannot help—it has no magic to move goods and services yet to be produced in the future to the present. However,

monetary policy does commit to protecting the purchasing powers in one kind of store of value (i.e. money). Thus, people need to decide whether to take the risks in (long-term) asset markets or not. Once again, a reminder to those who do: fundamental asset prices, if too high, are also likely to collapse.

"Fundamental asset prices" as a term to distinguish "bubbles" may nonetheless obscure the volatility intrinsically associated with any price based on exchange value. The term "fundamental paper wealth" can serve as a caveat.

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