

# **Asset Prices and Monetary Policy: Some Notes\***

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### **Abstract**

Three issues regarding asset prices and monetary policy are clarified. First, increases in asset prices due to monetary expansion, despite their “paper” wealth nature, tend to make current consumers as a whole wealthier. Second, the weaker (stronger) effect of monetary policy on investment through the Tobin’s  $q$  effect is, the stronger (weaker) monetary effect on consumption through the wealth effect. Third, from the perspective of macroeconomic stability, 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.

## 1. Introduction

The impressive stock market booms in the United States (U.S.) during the 1990s have attracted public, policy as well as academic attention to the relationship between asset prices and monetary policy. As stock prices kept skyrocketing and consumption booms made the already low personal saving rate plummet further during the end of the decade, the U.S. monetary authorities (the Fed) were concerned that the so-called “wealth effect” could jeopardize the balance between aggregate demand and supply (Greenspan, 2000a, b). Accordingly, the Fed adopted preemptive monetary tightening by raising the Fed Funds rate for six times from mid-1999 to mid-2000, despite no obvious signs of imminent inflation. The preemptive tightening was questioned by many observers in financial communities, who did not share the Fed’s concerns over the wealth effect and argued that the Fed should not interfere with the stock market booms that are fundamentally driven by the underlying productivity growth in a “New Economy”. The Fed responded by frequently stressing that the motive of the tightening was not to interfere with the stock markets *per se* but to prevent an imbalance between aggregate demand (AD) and supply (AS), existing or potential.

Against this backdrop, there are burgeoning empirical studies in the literature on how asset prices affect consumption through the wealth effect (Poterba, 2000; Dynan and Maki, 2001; Maki and Palumbo, 2001; among others). Research interest has also been rekindled to investigate the wealth effect of monetary policy (Ludvigson, Steindel and Lettau, 2002). There are also intensive debates among academia and policymakers on whether monetary authorities should respond to asset price movements (Bernanke and Gertler, 1999, 2001; Cecchetti, Genberg, Lipsky and Wadhvani, 2000; among others).

Observing current discussions regarding asset prices and monetary policy, we find three fundamental issues, which have seemingly straightforward explanation, require clarification.

The first issue is regarding the wealth effect (on consumption) of monetary policy. It seems straightforward that monetary expansion,<sup>1</sup> by lowering the interest rate and hence increasing asset prices, tends to increase the wealth of consumers, who will accordingly increase their consumption. However, as argued by Gramlich (2001), if increases in asset prices are not due to increases in future incomes but because of a decline in 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 a word, Gramlich wonders how “paper wealth” changes induced by monetary policy affect consumption.

The term “paper wealth (change)” is often used to describe changes in asset value for reasons other than changes in the asset’s underlying productivities; e.g., asset bubbles can cause paper wealth increases. Since asset value variations caused by monetary policy are usually not taken as bubbles but as fundamental asset revaluations due to changes in the interest rate, we will call them “fundamental paper wealth” (FPW) changes. A conjecture is that, if FPW changes were merely changes in the metric of wealth, the aforementioned Fed’s preemptive tightening might not have caused much opposition.

The second issue is regarding how monetary policy affects asset prices. According to the widely used present value (PV) rule for asset price determination, it seems straightforward that monetary expansion will increase asset prices by decreasing the

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<sup>1</sup> To fix idea, we may discuss only the effects of monetary expansion; and those of monetary tightening are presumably the opposite.

interest rate as the discount factor in the denominators. However, since the decreased interest rate could increase investments and hence lower capital incomes, would not the numerators in the PV rule also tend to decrease? If so, monetary effect on asset prices is not as clear as it is commonly thought; nor is the wealth effect of monetary policy.

The third issue is regarding the concept and determination of fundamental asset prices. A common view holds that monetary authorities should not interfere with asset price movements driven by fundamentals. Based on this view, many observers argue against monetary responses to asset price movements on the ground that monetary authorities cannot distinguish between asset price movements driven by fundamentals and those not. However, conceptually, what kinds of asset price movements are fundamental; and what other kinds are misalignments? According to the PV rule, fundamental asset prices should reflect assets' underlying (risk-adjusted) yields—higher asset prices due to higher yields are fundamental, while those due to “irrational exuberance” are bubbles. Yet, given yields, asset prices also depend on how the yields are discounted. Then, what interest rate level is the “fundamental” discount factor? Would not changes in fundamentals tend to also alter the fundamental interest rate? If so, would not monetary responses be needed to accommodate the changes in the underlying interest rate?

The above questions, once raised, have self-evident answers. Indeed, direct or indirect answers can be found in the existing literature under different contexts. However, lack of recognition of them is evident in current public as well as academic discussions regarding asset prices and monetary policy. Thus, this paper attempts to provide some notes for

clarifying them. More importantly, the clarification provides some insights that have not been articulated by the existing literature.

We provide some qualifications from the beginning. First, we (explicitly or implicitly) consider asset prices from the “net wealth” perspective by using the capital price [Tobin’s (1969)  $q$ ] as an aggregate proxy for asset prices. Second, we abstract the implication of (expected) inflation to asset prices. Indeed, we consider a situation where inflation expectations are well anchored by inflation-targeting monetary policy. Third, we abstract the implications of risk premia to asset prices by assuming future capital incomes are risk free. Fourth, unless noted otherwise, *the* interest rate means the long-term (risk-free) interest rate. Note that the abstraction of inflation trivializes the difference between real and nominal interest rates (or other variables).

The remainder of the paper is organized as follows.

Section 2 clarifies the (fundamental paper) wealth effect of monetary policy. This issue has been studied decades before by the literature on the so-called interest-rate-induced wealth effect (IRIWE); yet the insights provided by which are often overlooked by the current discussion on the wealth effect of monetary policy. Thus, we revisit the issue, in light of the IRIWE literature, but from the perspective of the current discussion. We show that a FPW change is in essence a process of wealth redistribution between current and future asset holders; and a FPW increase tends to make current consumers as a whole wealthier. Despite this, the wealth effect of monetary policy meant by the current literature tends to be partly attributable to the consumption (intertemporal) substitution effect.

Section 3 formally studies the interplay between the wealth effect (on consumption) and Tobin's q effect (on investment) of monetary policy. We find that, the stronger the Tobin's q effect, the weaker the wealth effect. This result implies that, when it is costly in the margin to transform savings into new capital stock as the "concrete" wealth, paper wealth will be generated through asset price appreciation, which could result in savings being diverted back to consumption through the wealth effect.

Section 4 inspects the determination of fundamental asset prices from a macroeconomic (stability) perspective. The perspective indicates that, contrary to conventional wisdom, fundamentals-driven asset price movements can likely cause asset price misalignments that need to be corrected by monetary responses. It also indicates that, contrary to conventional wisdom, higher *future* productivities might not necessarily lead to higher *current* fundamental asset prices. Conceptually, the inspection clarifies that the soundness of asset market performances, from the perspective of macroeconomic stability, depends on whether asset prices are compatible with the AD-AS balance in the long run, irrespective of their underlying driving forces being fundamental or not.

Section 5 concludes the paper.

## 2. **Fundamental Paper Wealth Effect**

Increases in asset values due to monetary expansion are FPW in the sense that they are increases in the present values of the same amount of underlying future incomes. The nature of FPW and its effect on consumption have been investigated in Hicks (1939), Keynes (1930, 1936), Leijonhufvud (1968), Pesek and Savings (1967), Sweeney (1988),

among others,<sup>2</sup> which produce many insights as to the FPW effect. However, the insights are often overlooked by discussions on the wealth effect of monetary policy in the current literature.<sup>3</sup>

A detailed review of the IRIWE literature is beyond the scope of this paper.<sup>4</sup> In the following we focus on clarifying the current influential but casual interpretation of the wealth effect of monetary policy. We note that the essence of our clarifications 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.

### *Clarification*

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

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

which implies that the current consumption ( $C_0$ ) is positively—the consumption propensity  $\xi > 0$ —related to the net worth ( $W_0$ ), i.e., the PV of lifetime incomes.

Under a convenient assumption of unit elasticity of intertemporal substitution, which is often adopted to facilitate analyses of aggregate lifecycle consumption behaviors (e.g. Blanchard, 1985), a fall in the interest rate (due to monetary expansion) has no effect on

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<sup>2</sup> The FPW effect is more specifically called as the interest-rate-induced wealth effect (IRIWE) in this line of literature. Since the monetary effect on asset prices can also be viewed from the Tobin's  $q$  perspective—which will be adopted in the formal analysis in the next section—we prefer the term FPW, which captures the nature of asset price changes caused by monetary policy. Besides, as will be seen in the next section, in a general equilibrium framework, a change in the interest rate could induce not only changes in asset prices as the “paper wealth”, but also changes in the capital stock as the “concrete wealth”.

<sup>3</sup> 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.

<sup>4</sup> See Leijonhufvud (1968) and Sweeney (1988) for the development of the IRIWE literature.

$\xi$  but increases  $W_0$ . Hence, according to equation (1), the increase in  $W_0$  will raise consumption proportionally despite its paper wealth nature. Indeed, such a FPW increase is often casually referred to as an increase in consumers' wealth or lifetime resources; and the rise in the consumption is accordingly called as the "wealth effect" (e.g., Mishkin, 1995; Modigliani, 1971, among many others). We clarify this casual interpretation in the following. For clarification, we call the *proportional* effect on consumption of FPW changes in  $W_0$  (under the unit elasticity assumption) as the "FPW effect".

To establish a conceptual foundation for the clarification, we first introduce two ways of decomposing the interest rate effect on consumption. One is a three-effect decomposition on which the casual interpretation is (explicitly or implicitly) based; and the other is a two-effect decomposition adopted by the IRIWE literature.

Consider a Marshallian (current) consumption demand function  $C_0(r, W_0)$ , where  $r$  is the interest rate that essentially measures the price of current consumption in terms of that in the future. Denote the corresponding Hicksian demand function as  $C_0^h(r, u^*)$ , where  $u^*(r, W_0)$  is the indirect utility that measures the maximum achievable utility (or "wealthiness") under  $r$  and  $W_0$ .

To see the effect of a change in the interest rate ( $dr$ ) on  $C_0$ , totally differentiate  $C_0(r, W_0)$ , which gives

$$\frac{dC_0(r, W_0)}{dr} = \frac{\partial C_0}{\partial r} + \frac{\partial C_0}{\partial W_0} \frac{dW_0}{dr}. \quad (2)$$

The first term on the right-hand side (RHS) of equation (2) can be further decomposed through the well-known Slutsky decomposition:

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

where  $e_0(r, u^*)$  is the expenditure (function) measured in terms of the current consumption. Note that  $\partial e_0 / \partial r \leq 0$ —a fall in  $r$  increases the costs of future (in terms of current) consumption and hence requires a higher expenditure budget ( $e_0$ ) to maintain the indirect utility level ( $u^*$ )—the equality applies when future consumption is zero.

A combination of (2) and (3) gives the three-effect decomposition:

$$\frac{dC_0}{dr} = \left( \frac{\partial C_0^h}{\partial r} \right) + \left( - \frac{\partial C_0}{\partial W_0} \frac{\partial e}{\partial r} \right) + \left( \frac{\partial C_0}{\partial W_0} \frac{dW_0}{dr} \right), \quad (4)$$

where the first, second and third terms on the RHS are, respectively, the substitution, income and wealth effects—their signs on their tops.<sup>5</sup>

Intuitively, 1) the substitution effect measures the interest-rate effect on consumption given the original indirect utility level ( $u^*$ )—a fall in the interest rate lowers the cost of current consumption in terms of that in the future and hence increases the current consumption; 2) the income effect measures the interest-rate effect on consumption through the lifetime consumption cost (measured by  $e_0$ )—a fall in the interest rate makes lifetime consumption more expensive (in terms of current consumption) and hence decreases current (as well as future) consumption; and 3) the wealth effect measures the interest rate effect on consumption through the lifetime wealth (measured by  $W_0$ )—a fall in the interest rate increases consumers' wealth (in terms of current consumption) and hence increases the current (as well as future) consumption.

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<sup>5</sup> The origin of this three-effect decomposition, which has become a standard textbook material, is unclear to us. See Obstfeld and Rogoff (1996, pp. 28-45) for discussion on the three-effect decomposition in a two-period model.

A key point is that the wealth effect is not a proper measure of the interest rate effect on *wealthiness*. This is because a fall in the interest rate tends to increase not only the lifetime wealth ( $W_0$ ) but also the lifetime consumption cost ( $e_0$ )—this is precisely the essence of the aforementioned “no richer” argument by Gramlich (2001).<sup>6</sup> Indeed, the proper measure is the sum of the wealth and income effects. To see this, we need the 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:

$$\frac{dC_0(r, W_0)}{dr} = \frac{\partial C_0^h}{\partial r} + \frac{\partial C_0^h}{\partial u^*} \frac{du^*}{dr}. \quad (5)$$

Equation (5) implies that the interest-rate effect can be decomposed into the substitution effect (the first RHS term) and the *Hicksian* wealth effect (the second term).<sup>7</sup> While the substitution effect here is identical to the same effect in the three-effect decomposition, the Hicksian wealth effect measures the interest-rate effect on consumption through the wealthiness level ( $u^*$ ).

A comparison between the two versions of decomposition [equations (2) and (5)] indicates that the sum of the income and wealth effects is equal to the Hicksian wealth effect. Therefore, the income and wealth effects combined together (implicitly) measures the interest rate effect on the wealthiness.

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<sup>6</sup> Keynes (1936, p.94) made the same argument. Conceptually, the net worth  $W_0$  measures wealth in terms of current consumption; thus, for consumers who consume also in the future, interest-rate-induced net worth changes have ambiguous welfare implications. See Hicks (1939, p.232-235); Leijonhufvud (1968, chapter IV) for discussions.

<sup>7</sup> The Hicksian wealth effect here is originally called as the “income effect” by Hicks (1939) and sometimes also called as the “wealth effect” by later users of the Hicksian Apparatus (e.g., Leijonhufvud, 1968; King, 1991; among others). Since the two terminologies (i.e., the wealth effect and income effect) used 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 term “Hicksian wealth effect” to denote the income (or wealth) effect in the Hicksian decomposition.

With the conceptual foundation established, we proceed to clarify the FPW effect. In the consumption function (1), the substitution and income effects are captured by the interest-rate effect on  $\xi$ , while the wealth effect is captured by that on  $W_0$ . Under the unit elasticity, the substitution and income effects exactly offset each other; thus the interest rate effect on  $\xi$  is zero. Hence, 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 with larger FPW could indeed become less wealthy when the underlying decline in the interest increases the lifetime consumption cost more than it increases the net worth; i.e., when the income effect dominates the wealth effect. Second, the exact cancellation between the substitution and income effects is not equivalent to the case of them being both zero—an offset positive substitution effect (implied by the unit elasticity) is still positive but not zero. If the income and wealth effects happen to cancel out—which is essentially what Hicks (1939, p. 232-235) argues for in an aggregate sense<sup>8</sup>—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,<sup>9</sup> a decline in the interest rate will increase  $W_0$  but decrease  $\xi$  through the income effect. The balance of the two effects (i.e., the Hicksian

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<sup>8</sup> 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 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.

<sup>9</sup> 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.

wealth 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, p. 232-235). However, according to Leijonhufvud (1968, p. 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.

First, we explain that a FPW increase is a redistribution of wealth that benefits current capital owners at the cost of future owners. Suppose a monetary expansion lowers the interest rate from  $i$  to  $i'$  ( $i' < i$ ), then the price ( $q$ ) of a piece of capital that earns a constant dividend ( $r$ ) in every period will appreciate from  $r/i$  to  $r/i'$ , which provides the current owner of the capital a (paper) capital gain of the amount  $r(i - i')/ii'$ . It is a gain in the sense that, if currently being sold for consumption, the capital can provide  $r(i - i')/ii'$  amount of extra consumption. Where does this extra gain come from—note that the paper wealth increase does not create extra resources from the thin air? There are no free lunches—the gain is at the cost of future owners of the capital. At the original price,  $q$  dollar can own the whole piece of the capital that provides  $r$  amount of earning for each period. With the capital price appreciating to  $q'$ ,  $q$  dollar can only afford to  $q/q'$  (or equivalently,  $i'/i$ ) unit of the ownership, which implies  $r(i - i')/i$  amount of earning loss in each period. The PV of all the losses in all periods for the  $q$  dollar of investment is

$r(i - i') / ii'$ , which is precisely equal to the gain enjoyed by the current capital owner. In a sense, the gain enjoyed by the current owner is financed by the earning losses of the future owners.

The fate of an individual consumer in the wealth redistribution due to a FPW change depends on the capital ownerships she currently has and plans to assume in the future. Current capital owners will be no richer from a paper gain if they choose to hold on the capital forever—in a sense, the paper gain is offset by the earning losses from assuming all of the future ownerships. There are many determinants of capital ownership assumptions or dispossessions: consumption horizon, bequest motives, or the whim for wealth as such, to name a few. We narrow our focus by assuming that economic woman and man derive utility from their own material consumption only. If so, a FPW increase tends to make current consumers as a whole wealthier. We explain this in the following.

With finite-living consumers, capital will eventually be in the hands of consumers who are yet to be born. Since a (current) FPW increase benefits current capital owners at the costs of future owners, these unborn consumers, being among the future owners, are potential victims of the FPW increase. Since a FPW increase is a zero-summed wealth redistribution among all the consumers in all times, that the *unborn* consumers are victims implies that the current (*existing*) consumers as a whole are winners. In a word, a FPW increase tends to make current consumers as whole wealthier, albeit not in the Pareto sense—some current consumers might incur net losses from assuming future capital ownerships;<sup>10</sup> but in the compensational sense—the net gain for the current consumers as a whole is positive thanks to the (potential) loss of the unborn consumers.

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<sup>10</sup> Viewed from another angle, they lose from lower returns to savings.

Setting aside the distributional effects among the current consumers,<sup>11</sup> the wealthier current consumers as a whole will tend to consume more in aggregate. In a word, a FPW increase tends to increase the aggregate consumption by making current consumers as a whole wealthier. Therefore, besides the substitution effect, a positive (aggregate) FPW effect also captures consumption increase due to increase in wealthiness. In this sense, the casual “wealth effect” interpretation is not a complete misnomer.

### *Summary*

Although asset price appreciation due to monetary expansion is a FPW increase due to revaluation of the same amount of underlying incomes, it tends to make current consumers as a whole wealthier. The wealthier current consumers tend to consume more in aggregate. However, without the substitution effect, the increase in the aggregate consumption will be less than proportional to the FPW increase. In sum, the FPW effect is attributable partly to the substitution effect and partly to the increase in the aggregate wealthiness of current consumers.

### *Implication*

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

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<sup>11</sup> By no means unimportant, the distributional effects among the current consumers are an empirical issue. There are two rough 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 shorter consumption horizons and hence stronger 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 who tend to have smaller consumption propensities.

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 a FPW increase by which each of many victimized future capital owners tends to “contribute” only a little earning loss to finance the capital gain enjoyed by current capital owners, a FPW decrease is a reverse redistribution that could cost the current owners dearly.

Although society as a whole cannot avoid FPW variations, individuals can by holding liquid assets. Thus, the significance of a FPW decrease depends on who holds long-term assets. It might not matter much if the long-term assets are held by consumers who can afford large variations in wealth; yet, it is a matter of concern if the 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.

In this section, monetary policy is assumed to affect asset prices only through the interest rate; and the potential monetary effect on the yields of assets through investments is abstracted. In the next section we relax the assumption and formally study the wealth effect<sup>12</sup> of monetary policy with focus on its interplay with the Tobin’s q effect.

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<sup>12</sup> In the sense that current consumers do become wealthier from a FPW increase, the term “wealth effect” (of monetary policy) is not qualitatively misleading. For simplicity, we will use it in the remainder of the paper. We will use the term FPW when emphases are needed.

### 3. Interplay between the Wealth and Tobin's $q$ Effects

The wealth effect of monetary policy depends on monetary effect on asset prices. Based on the PV rule, it is commonly held that monetary expansion tends to raise asset prices by decreasing the interest rate. From the perspective of Tobin's  $q$ , this is equivalent to saying that monetary expansion raises  $q$  through a higher demand on capital. However, the decreased interest rate could also increase investments and hence lead to decreases in the yields of assets, which tend to dampen the rise in asset prices. Or from the  $q$  perspective, the response of the capital supply through the Tobin's  $q$  effect could dampen the rise in  $q$ . Therefore, a general equilibrium perspective that considers both the capital demand and supply is apt for a more rigorous analysis of monetary effect on asset prices and the wealth effect.<sup>13</sup> We conduct the analysis in the following.

To model the wealth effect, an overlapping generations (OLG) framework will be used to capture the feature of finite consumption horizon. For simplicity, we use a two-period OLG model; yet the results can be generalized in a multi-period one such as Blanchard's (1985) model. Since the two-period horizon framework is a theoretical abstraction, we will provide qualifications to the results.

#### The Model

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

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<sup>13</sup> We are aware of no existing 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 dismissed [e.g. Bernanke, Gertler and Gilchrist (1999)] or trivialized by the adoption of infinite-horizon modeling frameworks.

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.

The firms abstractly represent the function of production that is a process of using capital and labor to produce consumption output, while the entrepreneurs abstractly represent the function of 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 expenses. 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.

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.<sup>14</sup> Our goal is to see the effect of monetary policy on AD (especially aggregate consumption demand) through the wealth effect interacting with the Tobin's q effect.

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<sup>14</sup>The Walras' Law allows us to discuss only the equilibria in the goods, money and capital market.

### *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:

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

subject to:

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

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

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  $\theta$ ; and the real money balance provides liquidity services with  $\beta$  measuring the consumer's liquidity preference. We assume log utility for analytical convenience.

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

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

and money demand

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

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

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

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

### *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

$$Y_t = F(K_t) = A_t K_t^\alpha, \quad (9)$$

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:

$$r_t = F'(K_t), \quad (10)$$

$$w_t = F(K_t) - K F'(K_t). \quad (11)$$

### *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:

$$\text{Max } E U(\Pi_t^j)$$

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 (function) 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  $\bar{D}$ .  $D$  is a one-period bond.<sup>15</sup> 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  $\bar{D}$  is either held by the private sector ( $D_t$ ) or by the monetary authority ( $D_t^g$ ):

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<sup>15</sup> 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  $q$ .

$$D_t + D_t^g = \bar{D} . \quad (13)$$

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

### *Monetary policy*

The monetary authority decides 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):

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

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

$$M_{t+1} + D_{t+1} = M_t + D_t , \quad (15)$$

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:*

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<sup>16</sup> 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.

The asset stocks (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,

$$K_t = K_{t-1}; D_t = D_{t-1}; \text{ and } M_t = M_{t-1}.$$

### *The Goods Market*

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

We assume that 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 inspecting the core issue, i.e., the monetary effect on the AD through the interplay between the wealth effect and the Tobin's  $q$  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 effects of monetary policy depend not only on its effect 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.<sup>17</sup>

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<sup>17</sup> 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

According to equation (6),

$$dC_{1t} / dM_{t+1} = 0, \quad (16)$$

which implies that money has no effect on the young's consumption demand. This is because monetary policy affects neither the young's wealth, which is her current disposable income, nor her consumption propensity ( $\xi$ ) due to the log utility.<sup>18</sup>

According to equation (8),

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

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

**Proposition 1** *The effect of monetary policy on aggregate consumption demand is positively related to its effect on the capital price.*<sup>19</sup>

#### *The money market*

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

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

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transmissions. Studying the wealth effect channel and its interaction with other channels in a business cycle context is an interesting topic for future research.

<sup>18</sup> On the one hand, the log utility assumption implies existence of the substitution effect, without which money will negatively affect  $\xi$ . 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) wealth 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.

<sup>19</sup> According to the discussion in the last section, this proposition will hold even when the assumptions of two-period horizon and log utility are relaxed.

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:

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

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

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

where  $\pi_v (= P_v / P_{v-1} - 1)$  is the inflation rate in period  $v$ —note that  $\pi_{t+1}$  is equal to zero due to the price rigidity assumption. Equation (19), being a version of the PV rule, is essentially a capital demand function that relates the capital price ( $q_t$ ) to the capital stock ( $K_{t+1}$ ) that is implied by the capital income ( $r_{t+1}$ ). To determine the general equilibrium capital price, we need the capital supply function as well.

The supply of capital comes from two sources: one is the supply of existing capital by the old consumer's asset decumulation; 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. We model investment behaviors in the following.

First, 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  $\Pi_t^j = (q_t - 1)I_t^j$ . This implies that a competitive equilibrium in the capital market will only be reached when the capital price is

$$q_t = 1. \quad (20)$$

As a capital supply function, equation (20) implies perfect elastic investment (to  $q$ ).

Perfect elastic investment is rare in reality; and many "impediments" could make investment less than perfect elastic (LTPE). Here we discuss two fundamental cases:<sup>20</sup> one is convex investment adjustment costs and the other is risky investments coupled with risk-averse entrepreneurs. We start with the case of convex adjustment costs.

Suppose the aggregate investment cost function is in the form of

$$c(I_t) = I_t(1 + \gamma I_t), \quad (21)$$

where  $\gamma > 0$  implies convex adjustment costs.<sup>21</sup> Without uncertainty, the utility-maximizing representative entrepreneur chooses  $I_t$  to maximize profit:

$$\text{Max} \Pi_t = q_t I_t - c(I_t)$$

subject to the investment cost function (21); the result of which is

$$q_t = c'(I_t) = 1 + 2\gamma I_t. \quad (22)$$

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<sup>20</sup> By fundamental we mean impediments *not* caused by irrational behaviors or institutional imperfections.

<sup>21</sup> 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, i.e., equation (21).

With  $\gamma > 0$ , equation (22) implies LTPE investment and hence an upward-sloping capital supply function.

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

$$c(I_t^j) = I_t^j (1 + z_t^j), \quad (23)$$

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

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

which implies constant absolute risk aversion. According to the investment cost function (23) and the utility function (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:  $q_t = 1 + \varphi\sigma^2 I_t^j$ . With  $n$  identical entrepreneurs, the aggregate investment function would be

$$q_t = 1 + \frac{\varphi\sigma^2}{n} I_t. \quad (25)$$

The capital supply function (25) 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 ( $n \gg 0$ ), then, according to the law of large numbers, the aggregate investment cost function would be

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

which implies a constant marginal cost for the aggregate investment. Despite the marginal investment cost being constant 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

$$q_t = 1 + \eta I_t \quad (27)$$

With capital demand and supply being specified, we proceed to discuss the effect of monetary policy on the equilibrium capital price ( $q_t^e$ ), which is determined by a simultaneous system composed of the capital demand function (19), the capital supply function (27), the money demand function (7'), and equation (10) together with (12) that determines the relationship between capital income ( $r_{t+1}$ ) and investment ( $I_t$ ). We will use comparative statics based on the simultaneous system to show how a monetary shock ( $dM_{t+1}$ ) affects  $q_t^e$ .

First, we need to specify how  $dM_{t+1}$  affects the expectation terms ( $E_t i_v$ ,  $E_t \pi_v$  and  $E_t r_s$ ) in the capital demand function (19), which is also a version of PV rule for capital valuation. For analytical convenience, we assume that capital is valued by a practically simplified version of the PV rule (19):

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

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.

In general, monetary policy can be viewed as monetary authorities using targeted short-term interest rates and/or other means (e.g. verbal signals) to influence the long-term interest rate, which is what really matters for asset prices and investments but depends on market expectations. For simplicity, assume  $d\bar{i} = \tau di_{t+1}$ , where  $\tau (> 0)$  measures the indirect effect of  $dM_{t+1}$  on the long-term interest rate through the short-term rate.

Expectations on future inflations depend mainly on monetary authorities' inflation targets and the credibility of the targets. For simplicity, assume that  $dM_{t+1}$  affects neither the targets nor their credibility; i.e.,  $d\bar{\pi} / dM_{t+1} = 0$ .

For simplicity, suppose the average growth rate of the capital income is  $g$ , i.e.,  $\bar{r} = gr_{t+1}$ . Assume  $dM_{t+1}$  is not expected to affect  $g$ ; then,  $d\bar{r} / \bar{r} = dr_{t+1} / r_{t+1}$ .<sup>22</sup>

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

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

$$(b) \quad \frac{\partial(dq_t^e / dM_{t+1})}{\partial\eta} > 0; \text{ and}$$

$$(c) \quad \frac{\partial(dI_t / dM_{t+1})}{\partial\eta} < 0,$$

which imply the following propositions:

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<sup>22</sup> 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.

**Proposition 2** *Under perfect elastic investment, 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 Tobin's  $q$  effect [result (b)] on investment; yet the weaker the monetary effect on the equilibrium  $q$  [result (c)]; and hence the weaker the wealth effect (proposition 1).*

The intuition behind these two propositions is straightforward. A monetary expansion leads to excessive demand for capital, which could be satisfied by an increase in either the quantity or price of capital, most likely both. The more elastic the investment is, the larger part of the excessive demand will be satisfied by the increase in capital stock; and hence the smaller its effect on the increase in capital price, which implies a smaller wealth effect. In a word, (the magnitude of) the wealth effect negatively depends on the Tobin's  $q$  effect.

### **Implication**

Whether monetary authorities' AD targets are achieved through the Tobin's  $q$  effect or the wealth effect might not be important from the point of view of short-term stability; yet it is non-trivial from the point of view of long-term growth because, while the investment part of AD helps to accumulate national wealth, the consumption part helps to

decumulate it. In the following, we show that the wealth effect can divert savings back to consumption.

In the above model, suppose that the monetary authority credibly targets zero-inflation; thus the role of monetary policy is to keep the money supply (or essentially the interest rate) at a level consistent with the AD-AS balance, i.e., the goods market equilibrium:

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

The gross saving (GS) comes from the young consumer's saving:  $GS_t \equiv w_t - T_t - C_{1t}$ , while the net saving (NS) depends also 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 a 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 the investment is LTPE (i.e.,  $\eta > 0$ ). It is not difficult to see that the larger  $\eta$  is; i.e., the less elastic the investment is, the smaller portion of the extra GS can be realized into the NS, which implies that the larger portion of it will be diverted back to consumption. Intuitively, the extra GS leads to insufficient AD that entails monetary expansion, the effect of which depends on the interplay between the Tobin's  $q$  effect and the wealth effect. Implied by proposition 3, the less elastic the investment is, the larger portion of the AD shortfall will be covered by consumption through the wealth

effect, while the smaller portion will be covered by investment through the  $q$  effect. In a sense, part of the extra GS is crowded out through the wealth effect.

During the end of 1990s, the already low U.S. personal saving rate plummeted further despite the baby boomers being at their prime saving ages. Policymakers attributed the fall to the wealth effect of the stock market booms (Greenspan 2000a, b). What factors caused the booms and how much the wealth effect contributed to the low saving are empirical issues in the end. Yet, the saving crowd-out mechanism discussed above 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 and cause consumption booms. The resulting low saving will then be not a result of spendthrifts but that of prosperity from the paper wealth. Yet, such paper wealth prosperity not only hinders the accumulation of capital on which future incomes depend, but also could be easily turned into poverty by possible paper wealth destruction in the future when retired baby boomers start decumulating their wealth, or when the U.S. assets lose their appeal for some reason.

Although such a paper wealth boom-bust cycle is ultimately driven by economic fundamentals (i.e., the baby boom demographic feature or shocks in the world capital market), monetary policy plays a role of accomplice even though it is for the purpose of maintaining the AD-AS balance. In a word, monetary policy for maintaining price stability in goods market could generate price instability in asset markets.<sup>23</sup> This is

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<sup>23</sup> At least, monetary authorities' commitments to price stability in goods market deprive them of the ability in stabilizing asset markets.

because, by essentially using the interest rate to influence AD, monetary policy tends to have “side effects” on asset prices (see the proposition 2 and 3).<sup>24</sup>

AD policies that use other instruments could (in principle) avoid the side effects. For example, investment subsidies can be used to facilitate investments to cover insufficient AD without destabilizing the interest rate or asset prices. 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 for the purpose of short-term stability. 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 wealth nature of capital.

However, while monetary expansion is always welcomed by financial communities, tightening tends to draw criticisms, especially when its purpose is perceived as to curb booming asset markets. In the next section, we address the issue of whether monetary authorities should respond to asset market variations.

#### **4. Fundamental asset prices: a macroeconomic perspective**

A common view holds that asset price movements driven by fundamental factors should not be a concern of (let alone intervened by) monetary authorities. Accordingly, another common view holds that, since monetary authorities are no better than markets in detecting “bubbles”, it would be better for them to leave asset markets alone.<sup>25</sup>

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<sup>24</sup> To increase the elasticity of investment through reducing investment adjustment costs or nurturing entrepreneur spirits will certainly help mitigating the side effects; yet perfect elastic investment is hardly an achievable goal.

<sup>25</sup> This view is popular in financial communities and also receives sympathy from academia. For example, in discussing whether monetary authorities should respond to asset price movements, Bernanke and Gertler (1999, p. 18,) argue that “policy should *not* respond to changes in asset prices, except insofar as they signal changes in expected inflation. Trying to stabilize asset prices *per se* is problematic for a variety of reasons,

Facing such conventional wisdom, despite admittedly taking asset markets into consideration for monetary policy designs, monetary authorities usually deny aiming directly at them. However, such denials are not always convincing, especially when policy action is preemptive tightening for releasing inflation pressure whose existence is subject to judgment.

The Fed's late 1990s tightening was such a case. For fear of a U.S. copy of Japan's experience in the 1980s—rapid booming asset markets sustained by easy money in a low inflation environment eventually collapsed, resulting in a depressed economy still struggling nowadays, the Fed initiated a tightening from mid-1999 till mid-2000 with six consecutive (Fed Funds) rate hikes. Without obvious signs of inflation, the tightening was officially justified as preemption over inflation pressure (Greenspan, 1999). Yet, many observers in financial communities interpreted it as Fed's act to curb then booming stock markets—an understandable suspicion after all the talks by the Fed officials about “irrational exuberance” and “wealth effect”. They complained that such an intervention was unfounded for the stock prices then were consistent with the promising future productivity potential in the New Economy, if not undervalued. Facing many such complaints, Fed stressed frequently that the tightening was not aimed at the stock markets *per se* but to prevent the wealth effect from destabilizing inflation. Yet, such a circumventing explanation is hardly convincing: if the stock prices are fundamental, why worry about the wealth effect? In another word, do not the Fed's concerns over the wealth effect imply unsound stock market performances? Apparently, a clarification is needed. We attempt to provide one here.

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not the least of which is that it is nearly impossible to know for sure whether a given change in asset values results from fundamental factors, nonfundamental factors, or both.” (Emphasis original).

The main point of our clarification is straightforward: fundamentals-driven asset price movements are also likely to 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. Details of the clarification are as follows.

First we clarify the concept of fundamental asset prices. Fundamental asset prices are commonly defined as prices reflecting assets' underlying (risk-adjusted) yields—higher asset prices due to higher yields are fundamental, while those due to irrational exuberance are bubbles. However, asset prices also depend on how the yields are discounted. Then, is there a “fundamental” discount factor? Financial analysts or other practical PV rule users who oftentimes simply take the current interest rate as given might be uninterested in such a question. Yet, monetary authorities and macroeconomists who take stable inflation as a fundamental state of economy tend to consider the so-called equilibrium (real) interest rate (EIR) as the fundamental discount factor. 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).<sup>26</sup>

With a clearer concept of fundamental asset prices, that fundamentals-driven asset price movements can also be misalignments is straightforward: Since changes in fundamentals tend to affect not only assets' underlying yields but also the EIR, asset price movements that reflect the yield changes *only* will nevertheless be misalignments to the EFAP. Yet, the adjustment process of the EIR to its new equilibrium needs monetary facilitation. Thus, monetary responses to fundamentals-driven asset prices could be

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<sup>26</sup> The term might seem redundant to some readers who take EFAP as *the* fundamental asset prices. Yet, its merit will be clear in the discussion followed.

seemingly “interventions” but indeed monetary accommodations of changes in the EIR. For example, asset price appreciation driven by higher future productivities is commonly taken as fundamental; yet it could cause misalignments (to the EFAP) by generating excessive AD (through the wealth and Tobin’s q effects) under the original interest rate. The excessive AD indicates that the productivity growth has led to a higher EIR. Then monetary tightening for dampening the excessive AD appears as an intervention but is indeed realignment needed for accommodating the underlying interest rate hike.

In light of the above clarification, the Fed’s explanation of rationale for the late 1990s tightening would have been more convincing were it understood as follows. The claim of “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 explanation of “aiming at the wealth effect 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 a word, the controversy around the late 1990s tightening is due to the common but misleading view that fundamentals-driven asset price movements need no responses of monetary policy, without which the Fed’s circumventing and awkward explanation might not have been necessary in the first place.

Clarifying this view has two implications. First, it frees monetary authorities from unnecessary burden of policy justification. For example, rapid asset market booms such as the one experienced by the U.S. in the 1990s tend to cause (financial and real) economic imbalances, irrespective of the booms being driven by rational or irrational exuberance.<sup>27</sup> Since the real economic imbalances might not be overt in the short run due

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<sup>27</sup> See Borio, English and Filardo (2003) for discussion of financial imbalance buildup in an inflation-benign environment.

to various short-term nominal rigidities, preemptive monetary actions are needed to prevent them from developing to the extent where corrections could severely disrupt the economy. Yet, if the “burden of proof” of bubbles hinders the preemptive actions—lack of proof might make monetary authorities hesitate to preempt or make preemption hard to be pushed through—“bubble” booms-busts might eventually result even if the initial booms are rational (as far as market expectation on future productivities is concerned) and speculation free.

Second, the clarification also helps to disabuse financial communities of the notion that monetary responses to asset market performances must imply that monetary authorities disagree with markets over future economic prospects; and particularly, the notion that preemptive tightening implies monetary authorities’ detection of bubbles. Without such notions, disturbances to market psychology due to misreading monetary actions, which could cause unnecessary asset market or broader fluctuations and complicate the job of monetary authorities, can be avoided.

The notion that fundamentals-driven asset price movements could cause misalignments to the EFAP naturally begs for an inspection of the EFAP determination. Since many factors influence the EIR, the commonly used PV rule is not an adequate conceptual foundation for the inspection. Instead, a macroeconomic perspective whereby the determinations of the EFAP and EIR are considered together will provide a better view. In the following, we use the model presented in the last section to get the better view. Despite the simplicity of the model, the view provides some non-trivial but under-appreciated insights.

In the model, the *general* equilibrium capital price ( $q_t^E$ ),<sup>28</sup> defined as the one consistent with simultaneous equilibria in all the markets, can be determined by a simultaneous system composed of equations (6), (8), (11), (26), (27) and (28). In a reduced form,

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

where the signs on top of the parameters are the signs of their partial effects on  $q_t^E$ .

Assume away any non-fundamental element; then  $q_t^E$  is an aggregate proxy of the EFAP. A little inspection of equation (29) provides two insights about the EFAP determination.

First, the EFAP are affected by current economic conditions and behaviors. According to equation (29), 1) the current productivity ( $A_t$ ) positively influences  $q_t^E$ —*higher* asset prices are needed to stimulate AD to balance higher current output potential resulting from *higher* current productivity; 2) the current consumption propensity ( $\xi$ ) negatively influences  $q_t^E$ —an *increase* in consumption propensity tends to result in an excessive AD needed to be offset by a *decline* in asset prices; and 3) the elasticity of investment (measured reversely by  $\eta$ ) negatively influences  $q_t^E$  for reasons that have been discussed in detail in the last section.

Second, contrary to conventional wisdom, *future* productivities could have little influence over the EFAP. Indeed, equation (29) indicates no influence of future productivities over  $q_t^E$ —the PV rule [equation (19)] is not even in the simultaneous

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<sup>28</sup> 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.

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.<sup>29</sup> 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 better-viewed macroeconomic perspective, the link between assets’ (equilibrium) fundamental prices and their underlying future yields 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 the current macroeconomic condition. This insight sheds some light on current debates over whether inflation-targeting monetary policy should react directly to asset price movements.

Many opponents to the 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

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<sup>29</sup> The irrelevancy is 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 could increase the fundamental  $q$ . 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 productivity growth on the interest rate will thwart the asset price level from reaching the “fundamental” level based on a naïve assumption that the underlying interest rate will remain steady even when future productivities increase dramatically.

detecting asset price misalignments, at least not better than markets themselves (Bernanke and Gertler, 1999, 2001; among many others). Instead, they suggest that

*“[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, some proponents to the 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).

The key to the above difference in opinions seems to be 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 asset price misalignments—would not the task of keeping inflation on target already handle the “toxic side effects”? In light of the above insight about the EFAP determination, we address these two questions in the following.

For illustration, based on the above model, we consider an economy state  $\{i: q^E, \bar{r}, \bar{i}\}$  in which AD and AS are balanced under the short-term interest rate ( $i$ ) as a monetary policy instrument. Suppose the equilibrium capital price ( $q^E$ ) is sustained by expected future capital incomes ( $\bar{r}$ ) too high to be reasonable, i.e., there are asset price bubbles. Then, how should monetary authorities handle such a situation? While the Opponents might suggest no more duties for monetary authorities since the AD-AS balance indicates the “toxic side effects” have already been rid off, the Proponents tend to suggest 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 monetary tightening really help correcting the misalignments? It can certainly bring down the inflated asset prices through a higher interest rate; yet, the lowered asset prices will still be bubbles as long as the  $\bar{r}$  remain 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 over future productivities.

Monetary tightening might be able to help correcting  $\bar{r}$  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 correction of asset price misalignments is achievable in reality, is it worthy—what is the difference between the non-bubbles state and the original bubble state? There is not much difference; even the original misaligned asset price level is unaltered after the correction. The only difference is that  $\bar{r}$  and the interest rate are both higher in the bubble state than in the non-bubbles 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 experience of “bubble” boom-bust in the 1980s makes asset price movements hard to be taken lightly. Asset price boom-bust cycles, when happened, are usually considered as caused by bubbles;<sup>30, 31</sup> and monetary authorities are sometimes blamed for not taking care of the bubbles timely.<sup>32</sup> In the following, we point out that fundamental factors, with the acquiescence of monetary policy that focuses on the current AD-AS balance, can also likely cause asset price boom-bust cycles,

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<sup>30</sup> Asset price boom-bust cycles are currently under intensive research— for example, see the articles in “Asset Price Bubbles: The Implications for Monetary, Regulatory, and International Policies” edited by William C. Hunter, George G. Kaufman, and Michael Pomerleano (2003).

<sup>31</sup> Asset price boom-bust cycles are usually studied under the perspective of “bubbles”. As a rare exception, Borio and Lowe (2003) suggest posing the issue of asset price fluctuations not as bubble booms-busts but as “financial imbalances” building up and unwinding. They also warn that the financial imbalances build-up in a low inflation environment could eventually cause financial instability and jeopardize real economic stability in the long run.

<sup>32</sup> For example, with the benefit of hindsight, the central bank of Japan was often criticized for allowing the 1980s bubbles to develop in an easy-money environment. See Okina and Shiratsuka (2003) for discussion.

Recall that the macroeconomic perspective 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 and Tobin's  $q$  effects. If the relationship between asset prices and AD is stable, monetary policy that stabilizes AD will indirectly stabilize asset prices; and vice versa. However, asset price boom-bust cycles could happen if the relationship is not stable.

For illustration, consider a (close-economy) case in which a positive shock on productivity growth increases the growth in the output (AS) potential. Suppose monetary policy keeps 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 in AD, which will in turn need an increase in the growth of asset prices. In a word, the productivity growth shock tends to generate an asset price boom. We consider two different scenarios, respectively with and without a boom-bust cycle.

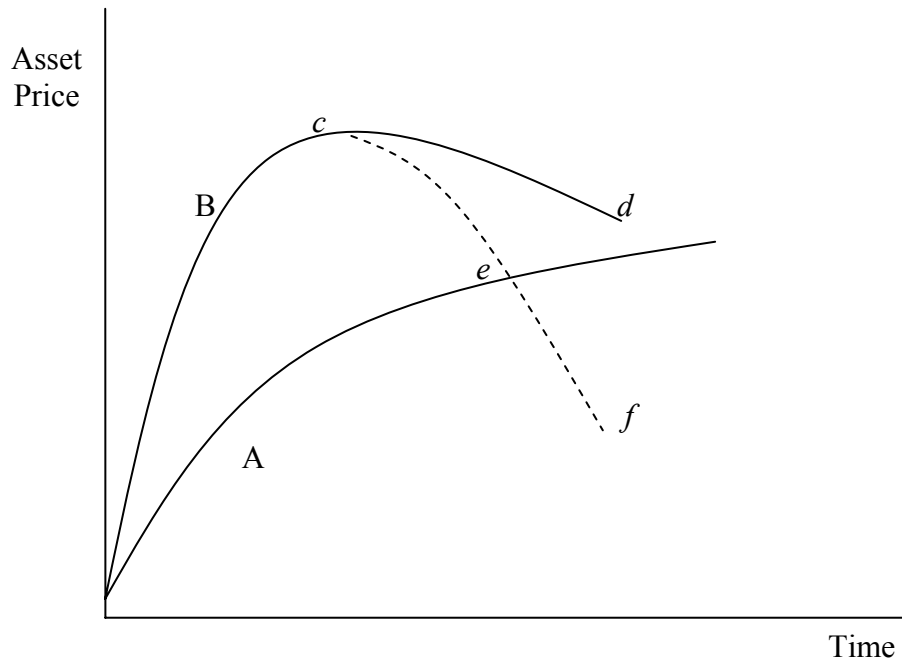
In scenario A, suppose the relationship between asset prices and AD is stable and regular. Then, asset prices will grow gradually, keeping pace with the growth of AD, or ultimately, the growth of the output potential. Therefore, no boom-bust cycle tends to happen, as depicted by the asset price growth 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 are yet to be convinced of a long-lasting boom.<sup>33</sup> 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

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<sup>33</sup> Consumers might be “target savers”, i.e., they change consumption behaviors only when wealth reaches targeted levels. In addition, besides the investment impediments discussed in the last section, investment uncertainty and irreversibility could make entrepreneurs adopt a “wait and see” strategy and hence prevent the Tobin's  $q$  effect from stimulating the investment component of the AD at the beginning of the boom. See Dixit and Pindyck (1994) for discussions on investment under uncertainty.

Figure 1. As the boom is gaining momentum, consumers might eventually be convinced of the “concreteness” of the wealth created by the booming asset prices and hence start increasing consumption significantly (at point *c* on the path B). Unfortunately, the paper



**Figure 1**

wealth “created” by a relatively low consumption propensity will tend to vanish when the propensity becomes higher—recall the negative relationship between consumption propensity and the EFAP indicated in equation (29). In another word, a downward correction of asset prices is needed to align the excessive AD (due to the delayed wealth effect) to the potential AS. The correction process could be a “soft-landing”, as depicted by the portion *cd* on the path B. However, if the boom has been inflated too much; and/or the correction comes too sudden, 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 the 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.<sup>34</sup>

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. 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' delayed reactions to the wealth accumulated; or the present pressure might not be overt because of short-term nominal rigidities. Yet, 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.

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

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<sup>34</sup> 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 behaviors tends to be infinitesimal; yet she might not have enough information to predict other agents' behaviors.

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 markets to preempt over inflation pressure;<sup>35</sup> 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.

### *Summary*

The concept and determination of the EFAP is inspected from the macroeconomic perspective. The inspection clarifies that 1) asset price movements driven by fundamentals could nonetheless cause misalignments to the EFAP and hence need monetary responses; 2) the link between future productivities and the EFAP tends to be slackened by the constraints of current economic conditions (especially the AS constraint) on the EFAP; and 3) fundamental asset market booms consistent with the current AD-AS balance might not be able to escape the fate of eventual collapse.

Conceptually, the inspection suggests that, from the macroeconomic perspective, the soundness of asset market performances does not depend on whether they are fundamental or not. Rather, it depends on whether they are compatible with the AD-AS balance in the long run. Non-fundamental booms can be sustained as long as they are

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<sup>35</sup> 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 current asset prices on future 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 the preemptive monetary intervention, the severity of damages on real economy caused by a bust suggests monetary authorities being less conservative in the preemptive intervention.

consistent with the AD-AS balance; nevertheless, fundamental booms might not be sustainable when they are not.

Practically, the inspection suggests monetary authorities viewing asset prices as a barometer for inflation pressure and watching out for unusual asset market booms.

It is well recognized that asset prices contain information about inflation expectations. Yet, (high) asset prices, representing (mass) purchasing power potential, could *be* inflation pressure by themselves. The pressure could be latent in the short run, yet accumulating through asset price appreciation. However, the pressure tends to eventually manifest itself and might have to be released through a downward correction of asset prices. In the case of the appreciation being too rapid and too large, and the correction being too sudden and too severe, an asset price boom-bust cycle happens.

It is worth stressing that such a cycle could happen even when the asset price appreciation is fundamentally driven by future productivities. Therefore, monetary authorities should always be concerned about rapid asset price appreciation, not for whether the appreciation is fundamental or not, but for the mass purchasing power potential it generates.

To prevent asset market boom-bust cycles from disrupting the real economy, monetary preemption for curbing the booms might be wise. This certainly does not mean no booms are allowed or frequent interventions are needed. Rather, it means that monetary authorities need to help soft-landing an inflated boom,<sup>36</sup> even when it takes

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<sup>36</sup> Identifying inflated booms due to delayed inflation pressure is not as difficult as determining whether booms are fundamental—the U.S. late 1990s stock market booms could be fundamental, or not; yet, in light of the much more significant growth in wealth than that in output, more chances than not the booms are inflated.

preemptive intervention that might slow the economy down and upset financial communities' dream of everlasting booms.

## 5. **Concluding Remarks**

This paper clarifies three conceptual issues regarding asset prices and monetary policy. First, FPW changes 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 and hence consume more. Second, the more elastic investment is, the stronger the Tobin's  $q$  effect (of monetary policy); yet the weaker the wealth effect. Third, from the 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 clarifications might be known to some readers in one way or another; yet, the apparent under-appreciation of them indicated by current discussions regarding asset prices and monetary policy convinces us of the worthiness of a formal articulation of them.

The implications of the clarifications have been discussed in detail in respective previous sections. We conclude with a brief summary.

The substance of wealth is the underlying incomes it represents, while the function of wealth is to provide purchasing powers. Monetary policy might not affect the substance; yet it does tend to affect the purchasing powers the substance can provide, which are

what really matters for wealth holders. This is the rationale for the wealth effect of monetary policy.

Monetary effect on asset prices and accordingly the wealth effect of monetary policy negatively depend on the Tobin's  $q$  effect, which in turn positively depends on the  $q$ -elasticity of investment. As the  $q$ -elasticity could be diminished by a variety of investment 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 tends to be enhanced as stock ownership becomes increasingly popular.

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; in another word, monetary policy for stabilizing prices in goods markets tends to make asset prices more volatile.<sup>37</sup> 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 acquiesce to the development of latent destabilizing elements in an inflation-benign environment, such as excessive asset market booms that not only tends to crowd out savings but also might eventually collapse.

Whether a 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

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<sup>37</sup> Certainly, inflation-targeting monetary policy, through anchoring inflation expectations, can reduce short-term asset price fluctuations around their long-term trends. Yet, it tends to enhance the volatility of the trends.

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 not like asset market booms being curbed by monetary interventions. Yet, the following clarifications might help mitigating the resentment. First, fundamental elements that affect asset prices also tend to influence the underlying interest rate. Thus, monetary responses to fundamentals-driven asset price movements tend to be endogenous monetary reactions to changes in the underlying interest rate. Such responses are not interventions; rather, lack of which is. Second, asset prices, fundamental or not, are intrinsically volatile. Asset market booms driven by fundamentals can also be excessive and eventually collapse for fundamental reasons. Thus, monetary preemption for deflating an excessive boom could help avoiding a bust. Third, monetary policy tends to affect assets' paper value but not their underlying earnings. On the one hand, if the paper wealth created by an unusual boom has a significant influence over consumption in the near future, a preemptive monetary tightening appropriately helps to release the existing or potential inflation pressure mildly. On the other, if the paper wealth does not matter for consumption in the near future, a decline in assets' paper value might not matter—after all, the substance of the assets is still intact. In this sense, monetary intervention in an unusual boom tends to be either necessary or harmless.

Keynes in his *General Theory* (1936, p.235) pointed out that monetary authorities could pull 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 authorities can help satisfying this desire as long as

people only take the wealth as such. Yet, when they 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 authorities cannot help—they have no magic to move goods and services yet to be produced in the future to the present. However, they do 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. One reminder to those who do: fundamental asset prices, if too high, are also likely to collapse.

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