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The Dot-Com Bubble, the Bush Deficits, and the U.S. Current Account

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Abstract: Over the past decade the United States has experienced widening current account deficits and a steady deterioration of its net foreign asset position. During the second half of the 1990s, this deterioration was fueled by foreign investment in a booming US stock market. During the first half of the 2000s, this deterioration has been fuelled by foreign purchases of rapidly increasing US government debt. A somewhat surprising aspect of the current debate is that stock market movements and fiscal policy choices have been largely treated as unrelated events. Stock market movements are usually interpreted as reflecting exogenous changes in perceived or real productivity, while budget deficits are usually understood as a mainly political decision. We challenge this view here and develop two alternative interpretations. Both are based on the notion that a bubble (the "dot-com" bubble) has been driving the stock market, but differ in their assumptions about the interactions between this bubble and fiscal policy (the "Bush" deficits). The "benevolent" view holds that a change in investor sentiment led to the collapse of the dot-com bubble and the Bush deficits were a welfare-improving policy response to this event. The "cynical" view holds instead that the Bush deficits led to the collapse of the dot-com bubble as the new administration tried to appropriate rents from foreign investors. We discuss the implications of each of these views for the future evolution of the US economy and, in particular, its net foreign asset position.

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0. Introduction

Since the early 1990s the United States has experienced steadily widening current account deficits, reaching 5.7 percent of GNP in 2004 (see top panel of Figure 1). These deficits are large relative to the post-war US historical experience. With the exception of a brief period in the mid-1980s when current account deficits reached 3.3 percent of GNP, the US current account has typically registered small surpluses or deficits averaging around 1 percent of GNP. As a consequence of the recent deficits, the US net foreign asset position has declined sharply from –5 percent of GNP in 1995 to about –26 percent by the end of 2004 (see bottom panel of Figure 1). The goal of this paper is to provide an account of this decline that relates it to other major macroeconomic events and helps us to grasp its implications for welfare and policy.

Any attempt to do this must take into consideration a major change in the pattern of asset trade between the US and the rest of the world (see Figure 2). During the second half of the 1990s, the US accumulated foreign assets and liabilities at the rate of $765 billion and $965 billion per year. About two-thirds of this consisted of increases in the volume and value of equity holdings. This pattern reversed sharply in the first half of the 2000s. The worldwide collapse in equity prices erased a substantial fraction of the assets and liabilities that the US had accumulated during the 1990s, resulting in an increase of US net holdings of equity of about $232 billion per year. Despite this, the US net foreign asset position declined at the rate of $296 billion per year as US net holdings of debt (both public and private) declined at the rate of $528 billion per year. While in the second half of the 1990s most of the changes in US foreign assets and liabilities were driven by equity, in the first half of the 2000s these changes were mainly driven by debt.

This change in the composition of the US current account deficit is a natural reflection of the two major macroeconomic events of this period. The first one is the “dot-com” bubble of the 1990s. Between 1990 and the peak in mid-2000, US equity prices increased nearly five-fold, and the growth rate of equity prices accelerated from 10.4 percent per year between 1990 and 1995, to 21.2 percent per year between 1995 and 2000 (see top panel of Figure 3). The value of US stock market capitalization grew even faster, doubling between 1990 and 1995, and then tripling between 1995 and the peak in 2000 (see bottom panel of Figure 3). The stock market boom in the rest of the world was less spectacular, but still quite impressive by historical standards. Equity prices in the major foreign markets grew 7.9 percent per year during the second half of the 1990s. As is well known, this episode ended with a sharp downward adjustment that started in 2000. By 2003 equity prices in the US and abroad had fallen by 30 percent, and stock market capitalization had fallen by about 25 percent. Since these changes in equity prices have taken place against a background of relatively low interest rates and low inflation, being in the stock market surely was a good idea in the second half of the 1990s but a lousy one in the first half of the 2000s.

The second major macroeconomic event was the reemergence of large fiscal deficits in the United States after the Bush administration took over in 2000 (see Figure 4). Unlike the 1980s, the 1990s were a period of declining budget deficits and small surpluses. After 2000 budget deficits reappeared with a vengeance however, reaching 4.8 percent of GNP in 2004. As a result, US public debt has increased sharply from 33 to 37 percent of GNP between 2001 and 2004. An intriguing feature of this recent period is that large budget deficits have not been accompanied by any significant increase in the cost of borrowing for the federal government (see Figure 4). Roughly speaking, the 1970s were characterized by low budget deficits and low interest rates, while the period 1980-95 featured high budget deficits and high interest rates. But over the past 10 years this pattern has unraveled, with fairly high interest rates and low deficits during the second half of the 1990s, followed by low interest rates and large budget deficits since 2000.

What are the links between the dot-com bubble, the Bush deficits, and the US current account? As a first attack to this question, we develop in Sections one and two a conventional macroeconomic that crudely, but effectively, encapsulates conventional views of the US current account deficit. According to these views, its appearance in the second half of the 1990s reflected an increase in US productivity relative to the rest of the world that led investors all over the world to place their savings in the US stock market. The situation reversed and US productivity declined in 2000, leading to the stock market collapse. But the current account deficit continued despite this, now fueled by a the drastic change in fiscal policy implemented by the Bush administration. This change is usually attributed to purely exogenous factors such as the cost of the wars in Afghanistan and Iraq, as well as a desire to cut taxes. This policy is however unsustainable and something must eventually give. Most observers think that this episode will end with a painful fiscal adjustment, although there are also those who argue that the resolution will entail some default on the part of the US government.[1]

This view has two major problems when confronting the data however. The first one is inability to explain observed movements in the stock market. If the latter only contains productive firms, its value should reflect that of the capital held by these firms. Since capital is reproducible, its price cannot exceed the cost of producing additional units. Therefore, increases in the value of the stock market must either reflect increases in the cost or the quantity of capital owned by US firms. But it is hard to find evidence of increases in either of these variables that would justify the more than three-fold increase in US stock market capitalization that occurred during the second half of the 1990s. And it is even harder to find evidence that would justify a one-quarter decline in the first few years of the 2000s. The second problem relates to the behavior of interest rates. The model predicts that the US fiscal expansion should increase the interest rate as government debt crowds out capital from the portfolios of investors. But the evidence shows exactly the opposite. The real interest rate fell from above three percent in the second half of the 1990s to almost zero percent in the early 2000s.

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[1] Few would argue that the US government will fail to make stipulated payments, but still some think that there is some probability that the US government effectively defaults on its obligations by engineering a high and unexpected inflation that reduces the real value of these payments.

What has been driving the stock market during the last decade? Why did the interest rate fall in the midst of one of the largest fiscal expansions in US history? We argue in Section three that the conventional model is ill-equipped to handle these questions, because it assumes that financial markets work relatively well and all savings are channeled into efficient investments. If financial markets do not work as well, the economy might contain pockets of inefficient investments that deliver a rate of return that is below the growth rate of the economy. These investments are inefficient since they absorb on average more resources than they produce.[2] It is well-known that in this situation both stock market bubbles and government debt can play the useful role of displacing inefficient investments, raising the interest rate and hence the consumption and welfare of all. Moreover, those who create the bubbles and/or issue the debt receive rents that can be interpreted as a fee for providing this service.[3] A crucial and novel aspect of the model presented here is that it provides a formal description of how bubbles and debt interact with each other as they compete for a fixed pool of savings.

In Sections four and five we show that these interactions provide a new perspective on recent macroeconomic events. In Section four we construct an equilibrium in which the stock market initially creates a bubble that eliminates inefficient investments. The world economy operates efficiently and the interest rate and welfare are both high. But a change in investor sentiment triggers the collapse of the bubble, so that inefficient investments reappear and the interest rate declines. The government reacts to this by running large budget deficits and expanding public debt sufficiently to crowd out these inefficient investments. According to this "benevolent" view, the Bush deficits constitute a welfare-improving policy response to the collapse of the dot-com bubble.

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[2] The resources devoted to keep these investments are roughly equal to the growth rate times the capital stock. The resources obtained from such investments are roughly equal to the rate of return times the capital stock. If the growth rate exceeds the rate of return, the economy obtains additional resources by eliminating these inefficient investments. See Abel et al. [1989].

[3] The paper that discovered dynamic inefficiency is Samuelson [1958]. See also Shell [1971] for a revealing discussion of this problem. For the analysis of government debt, see Diamond [1965], Woodford [1990] and Hellwig and Lorenzoni [2003]. For the analysis of stock market bubbles, see Tirole [1985], Grossman and Yanagawa [1993], King and Ferguson [1993], Olivier [2000], Ventura [2002, 2003].

Section five constructs an alternative equilibrium which again begins with the stock market creating a bubble that eliminates inefficient investments. The government initially refrains from running budget deficits and this creates space for the bubble to grow. But there is a change in government that leads to a drastic change in fiscal policy. The new government wants to collect as much revenue as possible and starts a fiscal expansion that crowds out the bubble. This policy implements a transfer from the owners of the bubble at home and abroad to the US government. In this “cynical” view, the Bush deficits constitute a “beggar-thy-neighbour” policy that is responsible for the collapse of the dot-com bubble.

Interestingly, the “benevolent” and cynical” views are observationally equivalent. In both of them, the collapse of the bubble is accompanied by a decline in the interest rate and a large fiscal expansion that leads to a high but stable level of debt. In both views, this high level of debt is compatible with the US running budget deficits forever (although smaller than the current ones). In both of them, the US net foreign asset position can remain negative forever. In both views, the collapse of the bubble generates a loss for shareholders at home and abroad and a windfall for the US government. The only difference between the two views lies in the shock that caused this chain of events. While in the “benevolent” view this shock is a change in investor sentiment, in the “cynical” view this shock is a change in government policy.

Of course, this is not the first paper to be written on the US current account deficit. A substantial literature in the past few years has studied the determinants and sustainability of the US current account deficit. Much of this literature has adopted what we have termed as “conventional” views without much discussion, and has instead focused on determining its implications. Most notably, Obstfeld and Rogoff [2000, 2004, and 2005], Blanchard, Giavazzi and Sa [2005], and Roubini and Setser [2004] have all argued a large current account reversal is inevitable and will likely be accompanied by a large and disruptive depreciation in the dollar.[4]

The two papers that are perhaps closer to this one are Ventura [2001] and Caballero, Farhi and Hammour [2005]. Both of these papers challenge "conventional" views and stress instead the effects of an expectations-driven stock market bubble on the US net foreign asset position. Ventura emphasized the role of the dot-com bubble as the main driver of the current account deficits during the second half of the 1990s, and argued that those deficits would be sustainable in the absence of a bubble collapse. Unlike this paper, Ventura did not offer a formal model connecting stock market bubbles and the net foreign asset position, nor did he analyze the potential interactions between bubbles and fiscal deficits. Caballero et al. study a one-country model in which high expectations about the future create sufficient savings to fund the investment necessary to validate these expectations. In contrast, we work with a world equilibrium model in which there is a fixed pool of world savings and the stock market bubble, capital, and public debt compete for it. While Caballero et al. place the savings decision and adjustment costs in investment at center stage of their story, we instead emphasize the portfolio decision and financial market imperfections.

1. A model of crowding-out with debt and capital

This section presents a stylized model of productivity, debt and deficits. It depicts a world where young individuals save to provide for their old age consumption. These savings are used to finance both productive investments and government deficits. Fiscal policy is used to redistribute consumption across different generations. In particular, deficits finance additional present

[4] We do not analyze the implications of our scenarios for the real exchange rate, although it would be straightforward to do it. The results would also be straightforward and standard. The real exchange rate would move in opposite direction to the current account and the magnitude of the change would depend on the usual parameters, i.e. the elasticity of substitution between traded and nontraded goods and the elasticity of substitution between traded goods produced at home and abroad.

consumption by crowding-out productive investments and lowering future consumption. This model constitutes a useful starting point for our argument, since it neatly encapsulates conventional views on the effects and the sustainability of fiscal deficits.

Consider a world with two regions: US and ROW. This world is populated by overlapping generations of young and old. Each generation contains a continuum of members with aggregate size one that are evenly distributed across the two regions. Let I and I* be the sets of US and ROW residents, respectively. As usual, use an asterisk to denote ROW variables and omit the asterisk to denote US variables. There is a single good that can be used for consumption and investment. Each generation receives an endowment of this good during youth, which is evenly distributed among all its members. The endowment grows from one generation to the next at a (gross) rate γ. We normalize units so that the endowment of generation t is equal to γ^t, and we express all quantity variables as a share of this endowment.

The young are patient and risk-neutral, and they maximize expected old age consumption. Given this objective, the young save all their income and the old consume all of theirs. Since the income of the young consists only of the endowment mentioned above, our normalization implies that all the quantity variables are to be interpreted as a share of world savings. The income of the old consists of the return to their savings plus a transfer from the government which could be positive or negative. We shall assume throughout that this transfer is independent of an individual's actions. Therefore, the only important decision in any individual's life is how to invest his/her savings so as to maximize its expected return. This portfolio choice is at the heart of the story we want to tell here.

The menu of investment options available to the young consists of government debt and firms. Government debt consists of one-period bonds. We assume that fiscal policies are consistent in the sense that, if the market decided not to roll over the debt, the government would be able (and willing) to generate enough of a surplus so as to redeem all the bonds issued. This ensures that debt payments are made with probability one. It also implies that debt issued by US and ROW governments must offer the same interest rate. Let r_{t+1} be this common (gross) interest rate for holding government debt from date t to date t+1.

Firms are investment projects run by entrepreneurs. A fraction κ_t of these projects is located in the US (although some of these projects might be managed by ROW entrepreneurs). We assume that this share can vary stochastically over time within the unit interval. Firms purchase capital during the entrepreneur's youth, produce during the entrepreneur's old age and then distribute a single dividend per unit of capital before breaking up. This dividend or production is random and has a mean π. To finance the purchase of capital, firms can use private or internal funds (i.e. the entrepreneur's own savings) or they can go public and raise external funds in the stock market (i.e. the savings of young other than the entrepreneur). Firms that are financed by internal funds offer an expected gross return equal to π. Firms that are financed by external funds are subject to agency costs equal to α and offer an expected gross return π-α.[5] Therefore, investing in self-financed firms is preferred to holding stocks of traded firms.

Throughout the paper, we assume that the economy is sufficiently productive, i.e. $\pi>\gamma$. This ensures that the expected return to capital exceeds the growth rate of savings. For the next couple of sections, we further assume that agency costs are not too severe, i.e. $\alpha<\pi-\gamma$. This is equivalent to saying that financial frictions are small and the stock market is close enough to the frictionless paradigm. This assumption turns out to be crucial and will be removed in Section three.

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[5] Agency costs arise from incentive problems that are created by the separation between ownership and control. One example is the cost of monitoring the manager to ensure that he/she does not embezzle funds from the firm. Another example is the efficiency loss due to less than optimal effort in situations where shareholders imperfectly observe the manager's actions or information set.

Each generation contains two types of young: "entrepreneurs" and "shareholders". The former have good investment projects that they can convert into a firm, while the latter do not. For simplicity, assume both regions have the same distribution of types. It follows from our assumptions that entrepreneurs either invest in their own self-financed firms or buy government debt, while shareholders are forced to choose between holding stocks of publicly traded firms and government debt.[6] Therefore, we can write the expected consumption of the different individuals as follows:

$$(1) \qquad E_t C_{i,t+1} = \begin{cases} \max\{\pi, r_{t+1}\} + E_t T_{i,t+1} & \text{if } i \in E \\ \max\{\pi - \alpha, r_{t+1}\} + E_t T_{i,t+1} & \text{if } i \notin E \end{cases}$$

where $T_{i,t+1}$ is the transfer that old individual i receives from its government[7] (remember that all quantity variables are expressed as a share of the world endowment); while E is the set of entrepreneurs. We assume the measure of this set is ε. Unless $r_{t+1} \geq \pi$, entrepreneurs enjoy higher expected consumption and therefore higher welfare than shareholders because of their ability to manage firms.[8]

Let D_t be total (US plus ROW) government debt, and let δ_t be the fraction of this total that has been issued by the US. Then, we can write debt dynamics as follows:

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[6] Who runs publicly traded firms? Remember each generation contains a continuum of individuals with aggregate income equal to γ^t. Assume each ("infinitesimal") entrepreneur can run a ("non-infinitesimal") firm of size υ. If this entrepreneur uses only internal funds, his/her expected utility is $\pi \cdot \gamma^t \cdot di$. If this entrepreneur uses external funds, his/her expected utility is old age consumption is $(\pi - \alpha) \cdot \gamma^t \cdot di + m$; where m is the manager's fee. Since there is free entry, the equilibrium manager's fee is $m = \alpha \cdot \gamma^t \cdot di$. Since this fee is infinitesimal, it constitutes a negligible cost for a non-infinitesimal of size υ and we can disregard it. Therefore, the model depicts a world where a "small" subset of entrepreneurs use external funds to build "large" firms that are traded in the stock market, while a "large" subset of entrepreneurs runs "small" firms using internal funds.

[7] We are assuming here that only the old receive transfers.

[8] This comparison holds both the transfer and the date of birth constant. Remember that expected consumption is measured as a share of the endowment and therefore welfare is given by $\gamma^t \cdot E_t C_{i,t+1}$. A shareholder of a future generation might enjoy more welfare than an entrepreneur of the present generation.

(2) $$D_{t+1} = \frac{r_{t+1}}{\gamma} \cdot D_t + \sum_{i \in I \cup I^*} T_{i,t+1}$$

(3) $$\delta_{t+1} \cdot D_{t+1} = \delta_t \cdot \left(D_{t+1} - \sum_{i \in I \cup I^*} T_{i,t+1} \right) + \sum_{i \in I} T_{i,t+1}$$

Equation (2) shows that debt equals to debt payments plus the primary deficit. The latter is nothing but the sum of all the transfers received by the old. Equation (3) shows how the US share evolves, for given primary deficits of the two regions. We shall only consider sequences of deficits such that $D_t \leq 1$ in all dates and states of nature. This is equivalent to assuming that governments never default on their debts. This assumption will be removed later, but it turns out not to be crucial.

The interest rate depends on the amount of debt that the government is trying to place in the market. In particular, we have that:

(4) $$r_{t+1} = \begin{cases} \pi - \alpha & \text{if } D_t < 1 - \varepsilon \\ [\pi - \alpha, \pi] & \text{if } D_t = 1 - \varepsilon \\ \pi & \text{if } D_t > 1 - \varepsilon \end{cases}$$

Equation (4) shows how the interest rate increases with debt. For low values of debt, the interest rate is π-α as the marginal buyer is a shareholder. For high values of debt, the interest rate increases to π as the marginal buyer of debt is now an entrepreneur. An important observation is that the assumption that financial frictions are small implies that the interest rate always exceeds the growth rate.

Let K_t denote the world capital stock, which is:

(5) $$K_t = 1 - D_t$$

Equation (5) simply says that capital and debt must add to world savings, since they are the only investment options available. Let NFA_t be the US net foreign asset position, i.e. the difference between US wealth and the US capital stock. This is a measure of US capital exports to the rest of the world, and is given by:

(6) $$NFA_t = (0.5 - \delta_t) \cdot D_t + (0.5 - \kappa_t) \cdot K_t$$

Equation (6) shows that the net foreign asset position of the US contains two pieces. The first term is the difference between the debt held by US residents and the debt issued by the US government, that is, the first term is US net borrowing. The second term is the difference between the capital stock owned by US residents and the capital stock located within the US, that is, the second term is US net holdings of equity.[9]

The mechanics of this model are as follows: Equations (2)-(4) jointly determine the dynamics of debt and the interest rate for a given sequence of primary deficits. With these dynamics at hand, Equations (5) and (6) determine the world capital stock and the pattern of trade. With the help of an additional assumption on how these deficits are distributed among old individuals, Equation (1) describes the welfare of different individuals. It is straightforward to see that this world economy has a unique equilibrium. We are now ready to use this simple model to provide a first analysis of the evolution of the world economy during the last decade.

2. Conventional views

Although stylized, this model captures well some conventional views of the sources and effects of the large and persistent deterioration in the US net

[9] Note that US residents own half of the world debt and half of the world capital stock. This only because we have assumed both regions have the same population size, the same distribution of types and the same endowment. This is just a harmless simplification as it is straightforward to generalize the model to include asymmetries in these variables. Note also that since we have assumed that government debt consists of one-period bonds and firms last only one period, the current account is equal to the net foreign asset position and we can use Equation (6) to talk about either concept. This is another simplification, of course, since the real world contains long-lived assets. But it will not play a role in what follows.

foreign asset position during the last decade. According to these views, in the second half of the 1990s the US became a more attractive place to invest relative to the rest of the world. That is, the number of good investment projects in the US grew relative to ROW (i.e. there was an increase in κ_t). Many have identified the boom in the information technology (IT) sector as a main reason for this. Although this sector grew rapidly worldwide in the second half of the 1990s, the US benefited more from this growth due to its strong technological lead relative to Europe and Japan. Others have pointed to the flurry of currency and banking crises in emerging markets as the main reason for the US becoming a more attractive place to invest relative to ROW. These crises, which started in Mexico and moved to East Asia and Russia, led to a downward reassessment of the expected return to emerging market projects.

For either or both of these reasons, the story goes, investors all over the world decided to put their savings into the US stock market and this is what generated the current account deficits of the second half of the 1990s. This is consistent with the evidence reported in Figure 2 that, in the second half of the 1990s, a large component of the change in the US net foreign asset position consisted of a decline in net holdings of equity. The story becomes a bit fuzzy when it comes to explaining the reversal in net holdings of equity that took place in the first half of the 2000s, also reported in Figure 2. In the context of our model, this reversal could be seen as a decline in the number of good investment projects in the US grew relative to ROW (i.e. there was a decrease in κ_t), although there is scant direct evidence supporting this view.

Although this account might sound reasonable at a superficial level, it should be met with a healthy dose of skepticism after looking at the actual numbers. Remember that value of the stock market increased threefold from 1995 to 2000 and then declined by one-quarter from 2000 to 2003. If the stock market contains only productive firms, its value reflects that of the stock of capital held by these firms. That is, the increase in stock market capitalization requires a comparable increase in the price of capital, or the stock of capital or both. Since capital is reproducible, its price cannot exceed the cost of producing additional units. In the model, this cost is constant and equal to one. Naturally, we could extend the model to allow for congestion effects on the cost of capital as in the popular Q-theory of investment. But it seems unlikely that such an extension would be able to explain much of the rise in the value of the stock market.[10]

Neither can this rise and fall be explained by an increase in the stock of capital. In the model world savings grow at a constant rate γ, and so a large increase in the US stock of capital would have to be associated with a decline in ROW's stock of capital. However, the increase in stock market capitalization took place all around the industrial world. Naturally, one could extend the model to allow for increases in savings and therefore the capital stock. But this would not get us very far quantitatively. Since the US capital stock is about twice US GNP, a three-fold increase in the stock of capital during the second half of the 1990s would have required astronomical investment rates! The question remains: how did the value of the stock market grow so much in the second half of the 1990s and then drop in the first half of the 2000s?[11]

Of course, there have also been many voices arguing that the US stock market during this period was fueled by a bubble rather than by an increase in US productivity relative to the rest of the world. According to this alternative view, foreign investors were not buying US firms in the IT sector because of their high productivity, but instead because they were expecting to resell them later at a higher price. The appearance of a bubble brings huge capital gains to those that are able to "create" it, and this could explain the massive increases in equity prices during the second half of the 1990s. But to realize these capital gains one must first find buyers for the bubble, and this is only possible if the bubble

[10] Hall [2001] estimates the price of installed capital in the US since 1946, and finds that this price increased by only about 25 percent during the second half of the 1990s. See also Hall [2004] for an attempt to measure the cost of capital.
[11] Hall [2001] argues that the increase in the total value of the stock market reflects massive accumulation of intangible capital. This increase is mostly a windfall, since it did not require significant investment expenditures. As Ventura [2001] points out, it is hard to see why this intangible capital suddenly disappeared in 2000.

promises a sufficiently attractive return. That is, a bubble can be created if and only if it is expected to grow fast enough so as to justify buying it.

It is possible to examine this alternative interpretation within our model. To do this, we formally define a stock market bubble as a situation in which firms without capital are valued and traded in the stock market. We refer to these firms as "bubbly" firms, as opposed to the "productive" firms that own the capital stock. The question is whether bubbly firms can survive in a stock market that also contains productive firms. Let B_t be the asset bubble (or aggregate value of bubbly firms as a share of world savings). Since bubbly firms do not distribute dividends, the return to holding them consists only of their price appreciation. Therefore, the young will buy these firms if and only if the expected rate of price appreciation is high enough:

$$(7) \qquad \gamma \cdot \frac{E_t B_{t+1}}{B_t} \geq r_{t+1} \quad \text{if} \quad B_t > 0$$

Otherwise, the young would prefer to hold shares in productive firms or government bonds. A bubble can therefore create its own demand only by growing on average as fast or faster than the interest rate. But the growth of the bubble cannot be so fast so as to outgrow world savings, i.e. $B_t \leq 1$ must hold in all dates and states of nature. And this requirement is incompatible with Equation (7) if the interest rate exceeds the growth rate. Therefore, we conclude that bubbly firms cannot survive in the stock market in this case. Our assumption that financial frictions are small rules implies that the interest rate always exceeds the growth rates and therefore rules out the possibility of stock market bubbles. This, we think, is the first serious shortcoming of the standard or conventional view.

This view also holds that the current account deficits continued after 2000 due to the sharp change in fiscal policy implemented by the Bush administration (i.e. an increase in the US primary deficit that leads to an increase in δ_t). This fiscal policy consists of spending more, cutting taxes, and financing the resulting budget deficits by issuing government debt. Overwhelmingly, this change in policy has been interpreted as a political decision and not as an economic policy response to a specific macroeconomic disturbance. In other words, the US fiscal expansion has been treated as an "exogenous" shock to the macroeconomic landscape. Much of the increment to public debt has been placed abroad. Between end-2000 and end-2003 US public debt increased by $500 billion, while foreign holdings of US treasury bills increased by almost the same amount. And to the extent that public debt has been placed at home, it likely has crowded out US corporate debt and forced firms to place an increasing fraction of their own debt abroad. Through these direct and indirect channels, the budget deficits of the Bush administration account for a substantial part of the large increase in net borrowing from abroad shown in Figure 2. The important question is whether this situation is sustainable and, if it is not, how the necessary adjustment will look.

To answer this question, we use the model to analyze the effects of a fiscal expansion in the US. The experiment is as follows. Initially both regions have no debt and follow balanced-budget policies, i.e. D_t=0 and $\sum_{i \in I \cup I^*} T_{i,t} = 0$. At some date, the US switches its policy for exogenous reasons and decides to increase spending, cut taxes and finance the resulting deficit by going into debt, while ROW keeps its budget balanced, i.e. $\sum_{i \in I} T_{i,t} = \overline{T} > 0$ and $\sum_{i \in I^*} T_{i,t} = 0$. The questions we address next are: What are the possible endings for this fiscal episode? What are its welfare consequences?

When the fiscal deficits appear, government debt starts growing at an accelerating rate, crowding out the investments of the shareholders. The growth of the debt is fueled directly by the deficits, but also indirectly by unfavourable debt dynamics resulting from the interest rate exceeding the growth rate. In fact, it is this second component growing over time that leads to accelerating debt growth. If the fiscal expansion lasts long enough, the debt also starts crowding out the investments of the entrepreneurs. At this point the interest rate goes up, debt dynamics become more unfavourable and debt accumulation further accelerates. As debt accumulates, US net borrowing abroad increases. Since the debt crowds out capital from the portfolios of investors worldwide, US net holdings of equity decline in absolute value.

This situation is not sustainable since the accelerating growth rate of debt is incompatible with a fixed pool of savings, and the US eventually must go through a period of fiscal adjustment. This essentially means that the US must reverse its fiscal policy (since it does not want to default) and start running sufficiently large surpluses, i.e. $\sum_{i \in I} T_{i,t} = \underline{T} < \left(\frac{\gamma - r_t}{\gamma} \right) \cdot D_t$. Not surprisingly, the magnitude of the fiscal adjustment increases with the level of debt. When the debt is higher, the surpluses need to be larger, last longer, or both.

Assuming that the US government only makes transfers to US citizens, the fiscal expansion increases the welfare of current US generations in detriment of future ones. After all, in this model a policy of budget deficits is nothing but a policy of passing the bill forward. When this policy is implemented, the old consume beyond the return to their savings and pass the bill to the next generation. This bill includes their extra consumption plus the interest. Rather than paying the bill, the next generation further increases it by also consuming more than the return to their savings and then passes the bill along to the following generation. This keeps going on for as long as the government follows a policy of running deficits and rolling over the debt. But the bill is growing too fast and must eventually be paid. This is what a fiscal adjustment is all about. The longer it takes for this adjustment to happen, the larger is the final bill and the costlier will be for the US to face it.

The welfare of present generations is also affected by the fiscal expansion indirectly through its effects on the interest rate. High interest rates raise the expected consumption of young shareholders both in the US and ROW. Since interest rate costs are added to the bill, future generations of US residents are also supporting higher consumption of current ROW generations. This constitutes a positive spillover of the US fiscal expansion on ROW. The fiscal adjustment will eliminate it and this is why ROW residents might prefer this to happen as late as possible.

Of course, one could argue that this scenario is unrealistic since it assumes that the US government will honor its debt in all contingencies. But relaxing this assumption has only minor effects on the overall story. To see this, replace Equations (2) and (4) for these straightforward generalizations:[12]

$$(8) \qquad D_{t+1} = \begin{cases} \frac{r_{t+1}}{\gamma} \cdot D_t + \sum_{i \in I \cup I^*} T_{i,t+1} & \text{with prob. } 1-\mu_t \\ 0 & \text{with prob. } \mu_t \end{cases}$$

$$(9) \qquad r_{t+1} = \begin{cases} \pi - \alpha + \mu_t & \text{if } D_t < 1-\varepsilon \\ \left[\pi - \alpha + \mu_t, \pi + \mu_t\right] & \text{if } D_t = 1-\varepsilon \\ \pi + \mu_t & \text{if } D_t > 1-\varepsilon \end{cases}$$

where μ_t is the (exogenous) probability that the US government defaults on its debt. A reasonable assumption is that this probability grows as the debt increases, but we need not make it here. Equation (8) recognizes that now debt can be defaulted upon, while Equation (9) recognizes that the expected return on government debt includes the promised return minus the expected loss from default. Note that default risk makes debt dynamics even more unfavourable by raising the interest rate. In other words, default risk makes the current situation even more unsustainable.

With a positive default probability the US fiscal expansion might have a different ending. If the current deficit goes on long enough and the required fiscal adjustment becomes too large, the US government might simply default on its debt. In this case, the adjustment takes place in a dramatic fashion. The generation of old (US and ROW) shareholders that suffers the default pays the entire bill for the excess consumption of its US predecessors. Since half of the

[12] One can think of default as surprise inflation that erases the real value of the debt. Here we are also assuming that the ROW government keeps with its policy of having no debt. Otherwise, we should also "break down" Equations (8)-(9) into their two regional components.

shareholders are not US residents, half of the bill is therefore paid by ROW citizens. In this scenario, current US economic policy is simply increasing consumption and welfare of current US residents at the expense of future US and ROW residents. This constitutes a negative spillover of the US fiscal expansion on ROW. A fiscal adjustment would ensure that this scenario does not happen and, as a result, ROW residents might prefer the US to reduce its budget deficits even if this lowers the interest rate.

One problem with this standard story is the behavior of the interest rate. While the model predicts that the US fiscal expansion will increase the interest rate, the evidence shows exactly the opposite. Figure 4 showed that, in the midst of one of the largest fiscal expansions in US history, the interest rate fell from above three percent to close to zero percent. The model can only account for this observation if there is a decline in the expected return to capital (i.e. a decline in π) and/or an increase in agency costs (i.e. an increase in α).[13] Given the magnitude of both the fall in interest rates and the increase in budget deficits, the decline in productivity and/or a increase in agency costs would have to be very large. There is scant evidence for a major decline in world productivity. And despite the intense media coverage of some financial scandals such as Enron or Parmalat, it is also unlikely that frictions in financial markets increased dramatically overnight. In our view, the inability to predict the behavior of the interest rate constitutes a second serious shortcoming of the conventional view.

To sum up, the model crudely but effectively encapsulates conventional views of the US current account deficit. Its appearance in the second half of the 1990s reflects an increase in US productivity relative to the rest of the world that led investors all over the world to place their savings in the US stock market. This situation ended with the stock market collapse in 2000. But the current account deficits continued after this now fueled by the drastic change in fiscal policy implemented by the Bush administration. This policy is however unsustainable and something must eventually give. Most observers think that

[13] We have assumed that π and α are constant. Note however that all the equations of the model still apply if we assume that these parameters vary stochastically over time.

this episode will end with a painful fiscal adjustment, although there are also those who argue that the resolution will entail some default on the part of the US government. The stylized model developed above shows how all of these observations fit together.

But the model is not free of problems, though. It cannot explain observed movements in equity prices, nor can it explain why the interest rate fell in the midst of one of the largest fiscal expansions in US history. How can we come to grips with these observations? The preceding analysis relies to a large extent on the condition that the interest rate exceeds the growth rate. This condition rules out the existence of stock market bubbles and underlies the notion that a policy of continued fiscal deficits is unsustainable. But this condition is not satisfied in the data. Figure 5 plots the ex-post real one-year Treasury bill rate and the real GDP growth rate for the US since 1970. With the exception of the 1980s, the interest rate has been consistently below the growth rate for almost all years during this period. More importantly for our purposes, since 1992 interest rates have averaged 1.7 percent while GDP growth has averaged 3.3 percent. As we shall show next, the behavior of the world economy is quite different when the growth rate exceeds the interest rate.

3. A model of crowding-out with debt, bubbles and capital

Assume next that agency costs are severe, i.e. $\alpha>\pi-\gamma$. This is equivalent to saying that financial frictions are large and the stock market is far from the frictionless paradigm. To analyze this case, we need to generalize a bit the theory since now the world economy can experience stock market bubbles. Consider the possibility that the stock market contains unproductive or bubbly firms that never deliver a dividend. The only reason to hold these firms is to realize capital gains. We assume that creating bubbly firms is simply a matter of luck and entails negligible costs. Naturally, all young try to create them and those that are successful obtain a rent by selling their bubbly firm during old age.[14] Let $N_{i,t}$ be the rent that individual i receives. We generalize Equation (1) as follows:

$$(10) \qquad E_t C_{i,t+1} = \begin{cases} \max\left\{\pi, r_{t+1}, \gamma \cdot \frac{E_t\{B_{t+1} - N_{t+1}\}}{B_t}\right\} + E_t T_{i,t+1} + E_t N_{i,t+1} & \text{if } i \in E \\ \max\left\{\pi - \alpha, r_{t+1}, \gamma \cdot \frac{E_t\{B_{t+1} - N_{t+1}\}}{B_t}\right\} + E_t T_{i,t+1} + E_t N_{i,t+1} & \text{if } i \notin E \end{cases}$$

where $N_t = \sum_{i \in I \cup I^*} N_{i,t}$ is the total value of the bubbly firms that appear at date t.

Note that the expected (gross) return on holding a bubbly firm is equal to the (gross) growth rate of its price. This growth rate is equal to the expected value of tomorrow's bubbly firms at date t+1, i.e. $\gamma^{t+1} \cdot E_t\{B_{t+1} - N_{t+1}\}$; divided by their value at date t, i.e. $\gamma^t \cdot B_t$.[15] Equation (10) exhibits two differences with respect to Equation (1). Bubbly firms are now included in the menu of assets and this affects the expected return on the savings of the young. In addition, the creation of new bubbly firms generates rents for the old and this constitutes an additional source of income.

Equations (2) and (3) describing debt dynamics still apply, but we must modify Equation (4) describing the interest rate as follows:[16]

$$(11) \qquad r_{t+1} = \begin{cases} \pi - \alpha & \text{if } D_t < 1 - \varepsilon - B_t \\ [\pi - \alpha, \pi] & \text{if } D_t = 1 - \varepsilon - B_t \\ \pi & \text{if } D_t > 1 - \varepsilon - B_t \end{cases}$$

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[14] Success is nothing but a positive realization of an individual-specific sunspot.
[15] Equation (6) implicitly assumed a fixed number of bubbly firms. In this case, the expected growth rate of the bubble equals the expected price appreciation of existing bubbly firms.
[16] We assume again that governments never default on their debts. As shown before, it is straightforward to generalize the analysis to the case in which there is an exogenous probability that governments default on their debts.

Equation (11) recognizes that debt and the bubble both compete with capital for the savings of the young. In order to create its own demand, the bubble must grow sufficiently fast:

$$\text{(12)} \qquad \frac{E_t\{B_{t+1} - N_{t+1}\}}{B_t} = \frac{r_{t+1}}{\gamma} \quad \text{if } B_t > 0$$

Equation (12) is a necessary condition for the young to be willing to buy bubbly firms. It applies whenever bubbly firms have a positive value in equilibrium. We shall construct later equilibria in which bubbly firms not only survive in the stock market, but drive all productive firms out of it. Finally, let β_t be share of all bubbly firms created by US residents. It then follows that:

$$\text{(13)} \qquad \beta_{t+1} \cdot B_{t+1} = \beta_t \cdot \left(B_{t+1} - \sum_{i \in I \cup I^*} N_{i,t+1} \right) + \sum_{i \in I} N_{i,t+1}$$

The presence of a bubble naturally affects asset trade. The world capital stock is now given by:

$$\text{(14)} \qquad K_t = 1 - D_t - B_t$$

and the capital stock of the US is then $\kappa_t \cdot (1-D_t-B_t)$. The US net foreign asset position is now given as follows:

$$\text{(15)} \qquad NFA_t = (0.5 - \delta_t) \cdot D_t + (0.5 - \beta_t) \cdot B_t + (0.5 - \kappa_t) \cdot (1 - D_t - B_t)$$

Equation (15) is a natural generalization of Equation (6) and includes an additional piece of the net foreign asset position of the US. This piece is the second term and consists of the difference between the share of the bubble held by US residents and the share of the bubble created by them. Now, the US net holdings of equity are given by the sum of the second and third terms of Equation (6).

The mechanics of this model are very close to those of the model in section 1: Equations (2), (11), (12) and (13) describe the dynamics of debt and the interest rate for a given sequence of bubbles and deficits. With these dynamics at hand, Equations (14) and (15) determine the world capital stock and the pattern of trade. With the help of additional assumptions about the creation of new bubbly firms and the distribution of deficits among individuals, Equation (10) describes the welfare of each individual. This world economy has many equilibria now, each of them corresponding to a different set of (consistent) assumptions about the behavior of bubbles and deficits. We shall later construct some of these equilibria and examine their implications.

This model allows us to study the large and persistent deterioration of the US net foreign asset position under the more realistic assumption that the interest rate falls short of the growth rate. As is well known, this condition implies that the world economy contains pockets of dynamically inefficient investments.[17] The logic behind this inefficiency is disarmingly simple and well understood: every period young shareholders invest $\gamma^t \cdot (1-\varepsilon)$ units of the single good, while old shareholders receive a return to their savings that on average equals $r_t \cdot \gamma^{t-1} \cdot (1-\varepsilon)$. If $r_t < \gamma$, it is welfare-improving to implement a social contract whereby all young shareholders are forced to stop investing and instead give all of their income to the old shareholders. This social contract would liberate an amount of resources equal to $(\gamma - r_t) \cdot \gamma^{t-1} \cdot (1-\varepsilon)$ per period, and these resources would go directly to the pockets of the future shareholders. Moreover, the

[17] In an influential paper, Abel et al. [1989] noticed that capital income exceeds investment in industrial countries and then argued that this observation is incompatible with the view that these countries contain dynamically inefficient investments. Their argument is misleading however. To see this, note that in our world economy capital income is $[\pi - \alpha \cdot (1-\varepsilon)] \cdot \gamma^{t-1}$ while investment is γ^t. The observation that capital income exceeds investment, i.e. $\pi - \alpha \cdot (1-\varepsilon) > \gamma$; does not rule out the possibility that there exist pockets of dynamic inefficiency, i.e. $\gamma > \pi - \alpha$. The observation that capital income exceeds investment only implies that the "average" investment is dynamically efficient. But this is not incompatible with the statement that the "marginal" investment be dynamically inefficient. Abel et al. [1989] did not notice this because they assumed throughout that financial markets are frictionless and, as a result, all investments exhibit the same return. This corresponds to the special case of our model in which $\alpha=0$. This is an unrealistic and yet crucial assumption. Once we remove it, the argument of Abel et al. does not go through.

generation that starts the social contract would get an upfront fee (for its service to society) that equals the endowment of the first generation of young that participate in the social contract, i.e. $\gamma^t \cdot (1-\varepsilon)$. This social contract therefore improves on the market and raises the consumption and welfare of all generations.[18]

At first sight, the practical difficulties in implementing this social contract appear overwhelming. But this is only a false appearance. It has been known for a long time that government debt and stock market bubbles can both crowd out inefficient investments and improve welfare. Complying with the social contract during youth and giving the endowment to the old can be seen as equivalent to purchasing the "right" to receive the endowment of the young during old age. But this exactly what government debt or stock market bubbles are. When the young buy any of these assets from the old (and thus give the old their endowment), they are doing so in the expectation of reselling them to the young later during their old age (and therefore receiving the endowment of the young). In this way, government debt and stock market bubbles eliminate inefficient investments and liberate resources that increase the consumption of all future generations. Since issuing debt or creating bubbly firms has negligible costs, those that "create" them receive in addition an upfront fee or rent which equals the full value of the asset created. This upfront fee or pure rent is exactly what $T_{i,t}$ and $N_{i,t}$ are.

As the previous discussion hints, the presence of pockets of dynamic inefficiency might lead to a substantial rethinking of the role of fiscal policy. Naturally, fiscal policy still redistributes consumption across generations. But it now also eliminates inefficient investments. Since bubbles are an alternative and market-generated solution to the same problem, this observation raises some interesting and still unanswered questions: Under what conditions does fiscal policy complement stock market bubbles as a mechanism to eliminate inefficient investments? Under what conditions does fiscal policy compete with stock market bubbles for this role? What are the welfare implications of these

[18] Since entrepreneurs receive an expected gross return to their savings that exceeds the growth rate, their investments are dynamically efficient and the government should not try to eliminate them.

interactions between bubbles and deficits? We next show that the answers to these questions lead to new and somewhat surprising views on US economic policy.

4. A "benevolent" view of US economic policy

We next construct an equilibrium in which the stock market initially creates a bubble that is large enough to crowd out all inefficient investments. The world economy operates efficiently and welfare is high. But there is a change in investor sentiment that triggers the collapse of the bubble. The result is that inefficient investments reappear. The government reacts to this by running large deficits that crowd out some of these investments and improve the functioning of the world economy. In this equilibrium, the US fiscal expansion constitutes a welfare-improving policy response to the bubble collapse.

Consider the case of a world economy in which investor sentiment fluctuates between two states: $S_t \in \{L,H\}$. In the L (or low) state, investors are "pessimistic", bubbly firms are not valued, and the stock market contains only productive firms. In the H (or high) state, investors are "optimistic", bubbly firms are valued, and they completely crowd productive firms out of the stock market. That is, we assume that the bubble evolves as follows:

$$B_t = \begin{cases} 0 & \text{if } S_t = L \\ 1-\varepsilon-D_t & \text{if } S_t = H \end{cases} \qquad (16)$$

We shall assume also that $N_t=0$ for all t, except for those dates in which the world economy transitions from L to H and $N_t=B_t$. That is, all bubbly firms appear at the onset of the bubble. After this, no more bubbly firms are created and the stock market bubble contains only a fixed number of firms whose value fluctuates over time.

How do these changes in investor sentiment happen? We assume that individuals coordinate to an equilibrium using a sunspot variable that moves between the high and low states. We refer to this variable as “investor sentiment”. Assume the transition probability or probability that there is a change in investor sentiment is λ. When a generation is optimistic, it believes that the probability the next generation will buy the bubble is $1-\lambda$. When a generation is pessimistic, it believes that the probability the next generation will buy the bubble is λ. If λ is sufficiently small, optimistic generations buy the bubble, pessimistic generations do not, and the probabilities assigned by both types of generations are exactly the equilibrium ones. We assume from now on that $\gamma\cdot(1-\lambda)>\pi-\alpha>\gamma\cdot\lambda$. As we shall see, this ensures that these changes in investor sentiment are an equilibrium. We shall see that a change in investor sentiment that moves the world economy from the high to the low state is nothing but a coordination failure, since the low state provides less welfare than the high state.

The fiscal policy of the US government recognizes the beneficial role that bubbly firms play in the world economy and avoids competing with them. When investor sentiment is high, the government refrains from running budget deficits and lets the (stock) market eliminate the inefficient investments on its own. When investor sentiment is low, the market cannot do this and the government runs budget deficits in order to help. These deficits raise government debt and crowd out the inefficient investments that the market is unable to eliminate by itself. In particular, we assume the US follows this fiscal policy:

$$(17) \qquad \sum_{i\in I} T_{i,t} = \begin{cases} \frac{\gamma - r_t}{\gamma}\cdot(1-\varepsilon) & \text{if } S_t = L \\ 0 & \text{if } S_t = H \end{cases}$$

We shall see that this fiscal policy ensures that government debt eventually absorbs all inefficient investments if investor sentiment remains low indefinitely. However, consistent with the view that the government is trying to remedy market failures, debt will never crowd out the investments of entrepreneurs.

Throughout, and only for simplicity, we assume that ROW has no debt and follows a balanced-budget policy, i.e. δ_t=1 and $\sum_{i \in I^*} T_{i,t} = 0$.

The assumptions made allow us to determine the equilibrium interest rate as follows:[19]

$$(18) \qquad r_{t+1} = \begin{cases} \pi - \alpha & \text{if } S_t = L \\ \gamma \cdot \dfrac{(1-\lambda)\cdot(1-\varepsilon)}{1-\varepsilon-\lambda\cdot D_t} & \text{if } S_t = H \end{cases}$$

Equation (18) shows that the implications of increased government debt on the interest rate depend crucially on investor sentiment. Note that the assumptions made ensure that the interest rate is always higher when investor sentiment is high. When investor sentiment is low, the interest rate is low because debt competes with capital and the latter offers a low expected return to shareholders. When investor sentiment is high, the interest rate is high because debt competes with the bubble which is a better asset than capital. It follows from Equation (15) (and the assumption that N_t=0) that the interest rate is nothing but the expected (gross) growth rate of the bubble.

To understand what is behind Equation (18), assume first that there is no government debt. Then, the expected growth rate of the bubble is γ if there is no change in investor sentiment, but zero if there is a change in investor sentiment. Since the latter happens with probability λ, the expected growth rate of the bubble is $\gamma\cdot(1-\lambda)$ and this is what the interest rate must be when D_t=0. Assume instead that there is some debt in the world economy. Since debt dynamics are favourable and both governments follow a policy of balanced budgets, we have that the debt is falling and the bubble is replacing it. Therefore, the bubble grows faster than the world economy since it absorbs an increasing fraction of the

[19] To derive the interest rate when S_t=H, substitute Equations (2), (16) and (17) into Equation (12) and then solve for the interest rate. Note that when S_t=L and D_t=1-ε, any $r_t \in [\pi-\alpha,\gamma]$ is also an equilibrium.

shareholders' savings. The larger is the debt, the faster it falls and the faster is the growth of the bubble and the interest rate.

Under the assumptions made about bubbles and deficits, the dynamics of debt are given by Equations (2) and (17)-(18). Substituting these dynamics into Equation (16), we also obtain the dynamics of the bubble. It is straightforward to check that, under our parameter restrictions, the sequences of bubbles and debt generated by these equations satisfy the conditions that $B_t \leq 1$ and $D_t \leq 1$ in all dates and states of nature. This confirms that these sequences constitute an equilibrium of the world economy. We use next this equilibrium to re-interpret the main macroeconomic developments of the last decade.

This equilibrium portrays an alternative and "benevolent" view of current US economic policy. The story goes as follows. Initially the world starts in the pessimistic state with the US having some intermediate level of debt and a low interest rate, i.e. $0<D_t<1-\varepsilon$ and $r_t=\pi-\alpha$. At some date, there is a change in investor sentiment and a stock market bubble appears. The bulk of this bubble consists of US bubbly firms, i.e. $\sum_{i \in I} N_{i,t} > 0.5$. After a few periods, there is a new change in investor sentiment that moves the world economy back into the pessimistic state. This brings about a collapse in the bubble. The questions we address next are: What are the macroeconomic effects of the appearance and bursting of the bubble? What are the effects of US fiscal policy?

Figure 6 illustrates the dynamics of debt by plotting D_{t+1} as a function of D_t. The convex upward-sloping line captures the dynamics of debt when investor sentiment is high, while the straight upward-sloping line shows the same when investor sentiment is low. The economy starts out with low investor sentiment and an initial level of debt D*. Debt dynamics are favourable and debt increases at a decreasing rate. Absent any further shocks it would asymptotically reach an upper bound of $1-\varepsilon$ where it would fully crowd out all the inefficient investments of the shareholders. However, before this (when debt is equal to D_0) investor sentiment changes and a bubble appears in the stock market. The government reacts to this by eliminating the budget deficit, and debt begins to fall. Absent any further shocks debt would asymptotically reach zero as it is no longer needed to crowd out inefficient investments. Before this happens, there is again a change in investor sentiment (when debt is equal to D_1) and the bubble collapses. The government responds with fiscal deficits that set debt on an upward trajectory again.

During the period before the bubble appears, US debt accumulates gradually and the net foreign asset position becomes more negative as some of this debt is held by foreigners. The government responds to the appearance of the bubble by eliminating the budget deficit, and debt accordingly begins to decline. The bubble provides shareholders with a more attractive investment option and therefore crowds out all productive firms from the stock market. As time passes, government debt declines and the bubble keeps growing and absorbing an increasing fraction of the savings of the shareholders. Despite the elimination of the budget deficit, the interest rate jumps up as government debt must now compete with the bubble for the savings of shareholders. The interest rate then declines slowly as the growth rate of the bubble also declines over time. The net foreign asset position jumps down as the US old sell their bubbly firms to the ROW young, and the composition of the net foreign asset position of the US shifts from debt to equity.

This rosy situation changes overnight as a result of a change in investor sentiment that brings about a collapse in the bubble. The inefficient investments of shareholders return. The US government reacts to this situation by engineering a fiscal expansion that eliminates these inefficient investments over time. Unlike the analysis of section two, debt dynamics are favourable and the debt grows at a decelerating rate, eventually stabilizing without the need for a fiscal adjustment. Despite the appearance of budget deficits, the interest rate jumps down and stays low since debt no longer competes with the bubble. The collapse of the bubble erases a fraction of the negative US net holdings of equity, and leads to a sharp increase in net foreign assets. But this is quickly reversed as US government debt accumulates.

This story is therefore broadly consistent with the evidence presented in the introduction. It can account for the boom in the stock market and the sharp decline in budget deficits during the second half of the 1990s, as well as the collapse of the stock market and the re-emergence of fiscal deficits during the early 2000s. It can explain why interest rates were high during a period of low budget deficits, but fell when high budget deficits returned. It can account for the decline in the net foreign asset position associated with the appearance of the bubble. Moreover, by virtue of the assumption that the bubble was created primarily in the US, it can account for the large expansion in foreign purchases of US equity during the second half of the 1990s, followed by a sharp reversal. This reversal in US net holdings of equity is offset by a decline in US net holdings of debt as the US government issues debt and sells part of it to foreigners.

The welfare implications of this scenario are easy to spot. The appearance of the bubble brings about an extraordinary bonanza for the current generation of old, since they cash in the rents from bubble creation and enjoy an unexpectedly high level of consumption. This windfall is equivalent to the upfront fee of implementing the part of the social contract that the debt was not implementing, i.e. $\gamma^t \cdot (1-\varepsilon-D_t)$. This fee is unevenly distributed since we have assumed that most of the bubble was created by US residents. The following generations of US and ROW shareholders are not so well off as the previous one, since there is no further creation of bubbly firms. But they still enjoy the benefit of a high interest rate, and this increases the consumption and welfare of shareholders all around the world. Through the high interest shareholders receive all the gains from eliminating their inefficient investments just as in the social contract, i.e. $(\gamma-\pi+\alpha)\cdot\gamma^{t-1}\cdot(1-\varepsilon)$.[20] In this world economy, a stock market bubble is a very good thing since it implements the social contract and everybody benefits.

[20] To understand the welfare implications for the subsequent generations, simply remember that trading the bubble essentially means that each generation of shareholders receives the endowment of the next one in exchange of its own.

The collapse of the bubble brings substantial hardship to the contemporary generation of shareholders, who bought the bubble during their youth and find out in their old age that it is worthless. Somewhat unfairly, this generation of shareholders pays a dear price for the fact that the next generation of the young decides to “break the social contract” and not buy the bubble from them. This price can be understood as the devolution of the upfront fee for destroying the social contract, i.e. $\gamma^t \cdot (1-\varepsilon-D_t)$. Subsequent generations do not suffer as much although they still find that interest rates are low and, as a result, so are their consumption and welfare. The gains from eliminating the inefficient investments are lost. The bursting of the bubble is a coordination failure and everybody loses from it.

The US fiscal expansion offsets part of this loss for US residents. To see this, note that we can use Equation (2) to decompose the revenues from the fiscal expansion, i.e. $\gamma^t \cdot \sum_{i \in I} T_{i,t}$, into two components. The first one consists of the gains from eliminating inefficient investments, i.e. $(\gamma-r_t)\cdot\gamma^{t-1}\cdot D_t$. The second one consists of the upfront fee for creating debt, i.e. $\gamma^t \cdot (D_{t+1}-D_t)$. That is, the US government is gradually implementing the social contract and distributing the gains to the different US generations in the form of transfers, i.e. higher spending and lower taxes. ROW residents do not benefit from this US fiscal policy because they are assumed not to receive transfer from the US government and the interest rate remains low throughout.[21]

This analysis departs fundamentally from the conventional view in two important respects. The first one is that the fiscal expansion is now seen as sustainable, while in section two it was deemed unsustainable. The second difference is that the fiscal expansion is now seen as benefiting all generations, while in section two it was perceived as a means to re-distribute consumption from future to present generations. Both of these differences, of course, are a

[21] They would benefit too though, if we had postulated a concave technology rather than a linear one, since the debt would raise the interest rate. And this would be a positive spillover of the US fiscal expansion abroad.

direct consequence of removing the unrealistic assumption, which underlies conventional views, that the interest rate exceeds the growth rate.

How plausible is this "benevolent" view of US economic policy? A first objection to it comes from a simple numerical observation. Favourable debt dynamics mean that debt accumulation decelerates and eventually stabilizes. But this requires that the deficits not be too large. To see this, assume now that $\sum_{i\in I} T_{i,t} > \frac{\gamma - r_t}{\gamma} \cdot (1-\varepsilon)$. In this case, government debt starts crowding out efficient investments before stabilizing and this turns favourable debt dynamics into unfavourable ones. If the deficits are too large, the situation is unsustainable even if the world economy contains pockets of dynamic inefficiency. This seems to be the situation nowadays. The US economy is about forty percent of the world economy. Its (net) growth rate is about three percent, the (net) interest rate is about one and a half percent, and the budget deficit remains at five percent of US GNP. Under these assumptions, by the time US government debt stabilizes it has already surpassed world savings by almost forty percent! The current budget deficits are not sustainable and this seems an unobjectionable conclusion to us.

But this does not mean however that the "benevolent" view is incorrect. The essence of this view is that the US government is supplying an asset (government debt) that is useful to eliminate inefficient investments, and it is receiving payments (deficits) for this service. The time profile of deficits reflects how these payments are distributed across the different generations. We made the simple assumption in Equation (16) that these benefits grew at the same rate as the world economy, i.e. so that generation t obtained $\gamma^{t+1} \cdot T$. But this is obviously not the option that the current US government has chosen. We get much closer to the actual behavior of the US government if we replace Equation (17) by the following one:

$$
\text{(19)} \qquad \sum_{i \in I} T_{it} = \begin{cases} \frac{\gamma - r_t}{\gamma} \cdot (1-\varepsilon) & \text{if } S_t = S_{t-1} = L \\ 1 - \varepsilon - \frac{r_t}{\gamma} \cdot D_{t-1} & \text{if } S_t = L \text{ and } S_{t-1} = H \\ 0 & \text{if } S_t = H \end{cases}
$$

Under this new assumption on fiscal policy, Equation (18) describing the interest rate still applies. The dynamics of debt under this fiscal policy are now however very different. When the bubble bursts, the US responds by engineering a very large fiscal expansion. In particular, it immediately expands debt by exactly the amount required to absorb all of the savings of the shareholders, and then stabilizes debt at this level by running much smaller deficits. The first generation after the bubble collapses receives the entire upfront fee. Future generations then simply receive the gains from eliminating inefficient investments. Whether this choice of distribution of gains corresponds to a preference for the current generation or, instead, to a desire to compensate the generation that lost the bubble is unclear. But to make the “benevolent” view consistent with observed policy one must assume that the lion’s share of the gains that accrue from supplying government debt are being reaped by the current generation.

This view is comes surprisingly close to capturing actual US fiscal policy. Suppose that the decline in the value of the stock market between 2000 and 2003, equalling a bit more than $3 trillion, represents the elimination of the bubble. According to this benevolent view the US government should run large fiscal deficits to quickly expand public debt by about the same amount. Interestingly, according to the baseline projections of the US Congressional Budget Office, public debt will expand by $2.6 trillion between 2000 and 2012, and then stabilize thanks to much smaller projected budget deficits of around 2 percent of GDP. This suggests that projected fiscal policy over the next several years will be successful in eliminating almost as many inefficient investments as the stock market bubble did in the 1990s.

Of course, it is possible that a bubble reappears in the stock market in the future, and this would require an adjustment in fiscal policy. According to the benevolent view, the government should respond to the reappearance of a stock market bubble by eliminating the fiscal deficits. In the context of our model, whether this fiscal adjustment will be painful or not depends on who issues the bubble. If the US is lucky and the new bubble is mostly created by US residents, then the rents from bubble creation will make for most of the lost budget deficits. And if this is the case, the US net foreign asset position will remain negative as US residents on net sell their bubbly firms to foreigners. If instead it is mostly ROW residents that issue the new bubble, then the fiscal adjustment would be costly since US residents would not be compensated for the loss of the budget deficits. In this case, the US net foreign asset position would turn positive as US debt declines and ROW residents sell bubbly firms to US ones.

Central to our model is the result that providing an asset that eliminates inefficient investments yields a benefit or fee to those that create it. According to the benevolent view, the government is "altruistic": it lets the private sector appropriate this benefit (rents from bubbly creation), and only intervenes when the market is incapable of providing itself with the appropriate asset. When this is the case, the government also receives part of this benefit (the budget deficits). But why would the government not want to appropriate this benefit even when the market works? One can also imagine that the government could be "opportunistic": it might try to displace an existing bubble and capture all the benefits from providing an asset that eliminates inefficient investments, and redistribute these benefits to its constituents. We examine next this possibility.

5. A "cynical" view of US economic policy

We consider next a situation in which there are two types of government. The "altruistic" government acts as in the previous section. Rather than allow the private sector to capture the rents from bubble creation, the "opportunistic" government expands public debt and crowds out the bubble in order to capture these rents and distribute them to its constituents. We construct an equilibrium in which initially the altruistic government is in power and the stock market creates a bubble that is large enough to crowd out all inefficient investments. The government responds by eliminating its budget deficits and making room for the bubble to grow. But there is a change in government and this leads to a drastic change in fiscal policy. The opportunistic government starts a fiscal expansion whose objective is to crowd out the bubble and in this way appropriate its value. In this equilibrium, the US fiscal expansion constitutes a “beggar-thy-neighbour” policy that is responsible for the collapse in the stock market.

Let $G_t \in \{A,O\}$ be a state variable indicating whether the altruistic (G_t=A) or the opportunistic (G_t=O) government is in power, and let ϕ be the probability the US government changes type. As in the previous section, the altruistic government uses fiscal policy to immediately eliminate inefficient investments whenever the stock market fails to do so. Therefore Equation (19) still applies when G_t=A. Instead, the opportunistic government uses fiscal policy to appropriate as many resources as possible and then distributes them as it sees fit. As a result, when G_t=O we must replace Equation (19) with the following:

$$(20) \qquad \sum_{i \in I} T_{it} = \begin{cases} \chi \cdot \left(1-\varepsilon-\frac{r_t}{\gamma}\cdot D_{t-1}\right) & \text{if } D_{t-1} < 1-\varepsilon \\ \frac{\gamma - r_t}{\gamma}\cdot(1-\varepsilon) & \text{if } D_{t-1} = 1-\varepsilon \end{cases}$$

where $\chi \in (0,1]$. Since $1-\varepsilon-\frac{r_t}{\gamma}\cdot D_{t-1}$ is the value of productive and bubbly firms owned by shareholders, Equation (20) is simply saying that the opportunistic government runs budgets deficits that crowd out a fraction χ of these firms. Note that this fiscal policy does not depend on investor sentiment. The government always expands debt when it arrives to power, regardless of whether this displaces inefficient investments or a stock market bubble.

Is the bubble in Equation (16) consistent with the existence of the opportunistic government? Assume first that χ is small, so that when investor sentiment is high the opportunistic government displaces the bubble slowly. In this case, the expected growth rate of the bubble still exceeds the return to the inefficient investments. And, as a result, the bubble in Equation (16) still constitutes an equilibrium. The interest rate (which can be obtained by the same procedure we obtained Equation (18)) depends on which government is in power. In particular, when investor sentiment is high the interest rate will be lower when the opportunistic government is in power. This reflects the effect of fiscal policy on the size of the bubble and therefore the return it offers. The opportunistic government makes the bubble a worse asset and debt does not need to offer a high interest rate to compete with it.

Assume instead that χ is large, so that the opportunistic government displaces the bubble rapidly when investor sentiment is high. In this case, the expected growth rate of the bubble falls short of the return to the inefficient investments. Therefore, the demand for the bubble drops to zero and the bubble bursts. In this case, the arrival of an opportunistic government burst the bubble on impact and leads to the reemergence of inefficient investments. As a result, Equation (16) no longer constitutes an equilibrium and must be replaced by the following one:[22]

$$(21) \qquad B_t = \begin{cases} 0 & \text{if } S_t = L \text{ or } G_t = O \\ 1 - \varepsilon - D_t & \text{if } S_t = H \text{ and } G_t = A \end{cases}$$

Equation (21) recognizes that, if χ is high enough, the bubble can only exist if investor sentiment is high and the government is sufficiently altruistic. From now on, we shall assume that the altruistic government crowds out the bubble immediately, i.e. $\chi \to 1$; and we consider the bubble in Equation (21). Note that in this case, there is a bubbly state where both the altruistic government is in power and investor sentiment is high, and a non-bubbly state where either investor sentiment is low, the opportunistic government is in power, or both.

[22] Can the bubble exist even if there is an altruistic government in power? The answer is positive if the transition probability ϕ is low enough (one example was the model of the previous section which is nothing but the limiting case where $\phi \to 0$). We assume this in what follows.

Given our assumptions, we have now that the equilibrium interest rate is given by:[23]

$$(22) \qquad r_{t+1} = \begin{cases} \pi - \alpha & \text{if } S_t = L \text{ or } G_t = O \\ \dfrac{\gamma \cdot (1-\varepsilon) \cdot (1-\eta)}{1-\varepsilon-\eta \cdot D_t} & \text{if } S_t = H \text{ and } G_t = A \end{cases}$$

where $\eta=1-(1-\lambda)\cdot(1-\phi)$ is the probability that the economy transitions from the bubbly to the non-bubbly state. Note that the expression for the interest rate is identical to that in Equation (18), with the exception that we must replace the transition probability λ with η. The intuitions are also identical: in the absence of a bubble, the interest rate is low since debt competes with capital and the latter offers a low expected return to shareholders. When the bubble appears, the interest rate is high because debt competes with the bubble which is a better asset than capital.

Interestingly, the equilibrium of this section is observationally equivalent to that of the previous section. In both equilibria, when the bubble exists, budget deficits are zero and the bubble absorbs all of the inefficient investments of the shareholders. In both equilibria, the bursting of the bubble is accompanied by a large fiscal expansion that ensures that debt now performs the same task of eliminating inefficient investments. The welfare consequences of these two equilibria are also the same. When the bubble collapses, both US and ROW shareholders suffer large losses. US shareholders of the current generation are compensated for this loss by the large fiscal deficit which corresponds to the up-front fee for creating debt, but ROW shareholders receive none of this. The collapse of the bubble therefore implements a transfer from ROW to the US.

They key difference between the two equilibria lies in the underlying shock that leads to the bursting of the bubble. The first possibility corresponds to the "benevolent" view that we have already discussed: investor sentiment

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[23] Once again, note that when S_t=L or G_t=O and $D_t=1-\varepsilon$, any $r_t \in [\pi-\alpha,\gamma]$ is also an equilibrium.

changes exogenously, and an altruistic government responds by running large fiscal deficits. This policy reaction does not hurt ROW residents because the bubble bursts anyway, but helps US residents. The other possibility corresponds to a more “cynical” view: when the opportunistic government comes into power, it immediately crowds out the bubble in order to appropriate its value. This policy reaction hurts ROW residents, since the bubble would not have burst without it. In this case, US fiscal policy is a “beggar-thy-neighbour” type of policy.

6. Final remarks

In this paper we have provided a joint account of some of the major US macroeconomic events of the past decade: large current account deficits and a steady decline in the net foreign asset position; the large boom and subsequent crash in the stock market; and the emergence of large fiscal deficits. According to the conventional view, the evolution of the stock market and fiscal deficits are more or less unrelated events, with the former driven by sharp swings in US productivity, and the latter by shifting US political considerations. Both of these in turn fueled current account deficits that must eventually be reversed as the accumulation of public debt becomes excessive.

We instead propose two alternative views in which the stock market and the fiscal deficits are closely linked. Central to our account is the notion that the US economy contains “pockets” of inefficiency. This opens the possibility for asset bubbles to exist, which in turn provides a more plausible explanation for the large swings in equity values over the past decade. The appearance of a bubble in the US stock market in the second half of the 1990s accounts for much of the decline in US net foreign assets during this period. At the same time, the bubble raised welfare worldwide by eliminating inefficient investments. According to the “benevolent” view, the collapse of the stock market in 2000 was the result of a coordination failure or change in investor sentiment, and the rapid expansion of public debt since then served to displace inefficient investments in the same way that the bubble did. Viewed in this light, the large budget deficits of the Bush administration can be interpreted as a welfare-improving response to this market failure. But there is also a more “cynical” interpretation, that is observationally equivalent to the “benevolent” view. Under this interpretation the expansion in public debt caused the collapse of the bubble, as the US government tried to appropriate the value of the bubble from its US and foreign owners.

To explore these ideas, we have used a minimalist model that puts a large weight on theoretical clarity even at the cost of leaving out many important aspects of reality. The advantage of this approach is that, by clearly exposing the main mechanisms at work, it provides a simple framework to think about the interactions between stock market bubbles, budget deficits and the current account. This framework has been used to provide a *qualitative* account of the recent US macroeconomic experience. But this can only be seen as a first step towards a fuller understanding of this period. The natural next step is to use the framework presented here to provide a *quantitative* account of the recent US macroeconomic experience. This will no doubt require enriching the theory by bringing back some of those important aspects of reality that have been left out here.

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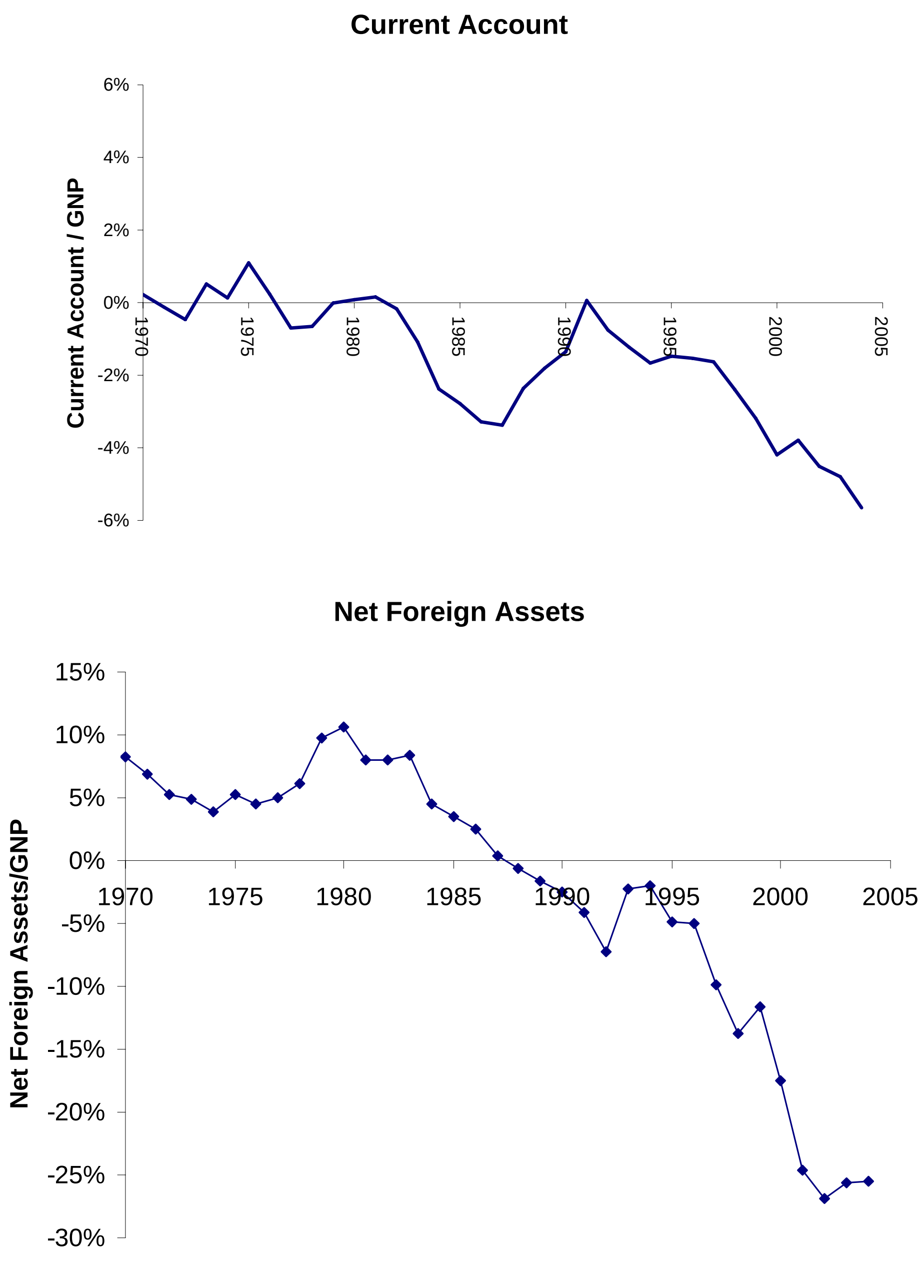
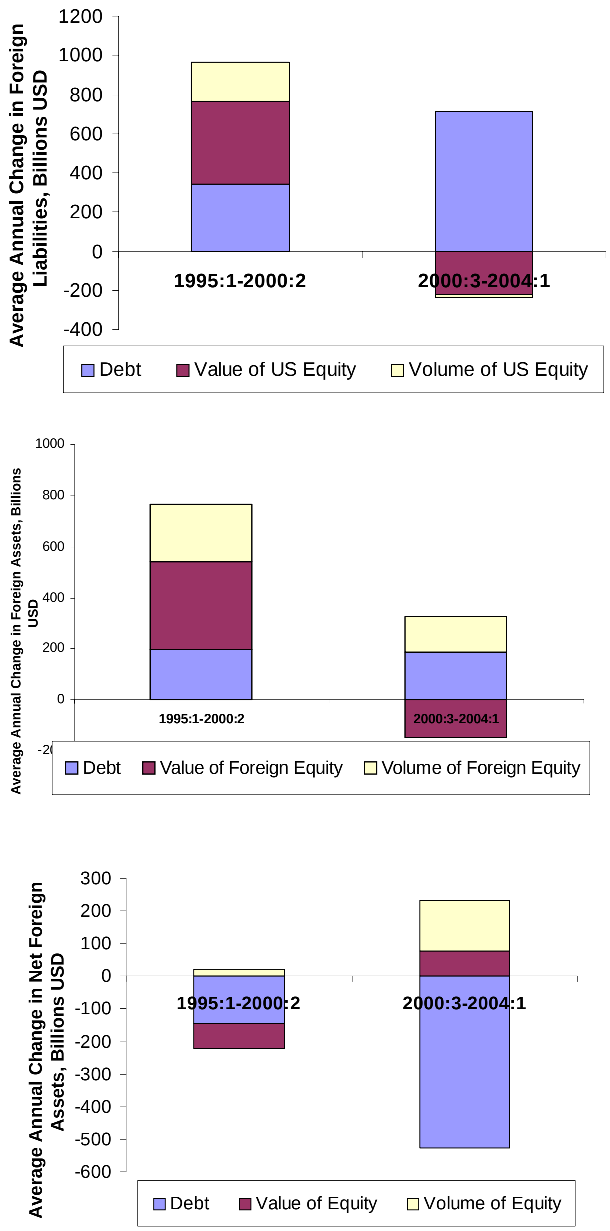
Figure 1: US Current Account and Net Foreign Assets



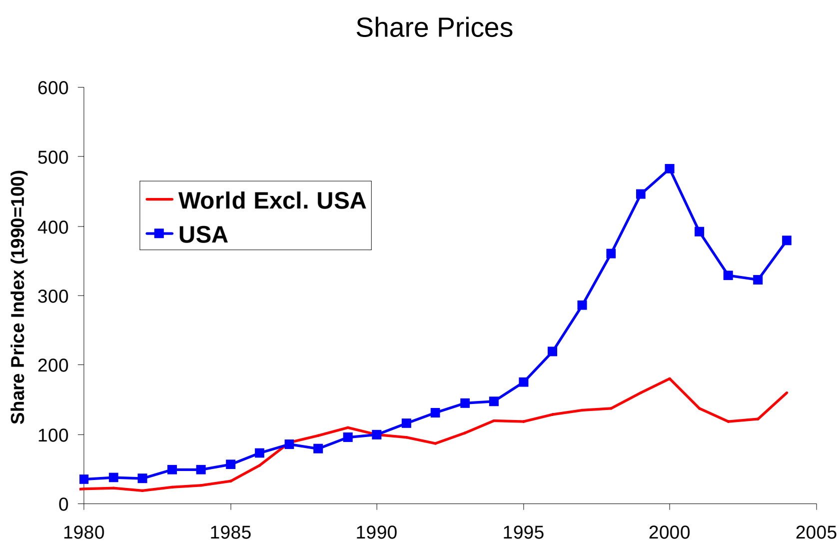
Source: Current account data are from US Bureau of Economic Analysis. NFA data are from Gourinchas and Rey (2005).

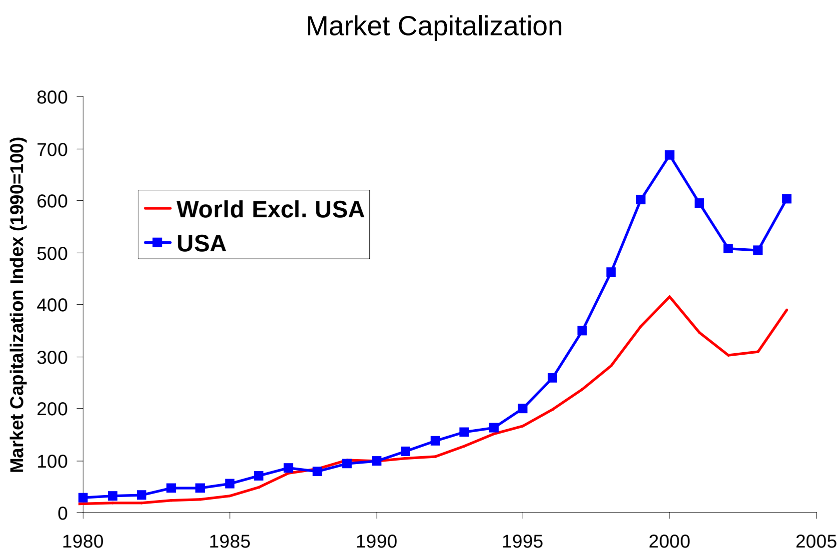
Figure 2: Average Annual Changes in US Foreign Assets and Liabilities



Source: Gourinchas and Rey (2005). Change in value of equity estimated as sum over all quarters of difference between quarterly change in stocks and and corresponding quarterly flows.

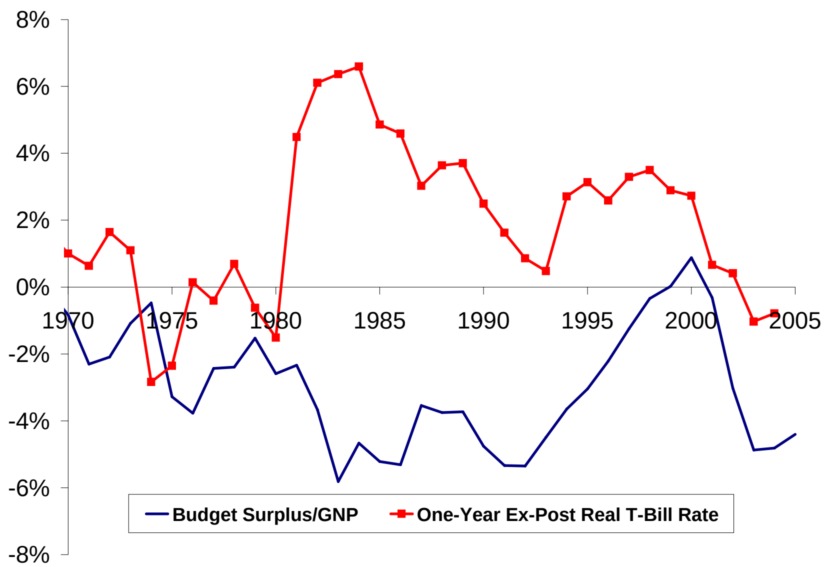
Figure 3: Stock Market Boom of the 1990s





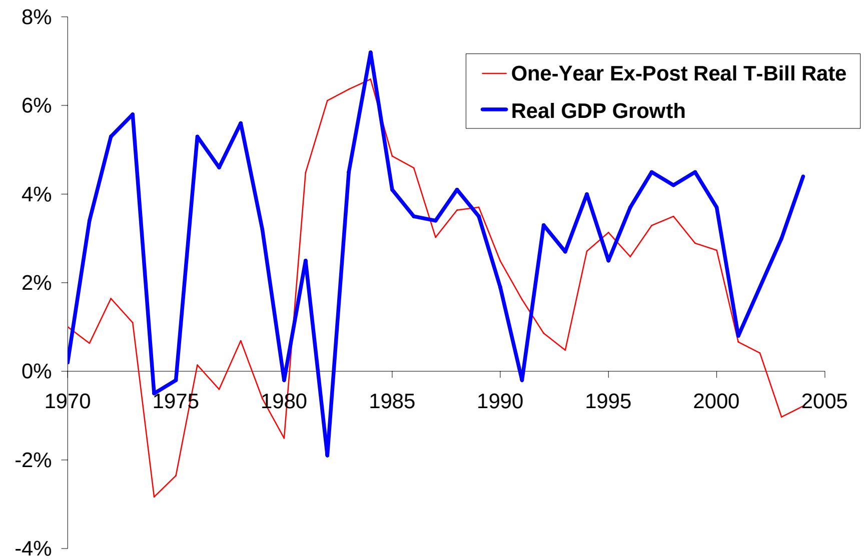
Source: Datastream

Figure 4: Budget Deficits and Interest Rates



Source: Congressional Budget Office and Board of Governors of the Federal Reserve System.

Figure 5: Interest Rates and Growth Rates



Source: GDP growth is from US Bureau of Economic Analysis and interest rates are from the Board of Governors of the Federal Reserve System.

Figure 6: Debt Dynamics in the Benevolent View