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The Debate about the Revived Bretton-Woods Regime: A Survey and Extension of the Literature*

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Abstract

This paper surveys the literature dealing with the thesis put forward by Dooley, Folkerts-Landau and Garber (DFG) that the present constellation of global exchange-rate arrangements constitutes a revived Bretton-Woods regime. DFG also argue that the revived regime will be sustainable, despite its large global imbalances. While much of the literature generated by DFG's thesis points to specific differences between the earlier regime and revived regime that render the latter unstable, we argue that an underlying similarity between the two regimes renders the revived regime unstable. Specifically, to the extent that the present system constitutes a revived Bretton-Woods system, it is vulnerable to the same set of destabilizing forces -- including asset price bubbles and global financial crises -- that marked the latter years of the earlier regime, leading to its breakdown. We extend the Markov switching model to examine the relation between global liquidity and commodity prices. We find evidence of commodity-price bubbles in both the latter stages of the earlier Bretton-Woods regime and the revived regime.

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Keywords: Bretton-Woods regime, international liquidity, price bubbles, Markov switching model

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There is also the consideration that politicians and officials are, on the basis of all previous experience, incapable of thinking about long-range problems unless either a crisis has already come upon them or a major war has prevented them from pursuing short-run victories over each other and obliged them to think about long-range problems as a relief from the boredom of enforced political inactivity. That consideration alone guarantees us another international monetary crisis in the not-too-distant future. We will have a plethora of plans, but a paucity of action.

Harry G. Johnson (1973, pp. 437-38)

1. Introduction

What kind of exchange-rate arrangement characterises the current international monetary system? Although the exchange rates of many of the major currencies - - including the U.S. dollar, the euro, the yen, and the pound sterling - - float against each other, the currencies of many Asian emerging-market economies and oil-exporting economies are pegged to the U.S. dollar. This circumstance has provoked a series of articles by Dooley, Folkerts-Landau, and Garber (hereafter DFG), who argue that the present constellation of global exchange-rate arrangements constitutes a revived Bretton-Woods, or Bretton-Woods II, regime.[1] As was the situation under the Bretton-Woods I regime, which was an arrangement formally agreed among the participants during the period from the mid-1940s until the early-1970s, DFG posit that the United States serves the role of asymmetric center of the current regime, running current-account deficits, providing global (U.S. dollar) liquidity, and absorbing exports from the rest of the world. In the earlier Bretton-Woods regime, Japan and the countries of Western Europe formed a periphery with the United States at the center of the international monetary system. The periphery maintained undervalued, pegged exchange rates and accumulated large amounts of U.S. dollar-denominated reserves in the pursuit of export-led growth. In the Bretton-Woods II regime, the emerging-market economies of Asia, including China, largely serve as dollar peggers and dollar accumulators.[2] The Bretton-Woods I regime lasted for about a quarter of a century. DFG have argued that the present system, despite its large global imbalances, will also be sustainable.[3]

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[1] See DFG (2003, 2004a, 2004b, 2004c, 2005, 2006, 2009). See, also, Dooley and Garber (2005a, 2005b).

[2] DFG (2003, p. 5) included China, Hong Kong, Korea, Malaysia, Singapore and Taiwan in the group comprising the new periphery.

[3] DFG (2005) stated that the current regime would last for another 10 years (from the mid-2000s). They also put forward the view that, at some point in the future, the regime will metamorphosise into a Bretton-Woods III regime as a new group of countries graduate to the periphery. Caballero, Farhi and Gourinchas (2008) also stressed the sustainability of the mid-2000s' regime.

Many commentators (*e.g.,* Eichengreen (2004, 2007), Roubini (2006), Hunt (2008)) have accepted the broad thrust of DFG's thesis, but point to specific *differences* (discussed in Section 4) between the earlier and present Bretton-Woods regimes which they believe renders the current regime structurally unstable. We argue that an underlying *similarity* between the earlier regime, especially as it is evolved in the late 1960s and early 1970s, and the current regime renders the latter regime vulnerable to asset-price booms and financial crises. That is, we argue that, to the extent that the current regime constitutes a revived Bretton-Woods regime, it is vulnerable to the same set of destabilizing forces - - including asset-price bubbles and global financial crises - - that led to the breakdown of the earlier regime. In this connection, we argue that actions by the Federal Reserve and the U.S. government in the late 1960s and early 1970s to demonetise gold at the margin marked a structural change in the earlier Bretton-Woods regime, leaving the global financial system without an anchor to restrict the creation of international liquidity. Specifically, actions to remove the requirement making the dollar convertible into gold (at a fixed price) eliminated any disciple on U.S. monetary policy. These actions set the stage for an explosion of international liquidity in the early 1970s, culminating in a commodity-price bubble and a major exchange-rate crisis and leading to the collapse of the earlier Bretton-Woods regime.[4] The absence of a convertibility requirement on the anchor currency has carried over to the revived Bretton-Woods regime of the 2000s. That regime has also been marked by a sharp expansion of global liquidity, asset-price bubbles, and a major financial crisis.

The remainder of this paper consists of six sections. Section 2 outlines key characteristics of the original Bretton-Woods regime, *circa* the mid-1940s until its collapse in 1973. Section 3 describes the central features of the revived Bretton-Woods thesis put forward by DFG. Section 4 provides an overview of the literature that has emerged in reaction to the DFG thesis. Section 5 discusses the relation between global-liquidity creation and asset-price booms under both Bretton-Woods regimes. Section 6 provides a formal test of regime-switching behavior; in particular, we investigate whether the period marking the latter stages of the earlier Bretton-Woods regime and the period marking the revived regime exhibited similar bubble-like behavior in commodity prices. Section 7 concludes.

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[4] Commodities comprise an asset class and are also used as inputs into production. On the use of commodities as an investment vehicle, see Mongars and Marchal-Dombrat (2006)

2. Bretton-Woods I, Revisited

A monetary regime can be defined as a set of monetary arrangements and institutions that constrains the ability of the monetary authorities to influence the evolution of the macroeconomic aggregates (Bordo and Schwartz, 1997, p. 1; Eichengreen and Temin, 2010, p. 4). Regimes have both domestic and international components. The domestic component relates to the policy actions and institutional arrangements of the monetary authorities. The international component concerns the monetary relations - - including exchange-rate arrangements and permittable degree of capital mobility - - among economic entities (Bordo and Schwartz, 1997, p. 2). In what follows, we focus on the international component of monetary regimes.

The regime that was agreed at Bretton Woods, New Hampshire, in July 1944 had several major objectives, including the following.[5]

- It sought to avoid the exchange-rate instability of the floating-rate regime of the 1920s, which was seen as having impeded external adjustment and the post-World War I reconstruction of trade and finance.[6]

- It aimed to prevent a repetition of the beggar-thy-neighbor policies that had characterised the latter stages of the interwar gold-exchange standard, during the existence of which countries used trade restrictions and competitive currency devaluations to increase trade surpluses (or reduce trade deficits) in attempts to reduce domestic unemployment, shifting that unemployment to other countries (Solomon, 1977, p. 1; Bordo, 1993, p. 35; Cohen, 2002, p. 2).

- It endeavored to provide autonomy for monetary and fiscal authorities to pursue domestic policies targeted at achieving full employment.

- It sought to attain symmetric adjustment between those economies with balance-of-payments surpluses and those with balance-of-payments deficits.

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[5] The architecture of the system was decided before the Bretton-Woods conference, in negotiations that began in 1942 between UK officials and U.S. officials (Kenen, 1993). The following account is based on Yeager (1976), Solomon (1977), Meltzer (1991), Bordo (1993), Kenen (1993), McKinnon (1993), Cohen (2002), and Eichengreen (2008).

[6] Broadly stated, there were three exchange-rate regimes during the interwar period: (1) general floating from 1919 to 1925; (2) the gold exchange standard from 1926 until the early 1930s; and (3) a managed float from the early 1930s until 1939 (Bordo, 1993, p. 6). The view that floating exchange rates discourage international trade and finance and impede external adjustment gained prominence as a result of Nurske's report (1944) for the League of Nations. Nurske's view was based mainly on his interpretation of France's experience with flexible exchange rates during the mid-1920s. Nurske's interpretation of that episode was criticised by Friedman (1953).

- It aimed to achieve symmetric positions among currencies within the international financial regime.

To help achieve these objectives, a new institution, the International Monetary Fund (IMF), was established and charged with promoting collaboration on international monetary issues, facilitating the maintenance of full employment, maintaining stable exchange rates, providing a multilateral payments system, and eliminating exchange restrictions, and providing financial assistance to members with balance-of-payments deficits, thereby reducing external disequilibria (Yeager, 1976, pp. 390-91; Solomon, 1977, p. 12; Bordo, 1993, pp. 34-35).[7] Each member of the Fund was required to establish a par value for its currency in terms of either gold or the U.S. dollar and to maintain the market exchange rate of its currency within one percent of the declared par value through intervention in the foreign-exchange market by buying and selling the currencies of other countries. Instead of the rigid exchange rates of the gold-exchange standard and the floating rates that characterised the mid-1920s, the earlier Bretton-Woods regime featured fixed-but-adjustable exchange rates. Parities could be changed with Fund approval if a member faced a "fundamental disequilibrium" on its external accounts.[8] Moreover, each member of the Fund was expected to make its currency convertible for current-account transactions (Solomon, 1977, p. 12; Bordo, 1993, p. 35; Kenen, 1993, p. 235, Bordo, and Eichengreen, 2008). Fund members were allowed to use controls on capital-account transactions. Controls on the capital account permitted some autonomy for the conduct of domestic monetary policy.[9]

The system that emerged was considerably different from that which had been intended (Bordo, 1993). Instead of a system of equal currencies, the U.S. dollar was the center of the system. The U.S. Treasury, which entered the Bretton-Woods period holding three-fourths of the global monetary gold stock (Meltzer, 1991), pegged the price of the dollar at 35 dollars per ounce of gold, freely buying and selling gold to official bodies at that price. Others intervened to keep their currencies within one percent of parity against the dollar by buying and selling dollars (Bordo, 1993, pp. 37 and 49). In 1949 a group of

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[7] The Fund's Articles of Agreement came into effect at the end of 1945. The Fund's governing body, the Board of Governors, first met in March 1946.

[8] The term "fundamental equilibrium" was never defined. The Fund could not disapprove a change in parity, however, if the change was less than ten percent (Bordo, 1993, p. 35).

[9] A post-war transitional period was provided during which Fund members could circumvent the ban on controls over current-account transactions. Countries maintaining controls for more than five years after the start of Fund operations - - that is, beyond 1952 - - were expected to consult with the Fund about them annually. See Yeager (1976, p. 391) and Bordo (1993, p. 35).

24 countries devalued their currencies against the dollar; however, exchange-rate adjustments among the major currencies became less-frequent over time, reflecting, in part, concerns that a devaluation would result in a decline in national prestige and lead to competitive devaluations by other countries (Obstfeld, 1993, p. 230).

For most of the 1950s and the 1960s, major European countries and Japan used capital controls to maintain undervalued real exchange rates against the U.S. dollar in the pursuit of export-led growth (Meltzer, 1991, p. 87). In turn, for most of the 1950s and the 1960s, the United States ran balance-of-payments deficits, supplying dollar liquidity to the rest of the world.[10] In this connection, a key characteristic of the system was that the United States played the role of world banker; specifically, the United States engaged in maturity transformation, providing short-term liquidity services (*i.e.*, borrowing short-term) and lending long-term to the rest of the world (Despres, Kindleberger and Salant, 1966).

During the late 1960s and early 1970s several events transformed the Bretton-Woods I regime from a regime based on the convertibility of the U.S. dollar into gold (at a fixed price) to a regime based on fiat money. In this connection, prior to 1958, less than ten percent of cumulative U.S. balance-of-payments deficits since the end of World War II had been financed through U.S. gold sales; from 1959 until 1968 almost two-thirds of the U.S. cumulative balance-of-payments deficits were financed from U.S. gold reserves (Cohen, 2002, p.6). When the Bretton-Woods regime started, the United States held about three-quarters of the world's monetary stock (Meltzer, 1991, p.56); by 1968, the share had declined to about one-quarter. To preserve its remaining gold stock, the following measures were taken to sever the link between the dollar and gold.

- A run on sterling and the dollar into gold brought a collapse of the gold-pool agreement in March 1968. Created in 1961 by eight major countries (Belgium, France, Federal Germany, Italy, the Netherlands, Switzerland, the United Kingdom, and the United States) to stabilise the U.S. dollar price of gold at $35 an ounce on the London market (the main trading center for gold), the gold pool became a key pillar of the Bretton-Woods I regime.[11] With the abandonment of the gold pool, the price of gold for official transactions remained at $35 per

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[10] However, from 1959 until 1971, the United States mainly ran current-account surpluses. The absolute size of the surpluses began to decline in 1964. In 1968 and 1969 the U.S. had balance-of-payments surpluses, reflecting a tightening of Fed policy and ceilings on interest rates on deposits. See Bordo (1993).

[11] See Yeager (1976, pp. 425-27) and Eichengreen (2007, Chapter 2).

ounce but the members of the gold pool did not attempt to control the price of gold in *private* transactions; in order to prevent arbitrage between the private and official markets for gold, central banks agreed not to sell in the private gold market (Meltzer, 1991, p. 63).

- In March 1968 the Federal Reserve removed the 25-percent gold backing requirement for the issuance of Federal Reserve notes. As Bordo (1993, pp. 70-72) argued, "the key effect of these [two] arrangements was that gold was demonetised at the margin… In effect, the world switched to a *de facto* dollar standard."[12]

- Following a sharp rise in the U.S. balance-of-payments deficit in the first quarter of 1971 and a resulting run against the U.S. dollar, in August 1971 President Richard Nixon ended U.S. gold loss by announcing that the United States would no longer sell gold to foreign central banks. This action severed the remaining link between the dollar and gold.[13]

Why did the United States sever the links between the dollar and gold during the late 1960s and early 1970s? Beginning in the early 1960s, the Federal Reserve implemented expansionary monetary policies, which led to rising inflation, declining competitiveness, and growing balance-of-payments deficits (Meltzer, 1991, Bordo, 1993); the Fed's monetary policy "concentrated almost excessively on domestic objectives" (Meltzer, 1991, p. 79). As foreign central banks accumulated U.S. dollar reserves, the United States came under the threat of a convertibility crisis. To address this threat, the U.S. government and the Federal Reserve severed all links between the dollar and gold. However, those actions transformed the international monetary system from a commodity-based system to a fiat-money system. The Bretton-Woods regime was set adrift without an anchor.[14] As a result, growth of global liquidity exploded in the early 1970s (Section 5, below) and, in early 1973, the old regime collapsed, ushering in a new regime of managed floating exchange rates.

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[12] Similarly, Yeager (1976, p. 575) argued that "with convertibility at an end, the world was on a *de facto* dollar standard rather than a genuine gold-exchange standard."

[13] Nixon announced that the suspension of convertibility would be temporary. At the Smithsonian Agreement of December 1971, gold was repriced at $38 per ounce but the dollar remained *de facto* inconvertible. Meltzer (1991, p. 80) observed that the action by the U.S. government in August 1971 "formalised the restriction that had been in effect for more than three years by refusing to sell gold."

[14] Meltzer (1991, p. 82) noted that "discipline [on the Federal Reserve] was lacking once the *de facto* embargo on gold was in place after March 1968." Meltzer also pointed out that some of the responsibility for the breakdown of the earlier Bretton-Woods regime lied with the periphery countries, which made few efforts to adjust their policies. Bordo (1993, p. 73) argued: "without gold convertibility, there was no commitment mechanism to constrain the United Stated to follow a stable monetary policy.

3. Bretton-Woods Revived

DFG attempted to explain a major paradox within the international financial system that emerged in the early 2000s - - namely, that rapidly-growing capital-poor-but-labour-rich developing economies were exporting capital, on net, to the capital-rich United States. To explain this paradox, DFG postulated that sometime during the early-2000s the international-monetary regime metamorphosised into a new Bretton-Woods regime. Two developments that occurred during the 2000s form the main backdrop to their thesis. First, beginning in the early-2000s an enormous expansion in global liquidity took place; during the period 2003 to 2007 global reserves increased 127 percent, compared with a 33 percent increase during the preceding five-year period.[15] Moreover, much of the reserve accumulation during the latter period was by Asian emerging market economies. Second, the large accumulation of reserves was used mainly to finance growing U.S. current account deficits.[16] All other factors held the same, the deficits should have become increasingly difficult to finance as the net international investment position of the United States declined. With investors becoming increasingly reluctant to invest in U.S.-dollar-denominated financial instruments, yields and spreads on those instruments would have been expected to rise. In fact, however, nominal yields and spreads on dollar-denominated instruments fell during the period 1999 through the mid-2000s (DFG, 2006). What accounts for this circumstance? DFG argued that, after the collapse of Bretton-Woods I, the structure of the international monetary system came "full circle to its essential Bretton-Woods era form", allowing the U.S. current-account deficits to be financed while both nominal interest rates and interest-rate spreads on U.S. financial instruments fell (DFG, 2003, p. 2).

The DFG argument runs as follows. During the late 1980s/early 1990s, with the fall of the planned economies, millions of previously unemployed workers joined the world's market economies. This situation created an excess supply of labour that should have driven global interest rates upward.[17] To absorb the excess labour, emerging Asian economies followed export-led growth strategies based on undervalued real exchange rates against the U.S. dollar, similar to the strategies followed by many European

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[15] Reserves are net of gold. The data in the text are from the IMF's *International Financial Statistics*.

[16] As a percentage of GDP, the U.S. current-account deficit rose steadily from about 3 percent in 1999 to 6 percent in 2006; it then fell to 5.3 and 4.6 percent in 2007 and 2008, respectively. Source, IMF *World Economic Outlook* (2009).

[17] All other factors held the same, a rise in the supply of labour increases the marginal productivity of capital, causing real interest rates to rise.

countries and Japan under the Bretton-Woods I regime. DFG (2003, 2004a, 2004b, 2005) argued that the emerging Asian economies form a new periphery. Under the revived Bretton-Woods regime, the new workers were, in the aggregate, large net savers. As a result, an enormous increase in saving occurred in emerging Asian economies. Based on this circumstance - - that is, a huge increase in the supply of labour that came with an enormous rise in saving - - DFG posited that the global economy did not face a problem of excess saving. Instead, the global economy faced a problem of an excess supply of labour; the export-led growth strategy of the new periphery allowed the countries comprising the periphery to experience high growth rates, providing jobs for the previously-unemployed workers. As was the case under the earlier Bretton-Woods system, the United States provides the "export market of last resort" (Eichengreen 2007, p. xi) for the new periphery, validating the export-led growth strategy of that group of countries. As was also the situation under the earlier regime, the reserve accumulation associated with the periphery's foreign-exchange-market interventions allows the U.S. monetary authorities to neglect external factors in setting interest rates.

In turn, rapid growth in Asia contributed to high oil prices, leading to high saving rates in oil-producing countries (mainly in the Middle East). In this connection, DFG (2005, p. 3) pointed-out that, during the first half of the 2000s, almost all of the increase in saving rates in the Asian and Middle-Eastern regions was matched by a fall in the saving rate of the United States. Moreover, almost all of the increase in the dollar value of saving in emerging Asia and the Middle East was placed in dollar-denominated instruments, reflecting both growth strategies aimed at maintaining undervalued currencies (against the U.S. dollar) in those economies, the underdeveloped state of domestic financial systems in those regions, and the deep and broad U.S. financial system.

The role of China figures prominently in the DFG analysis. That country faces the challenge of mobilizing an enormous pool of domestic savings to create an internationally-competitive capital stock that can employ hundreds of millions of workers in productive activities (DFG, 2005, p. 1; Frankel, 2005, p.1). However, China lacks a domestic financial system and the managerial skills that can channel these savings in productive investment. To deal with this situation, China relies on export-led-growth to absorb millions of workers from its agricultural sector in its industrial-traded-goods sector. In turn, reserve accumulation by Asian and other central banks allowed the United States to rely on domestic demand to underpin its growth and finance its current-account deficits.

In DFG's view, reserve accumulation by China and other emerging-market economies can be thought of as collateral held against the stock of FDI in those economies. The basic idea is that while financial intermediation by the United States facilitates growth in the periphery, it also generates asymmetric risks for the centre country since the periphery is less credit-worthy than the United States (DFG, 2004c, p.3). To offset these risks, the periphery must post collateral for actual and potential mark-to-market losses. In DFG's view, it is the goods and services *already delivered* to the United States that provide a hedge against the stock of direct investment claims held by that country. As stated by DFG (2004c, p. 3), "it follows that …the United States must be willing to run a current account deficit in order to fulfill its role as the centre country in the system." In this total-return-swap, China gets the return on dollar-denominated financial instruments (mainly U.S. Treasury securities) and foreign investors get the return on equity. Thus, as under Bretton-Woods I, the United States engages in maturity transformation, borrowing short-term, on net, from the periphery, and lending long-term, on net - - mainly in the form of FDI - - to the periphery. DFG have also argued that the old periphery - - consisting of Western Europe, Canada, Japan, and parts of Latin America - - interacts with the center with flexible exchange rates; its aggregate current account has been roughly in balance. As under the older system, the United States remains the centre country, pursuing a monetary-policy strategy that ignores the exchange rate.

What are the implications of the global financial crisis that erupted in August 2007 for the DFG thesis? DFG (2009) argued that global financial crisis was not caused by the global current-account imbalances since the crisis did not entail a sudden stop of capital flows to the United States, which would have led to a large depreciation of the U.S. dollar. To the contrary, they pointed out that the U.S. dollar appreciated against most major currencies during the crisis. In their view, "the crisis was caused by ineffective supervision and regulation of financial markets in the U.S. and other industrial countries" (DFG, 2009, p. 3). Consequently, DFG (2009) argued that the Bretton-Woods analogy continues to define the international monetary system.

In sum, DFG identified a number of similarities between the international monetary regime of the 1950s and 1960s and the regime that has operated in recent years. (i) As was the case under the Bretton-Woods I regime, the present regime is comprised of a center country and a group of economies constituting a periphery. The center country has been the United States in both regimes. (ii) Under both regimes, there is asymmetric behavior,

with the U.S. ignoring external factors in setting interest rates and the periphery paying close attention to external factors. (iii) Under both regimes, the periphery follows an export-led growth strategy based on undervalued currencies, pegged against the U.S. dollar and supported by controls on capital flows. (iv) Under both regimes, the undervalued currencies give rise to a massive accumulation of foreign-exchange reserves mainly in the form of low-yielding U.S.-dollar-denominated financial instruments. (v) Under both regimes, the United States provides the main export market for the periphery, underpinning the periphery's export-led growth strategy. (vi) As was the situation in the earlier regime, in the current regime, the United States serves as world banker, providing financial-intermediation services for the rest of the world. (vii) As was the case with the Bretton-Woods I regime, the present system will prove to be sustainable and metamorphic. At some point in time, "there will be… another wave of countries, as India is now doing, ready to graduate to the periphery" (DFG, 2004, p. 308).

4. Assessments of the DFG Thesis

The idea that the international monetary system has evolved into a revived Bretton-Woods regime has generated two (sometimes overlapping) strands of critical literature. One group of authors has accepted the general validity of the Bretton-Woods metaphor but also points to substantial differences from the earlier Bretton-Woods system. A second group of authors has challenged some of the key assumptions - - especially with regard to the central role of China - - underlying the revived Bretton-Woods story.

a. Regimes Differences

As noted, while accepting the general validity of the DFG thesis one group of critics of that thesis posits that the Bretton-Woods metaphor is incomplete because it overlooks crucial differences between the earlier and the revived Bretton-Woods regimes. These differences, according to this group of writers, will render the revived regime unstable. The key differences cited in the literature are as follows.

1. External position of the United States. Eichengreen (2004, 2007) and Roubini (2006) pointed out that, unlike the situation under Bretton-Woods II in which the United States has been running large current account deficits and incurring a rapidly-expanding net foreign-debt position, the United States registered current-account surpluses through most of the period 1954-71 and was a net investor abroad. In addition, Roubini (2006, p.

306) noted that, unlike the situation that emerged in the 2000s, U.S. fiscal deficits were relatively-modest under the Bretton-Woods I regime. Consequently, the above-cited authors have argued that the combination of large U.S. fiscal and external deficits will undermine the stability of the Bretton-Woods II regime so that, unlike the earlier regime, it will be short-lived (Roubini, 2006, p. 306; Eichengreen, 2007, pp. 27-28; see, also, Munchau, 2007).

2. Accumulation of U.S. dollar liabilities. Closely related to the previous argument, some authors have maintained that the magnitude of the financial flows required to finance U.S. current-account deficits will increase at a faster rate than the willingness of the world's central banks and global private investors to accumulate dollar reserves (Roubini and Sester, 2005; Roubini, 2006; Hunt, 2008; Sester, 2008; Bibow, 2010). In this connection, Roubini argued that the durability of the Bretton-Woods II system required a sustained, robust expansion of U.S. domestic demand to absorb the exports of the periphery. Roubini (2006) posited that expansionary fiscal and monetary policies in the United States needed to sustain an expansion of domestic demand were underpinning a housing-market bubble in that country; that author also predicted that the bubble would burst, leading to an economic showdown and driving the exchange-rate of the U.S. dollar downward. Wolf (2008) and Bibow (2010) argued that the large U.S. current-account deficits of the mid-2000s were unsustainable because a domestic counterpart of those deficits was a build-up of U.S. household debt, which was being used to finance an unsustainable expansion of private consumption.

3. The international role of the U.S. dollar. Several authors (Eichengreen, 2004, 2007; Frankel, 2005; Munchau, 2007) stressed that during the 1950s and 1960s there was no major alternative to challenge the U.S. dollar as the key international currency; under the new regime, the dollar faces a strong alternative in the euro; therefore, unlike the situation that existed in the 1960s, the United States will not be able to supply unlimited dollar liquidity to the rest of the world without generating a run on the dollar. The knowledge that an excess supply of dollar liquidity could lead to a run on the dollar is said to act as a constraint on the behaviour of U.S. policy-makers, thereby differentiating the present regime from the earlier regime (Eichengreen, 2004; 2007). In addition, Eichengreen (2007, p. 6) argued that, under the earlier regime, the European countries that formed the periphery constituted a cohesive bloc; thus, those countries were "ready and

able to act in their collective interest." Under the new regime, in contrast, the countries of the Asian periphery tend to act in a heterogeneous fashion (Eichengreen, 2007, pp. 24-25).

4. A key similarity

Frankel (2005) and Obstfeld and Rogoff (2005) presented a different argument from those above to support the view that the Bretton-Woods II regime would be unsustainable. In this connection, Frankel noted that although the United States ran current-account surpluses in the 1960s, it nevertheless ran *balance-of-payments* deficits beginning in 1958. These deficits "defined the 1960s as a period of excess supply of dollars" (2005, p. 197), just as an excess supply of dollars marked the period that began in the early-2000s. It was this underlying *similarity* between the Bretton-Woods I and II regimes that, according to Frankel, would lead to the unraveling of the latter regime. Similarly, Obstfeld and Rogoff (2005) pointed to the parallels, in terms of the large U.S. twin deficits, between the periods marking the early-1970s and the mid-2000s to support their argument that the revived regime would not be sustainable. We develop this argument in the sections below.

b. Is the Bretton-Woods Metaphor Valid?

As mentioned, a second group of critics have questioned the validity of the Bretton-Woods metaphor. The main arguments made by these critics are the following.

1. The role of FDI. DFG pointed that the Bretton-Woods II regime provides China with a large flow of FDI, contributing to the build-up of a highly-efficient capital stock that would otherwise have been unattainable in that country because of inefficiencies and distortions in the domestic financial system. Goldstein and Lardy (2005a, 2005b) provided data showing that foreign investment in China funded less than five per cent of fixed-asset investment in that country in the early-to-mid-2000s - - "far too small a share to offset the misallocation of investment financed through China's weak domestic banking system" (Goldstein and Lardy, 2005b, p.15). Those authors concluded that, in the absence of the efficient-capital-stock argument, the Bretton-Woods II thesis "is just another ill-informed employment-oriented case for exchange rate undervaluation" (Goldstein and Lardy, 2005a, p. 11).

2. Sterilisation. To maintain undervalued currencies against the U.S. dollar, China and other Asian emerging-market economies have engaged in sterilisation operations. DFG argued that, in the case of China, this policy was feasible because the interest rate on its domestic debt was lower than the interest rate earned on U.S. government securities.

Roubini (2004), Eichengreen (2004, 2007), Rajan and Subramanian (2004) and Goldstein and Lardy (2004, 2007) have argued, however, that DFG underestimated the costs of sterilisation. Specifically, the former group of authors has put forward the view that prolonged sterilisation will lead to financial repression, leading to depressed consumption and forced savings, inhibiting the efficient allocation of resources and undermining long-term potential growth. In addition, Roubini (2005) argued that the enormous growth of reserves in the Asian periphery was becoming more difficult to sterilise, especially in China where the resulting increase in the money supply was fueling a lending boom and an asset-price bubble.

3. Exchange-rate policy of the periphery. Goldstein and Lardy (2008) and Truman (2008) have argued that the exchange-rate policies of many Asian economies, including China, have been more flexible than assumed by DFG. Although the periphery has, for the most part, maintained undervalued exchange rates against the dollar, there is a marked difference between the exchange-rate regime used by the earlier periphery and the regime used by the new periphery. Specifically, unlike the adjustable-peg of the earlier Bretton-Woods regime, which featured occasional - - but large any discrete adjustments in nominal exchange rates - - the revived regime resembles a crawling peg. That is, the revived regime combines elements of both the adjustable peg of the Bretton-Woods I regime and a more flexible exchange-rate arrangement. Consequently, it is not entirely accurate to describe the present regime as a revived Bretton-Woods regime (Goldstein and Lardy, 2008).

Kamin (2005) agreed with DFG that the authorities in the Asian periphery had maintained competitiveness of their exports by limiting the nominal appreciations of their currencies *vis-à-vis* the U.S. dollar. However, that author attributed the current-account surpluses in that region mainly to special on-going effects related to the deadline in investment and domestic demand in the aftermath of the Asian financial crisis of 1997-98. Kamin (2005, p. 3) argued that "once these effects wane, the surpluses will wane as well (so that, over time, the revived Bretton-Woods regime would come to an end.

c. Asymmetric Behaviour

Hall, Hondroyiannis, Swamy and Tavlas (2011) formally tested whether (1) the United States, the centre country under both Bretton-Woods regimes, ignored external factors (proxied by the change in foreign exchange reserves divided by high-powered

money) in formulating monetary policy (as proxied by short-term interest rates) in these regimes and (2) the periphery also ignored external factors in setting monetary policy under both regimes.[18] The idea underlying this work was to test whether there was asymmetry between the behaviour of the centre country, which under the asymmetry hypothesis conducts monetary policy strictly on the basis of domestic objectives, and the periphery, which takes external factors into account in setting interest rates under the asymmetry hypothesis. The quarterly sample period used by the authors for the Bretton-Woods I regime was 1959:Q2-1971:Q4; for the Bretton-Woods II regime the sample period was 1998:Q1-2009:Q4. The countries assumed to comprise the periphery under the earlier periphery were France, Germany, Japan and the United Kingdom. For the Bretton-Woods II regime, the countries comprising the periphery were China, Hong Kong, Korea, Japan, Malaysia and Singapore. The results suggested that the United States did not take external factors into account in formulating monetary policy under both regimes, as stipulated under the asymmetry hypothesis. Under the Bretton-Woods I regime, most countries in the periphery were found to have taken external factors into account in setting interest rates. Under the revived regime, in contrast, most of the countries comprising the periphery did not take external factors into account in setting interest rates. An implication of these results is that the regime comprising the period from the late-1950s until the early-1970s differed from the regime marking the period from the late-1990s until 2007 in terms of the policy responses of the economies comprising the periphery.

5. Asset-Price Bubbles and International Liquidity

There are no precise empirical definitions of either an asset-price bubble or an asset-price boom.[19] Following Kindleberger (1993), an asset bubble can be loosely defined as a sharp rise in the price of an asset or a range of assets in a continuous process with the initial rises leading to self-fulfilling expectations of further increases. Effectively, speculators are interested mainly in generating profits from trading in assets, not the underlying risk-adjusted expected rate of return on the asset (Kindleberger, 1993, p. 243). The rise is typically followed by a sharp reversal in price, often resulting in a financial crisis. Asset-prices booms are (loosely) differentiated from bubbles in that the price rise in the former tends to be milder and more extended than in the former and is less likely to

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[18] The study by Hall *et al.* (2011) departed from most other work comparing the two Bretton-Woods regimes in that it used formal empirical testing.
[19] Bordo and Wheelock (2004, 2007) used statistical algorithms to identify stock-market booms.

lead to a crash. Commodities are an alternative (to such assets as stock-market shares and bonds) asset class that has experienced rapid growth in both open positions at future exchanges and investments in commodity-indexed assets (Mongars and Marchal-Dombrat, 2006; IMF, 2008, p. 88). In what follows, the relationship between global-liquidity creation and commodity-price booms is investigated.

Our thesis is that, to the extent that the Bretton-Woods metaphor is valid, the Bretton-Woods II regime is marked by an underlying bias in favor of excessive global liquidity creation that can lead to asset-price bubbles as measured by changes in commodity prices.[20] In particular, the specific combination of (1) a large (in terms of economic size) periphery that maintains pegged, undervalued exchange rates, (2) a large hegemon, the currency of which is used by the periphery as the anchor for the peg, and, (3) the absence of a convertibility requirement on the hegemon, leads to a bias conducive to "excessive" global liquidity creation.[21] During most of the earlier Bretton-Woods regime, Federal Reserve monetary policy operated under a convertibility restraint - - that is, the requirement to sell gold to foreign central banks at a fixed price of $35 per ounce of gold. As noted above, however, in the late-1960s and early-1970s, as the constraint became binding, the U.S. loosened the constraint. As a result, under the latter stages of the Bretton-Woods I regime the absence of a convertibility requirement on the hegemon left it free to issue its fiat liabilities without a convertibility constraint. With the sharp increase in the U.S. balance-of-payments deficits, the issuance of U.S. fiat liabilities swelled, contributing to a huge increase in global liquidity as non-U.S. central banks acquired dollar reserves in an effort to maintain their exchange-rate pegs against the dollar (Meltzer, 1991; Bordo, 1993). [22]

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[20] In contrast to the situation in the 2000s, the sharp-rise in global liquidity during the late-1960s and early-1970s did not lead to price bubbles for assets such as equities and real estate. During the late-1960s and early-1970s many developed countries, including the United States, maintained controls on cross-borders flows. These controls may have dampened the linkages between global liquidity and developments in domestic asset markets. In contrast to real estate and equities, commodity trading takes place on an international exchange (London).

[21] Clearly, there is no precise definition of "excessive" liquidity creation. In what follows, "excessive liquidity creation is (loosely) taken to mean a rate of increase in global liquidity that exceeds the rate of growth of nominal world GDP.

[22] Obstfeld and Rogoff (2009, p. 38) made a similar argument to the one above: "During the closing years of the Bretton-Woods system, speculation against the overvalued dollar contributed to worldwide growth in international reserves and eventually to higher global inflation. In the 2000s up until the autumn of 2008, reserve growth similarly caused inflationary pressures outside the U.S., also driving increases in commodity, housing and other asset prices". Apart from that statement, Obstfeld and Rogoff (2009) did not develop the Bretton-Woods I and II analogy.

How does global liquidity affect asset prices? There are several channels through which an increase in liquidity may be associated with a rise in asset prices. First, an increase in liquidity tends to boost the demand for assets, such as government bonds, equities, commodity-indexed securities, and real estate, and, thereby, reduce the rates of returns on these instruments (Baks and Kramer, 1999, p. 5). If inflation in goods-and-services prices is relatively low because of, for example, productivity growth, the prices of assets will rise in real terms (IMF, 2000, pp. 88-89). Second, according to the Austrian view of financial crisis, a rise in asset prices, whatever the cause, can lead to a bubble if monetary policy passively allows bank credit to expand, fueling the boom (Bordo and Wheelock, 2004, p. 20). The Austrian view associates rising asset prices and financial imbalances (including current-account imbalances) with general inflation regardless of developments in the prices of goods and services.[23] Third, in the specific case of commodities, economies, such as that of China, that maintain undervalued exchange rates to boost growth contribute to a price spike in two ways. (1) The increase in the demand for commodities as inputs into production leads, other things being the same, to higher prices of commodities. (2) In turn, the initial price increases can lead to expectations of further increases, making commodities more attractive as an investment vehicle.

Table 1 provides data on the annual growth rates of global reserves, global GDP (both real and nominal), and four categories of commodity prices - - (1) a comprehensive index at the prices of thirty commodities compiled by the European Central Bank, (2) the price of those commodities excluding gold and energy, (3) the price of energy, and (4) the price of gold. (Definitions and sources are provided in the Table.) Four sub-periods over the period 1960-2007 are considered: 1960-1969, 1970-1974, 1975-2002, and 2003-2007. The period 1970-1974, corresponds to the latter stages of the Bretton-Woods I regime (with an added year to capture lagged effects), a period marked by the severance of the convertibility link between the dollar and gold. The period 2003-2007 corresponds to the initial years of Bretton-Woods II regime.[24] The starting point of the sample reflects the unavailability of data on the ECB's commodity price series before 1960. The ending point of the sample corresponds to the year of the eruption of the global financial crisis.

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[23] See, for example, Borio and White (2003).
[24] Since there is no official designation of a Bretton-Woods II regime in international law, there is no precise period that corresponds to the operation of the regime. This is no clear demarcation of either the latter stages of the earlier regime or the initial stages of the new regime.

As reported in Table 1, reserves rose by an annual rate of 6.8 percent during 1960-1969, but, following the break of the link to gold, the increase surged to an annual rate of 30.5 percent in the period, 1970-1974. The growth rate of reserves declined to 9.7 percent during 1975-2002, but then again rose sharply, to 17.1 percent, during 2003-2007.[25]

Why should the period, 1975-2001, have been marked by lower growth rate of reserves than the periods 1970-1974 and 2003-2007? After all, the gold-convertibility requirement was absent in all three periods. As noted, the earlier Bretton-Woods regime broke down in 1973, leaving most of the major currencies floating against the dollar. Effectively, most of world trade was conducted under floating exchange rates against the dollar. However, with the emergence of the revived Bretton-Woods regime in early-2000s, an increasing share of global trade was conducted under pegged rates against the dollar. Under the Bretton-Woods II regime, as under the earlier latter stages of the Bretton-Woods regime, the trinity of (1) a large periphery that maintains pegged, undervalued exchange rates, (2) a large hegemon, the currency of which is used by the periphery as the anchor for the peg, and (3) the absence of a convertibility requirement on the currency of the hegemon, was operational, leaving the global financial system susceptible to a bias in favor of excessive liquidity creation.

Commodity prices surged during both 1970-1974 and 2003-2007. As reported in Table 1, the composite price index of commodities rose by annualised averages of 33.9 percent in 1969-1974 and by 21.5 percent in the period 2002-2007; energy prices increased by annualised averages of 56.2 percent in the former period and by 23.5 percent in the recent period. By comparison, during the period 1975-2002 the price index of commodities declined by an annual average of 0.5 percent; the price of energy rose by an annual average of 5.7 percent during that period. The prices of gold and commodities excluding energy and gold followed similar patterns as those of the other commodity categories listed in Table 1.

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[25] The results of a time-series model for structural breaks, proposed by Salkever (1976), confirms that the behaviour of reserves was different in the periods 1970-74 and 2003-2007 than in the period 1975-2002. Letting x_t equal the log of real reserves in period t, D_1 be a shift dummy equal to unity during 1970-74, and D_2 equal a shift dummy equal to unity during 2003-2007, the following results were obtained:

$$x_t = 0.043 + 1.07 x_{t-1} - 0.07 x_{t-2} + 0.035 D_1 + 0.036 D_2$$
$$\quad (0.3) \quad (6.7) \quad\quad (0.4) \quad\quad (1.9) \quad\quad (2.1)$$

where t-ratios are in parenthesis. Combining the dummies into a single dummy gives a coefficient of 0.035 with a t-ratio of 3.99. Note that the log of reserves is essentially a unit-root process, so that the average (quarter-on-quarter) growth of real reserves is about 4 per cent while in the two subperiods it is around 8 per cent.

Several common factors were associated with the booms in commodity prices (IMF, 2008, pp. 84-87). First, the initial phases of the booms coincided with accelerations in global economic growth (Radetski, 2006). Second, reflecting prior periods of low commodity prices, both booms started with lower-than-usual spare productive capacity and inventory levels (IMF, 2008, p. 85). Third, supply constraints - - including weather-related crop failures and the impact of the OPEC cartel - - influenced prices in both booms (IMF, 2008, p. 88). Finally, speculative activity involving the purchase of commodities intended for resale at higher prices rather than for commercial use drove up commodity prices during both booms.[26]

As mentioned above, the surges in commodity prices during both 1970-1974 and 2003-2007 *originated* during periods of strong global growth. Nevertheless, the historical association between commodity booms and global growth is not always robust: (1) global growth turned sharply downward toward the end of 1973, but the boom in commodity prices continued for another year; and (2) long periods of sustained global economic growth during the 1980s and 1990s were not accompanied by broad-based commodity price booms involving fuel and food commodities (IMF, 2008, pp. 84-85).

Are there additional factors that can explain the asset-price booms of 1970-1974 and 2003-2007? As reported above, the sharp rises in commodity prices during both periods were associated with exceptionally-large increases in global liquidity. To further investigate the relationship between commodity prices and global liquidity, the following regression was estimated:

$$\Delta(\log(CommP/CPI))_t = a_0 + a_1\Delta(\log(\mathrm{Re}s/CPI))_t + a_2\Delta\log IP_t \qquad (1)$$

where $(CommP/CPI)_t$ is the price of commodities deflated by world consumer prices,[27] *(Res/CPI)* is global reserve deflated by consumer prices, and IP_t is industrial countries' industrial production.[28] Clearly, the above specification is over-simplified; other variables, including variables representing supply constraints and inventories, should be included, but data on such variables are not available for many commodities. The first-difference specification, however, helps deal with omitted-variable biases and produces stationarity of the variables. Separate regressions were estimated for four commodity groups: (1) an

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[26] For a discussion of the possible role of speculation driving up commodity prices, see IMF (2008, Chapter 3).

[27] *CommP / CPI* can be viewed as the relative price of commodities.

[28] More details on the data definitions and sources of data are provided in Table 1.

index (used above) of the prices of thirty commodities, excluding gold; (2) the same index, but also excluding coal and oil; (3) an index of the prices of oil and coal; and (4) the price of gold. Regressions were estimated over the period 1970-2007. The data are annual.

The results are reported in Table 2. In all equations, there is a strong procyclical effect of industrial production on commodity prices; however, in the regressions with both the changes in energy prices and gold prices as the dependent variable, the demand variable is not significant. The coefficient on the change in reserves variable is positive and significant in all regressions with a coefficient that is generally above unity; in general, the results suggest that a 1 percent increase in the growth of reserves increases the growth rate of commodity prices between 1 and 2 percent.[29]

6. A Formal Test of Bubbles

The main counterpart of the build-up of reserves during five years ending in 2007 was the U.S. current-account deficits of that period (Table 3). Consider the following:

- U.S. current-account deficits averaged 5.4 percent of GDP during the five years ending in 2007, peaking at 6.0 percent in 2006. [30]

- During that period, the cumulative total of the U.S. current-account deficits amounted to 2.68 trillion SDRs.

- The change in global reserves during the same period was 2.42 trillion SDRs, close to the cumulative U.S. current-account deficits during the period (Table 2).

Global-reserve accumulation was underpinned by the accumulation of reserves by Asian emerging-market economies. Seven economies - - those of China, Hong Kong, India, Korea, Malaysia, Singapore and Taiwan - - accounted for over 45 percent of the build-up of global reserves during the five years ending in 2007 (Table 2).[31] The main drivers of reserve accumulation among the Asian emerging-market economies were the following: (i) an excess of domestic saving in some economies,[32] (ii) underdeveloped financial systems, so that there may have been difficulties in channeling saving to

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[29] We ran another set of regressions using world real GDP (from the World Bank databank) as the demand variable. The results are similar to those reported above. The results are available from the authors.

[30] During the preceding 30 years U.S. current-account deficits averaged 1.5 percent of GDP.

[31] DFG (2004a) included Japan, which they identify as an economy that manages its exchange rate against the dollar, as a member of the Bretton-Woods II periphery. Inclusion of the Japanese economy in that group increases share to sixty percent.

[32] Obstfeld and Rogoff (2008, p. 150) argued that, although an increase in global saving contributed to low global interest rates in the 2000s, a large rise in saving did not take place until 2004.

domestic investment, (iii) the desire to unilaterally to self-insure against future crises in the aftermath of the financial crises that hit several emerging-market economies in the 1990s and early 2000s, and, (iv) the pursuit of expert-led growth strategies supported by undervalued exchange rates, that is, the DFG thesis.

There is neither a precise nor a unidirectional relationship among the foregoing developments. Instead, the developments were marked by interconnected feedback loops. (i) Low U.S. interest rates contributed to higher U.S. domestic demand, increasing the current-account deficit and contributing to higher U.S. asset prices. (ii) Higher U.S. asset prices led (through wealth and balance-sheet effects) to an increase in U.S. economic growth, raising the current-account deficit. In turn, a widening of the U.S. current-account deficit may have pushed-up U.S. asset prices.[33] (iii) The exchange-rate policy of the periphery, whereby the periphery accumulated reserves and invested in U.S. financial instruments, raised the prices of those instruments and fed the asset-price boom.[34] (iv) The exchange-rate policy of the periphery led to higher, export-led growth in the periphery, increasing the demand for commodities as inputs. To the extent that the counterpart of the periphery's exports represented a rise in U.S. imports, the U.S. experienced a larger current-account deficit than it would have otherwise. Other things being equal, higher global commodity prices also widened the U.S. current-account deficit. (v) Higher commodity prices led to higher current-account surpluses for commodity exporters. Since many oil-exporting countries maintain dollar pegs, these surpluses resulted in higher global reserves and lower U.S. interest rates.

In what follows, we apply a formal test of a collapsing rational bubble, extending the technique of Hall, Psaradakis and Sola (1999), who proposed a switching Augmented-Dickey-Fuller (ADF) type test to capture collapsing and expanding bubbles. The aim of the test is to asses whether the relationship between global liquidity and commodity prices differed fundamentally during the early 1970s and the 2000s from the other years in our sample. Specifically, we aim to determine whether the periods marking the early 1970s and the 2000s were characterised by commodity price-bubbles.

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[33] Aizenmann and Jinjarak (2009) estimated that an increase in the U.S. current-account deficit by 1 percent of GDP is associated with a ten percent rise in real estate prices.

[34] Estimates by Krishnamurthy and Vissing-Jorgensen (2008) and Warnock and Warnock (2009) suggest that official demand for U.S. sovereign debt decreased long-term rates on that debt by more than 50 basis points.

The basic idea is that we use an extension of a Markov switching model to view the world as consisting of two regimes, either an expanding bubble or a stationary (or at most an untrended unit root) process. To capture these regimes, we allow the parameters of our model to switch between two discreet states. The conventional Markov switching model assumes that the probabilities of either remaining in a regime or switching are constant parameters. Here, we extend the standard model in two ways. First, we make the transition probabilities functions of global liquidity so that (assuming that we obtain the correctly-signed parameters) the probabilities change when liquidity is growing rapidly. Therefore, if we are in a bubble state and liquidity is growing at a relatively-high rate, we are more likely to remain in the bubble regime. Alternatively, if we are not in a bubble state, but liquidity is rising at a relatively-fast rate, we are more likely to switch into a bubble state. The second extension we make is to allow the probabilities to adjust gradually over time using a partial adjustment process.

The basic framework for this test is an extension of the standard ADF test for non-stationarity as follows

$$\Delta y_t = \mu_0(1 - s_t) + \mu_1 s_t + (\eta_0(1 - s_t) + \eta_1 s_t) y_{t-1} + \varepsilon_t \tag{2}$$

where y is the log of commodity prices, s is an indicator of the regime $s_t \in \{0,1\}$ and ε_t is an IID error process. Following Goldfeld and Quandt (1973) and Hamilton (1989) we would then set up a system under which the probability of being in regime s at time t is a function of the regime at t-1 and this is specified as a Markov chain on the state space with the following transition probabilities

$$\Pr(s_t = 1 \mid s_{t-1} = 1) = p \tag{3}$$
$$\Pr(s_t = 0 \mid s_{t-1} = 1) = 1 - p \tag{4}$$
$$\Pr(s_t = 0 \mid s_{t-1} = 0) = q \tag{5}$$
$$\Pr(s_t = 1 \mid s_{t-1} = 1) = 1 - q \tag{6}$$

where p and q are constants, representing the probabilities of being in the two regimes. For example, equation (3) says that if we were in regime 1 last period, there is a probability, p, of being in that regime this period. In what follows, we generalise this model, making the evolution of p and q functions of a variable, in this case the rate of growth of global liquidity. Since p and q are probabilities, any function that generates these probabilities

must bound them to be between zero and one. The following parameterisation has been used:

$$p_t = \omega p_{t-1} + (1-\omega)(e^{(\alpha_0 + \alpha_1 x_t)}) / (1 + e^{(\alpha_0 + \alpha_1 x_t)}) \qquad (7)$$

$$q_t = \omega q_{t-1} + (1-\omega)(e^{(\beta_0 + \beta_1 x_t)}) / (1 + e^{(\beta_0 + \beta_1 x_t)}) \qquad (8)$$

where α_1 is the probability of remaining in the stable regime if liquidity growth is high; a negative coefficient on α_1 indicates a high probability of *switching* to a bubble regime from the stable regime if liquidity growth is high. Similarly, β_1 is the probability of *remaining* in a bubble regime if liquidity growth is high; a positive coefficient indicates a high probability of remaining in the bubble regime. The effect of ω is to smooth sudden movements in the transition probabilities, while the effect of the growth in liquidity is to change the probabilities of switching into a bubble or remaining in a bubble through time. Thus, when liquidity grows rapidly we would expect to see a significant shift in the probabilities so that if we are not in a bubble regime, we are more likely to switch to a bubble; correspondingly, if we are in a bubble regime, we are more likely to stay there. The key parameters in terms of our hypothesis are α_1 and β_1, the coefficients on the growth of liquidity in the two equations generating p and q. If the hypothesis that high liquidity growth (1) results in a regime switch from a stable regime to a bubble regime, and (2) leads to a high probability of remaining in a bubble regime, is correct, we would expect that $\alpha_1 < 0$ and $\beta_1 > 0$

We estimated the above model using maximum likelihood. The model is quite demanding of the data because we need a large number of observations for both regimes to allow us to successfully identify the regimes and the transition from one regime to the other. In Section 4 above, we used annual data on liquidity and commodity prices; however, annual data provided an insufficient number of observations to estimate the above model. We have, therefore, used a monthly all-commodity price index, compiled by UNCTAD, which is available from 1962 to mid 2010, providing us with over 500 observations. Monthly data on global liquidity do not exist; therefore, the data on liquidity have been interpolated to a monthly frequency from the annual data used in earlier parts of this paper.

The results from estimating this model are reported in Table 4. The α_1 coefficient is significant, which suggests that there is a significant effect of a change in liquidity on the

probability of changing a regime. It is also negative, which means that it reduces the probability of remaining in the non-bubble regime and increases the chances of moving into the bubble regime. The β_1 coefficient is positive, as hypothesised but is not significant. Overall, the model works reasonably well, although some of the coefficients are not very significant. Regime 1 is virtually a unit root (since η_1 is close to zero) while the other regime is more stationary.

A key finding concerns the timing of the two regimes. Figure 1 shows the probability of being in one regime or the other, where 1 indicates being in the more unstable (i. e., bubble) regime and 0 indicates the stable one. From the early 1960s, the model suggests that commodity markets were predominantly in a stable regime until the early 1970s, during which time, the model suggests the world moved into a largely unstable one, until 1975. From that point on, although there are some brief periods in which the commodity markets are unstable, the model is predominantly stable through late 2002, at which point it switches mainly to the unstable regime for the rest of the decade. These episodes, then, match the dating of the original and revised Bretton-Woods periods remarkably well, strongly supporting our hypothesis that there was a qualitative difference in the relationship between global liquidity and commodity prices during the periods corresponding to both the latter stages of the earlier Bretton-Woods regime and the revived Bretton-Woods regime.

7. Concluding Remarks

The breakdown of the earlier Bretton-Woods regime ushered in a regime of managed floating exchange rates among the major currencies.[35] The managed-floating regime withstood a series of shocks to the global economy - - including several oil-price shocks and crises in emerging-market economies. It encompassed much of the period marked by the Great Moderation - - that is, the long period of sustained U.S. economic growth and relatively-low U.S. inflation of the 1980s and 1990s. Although the United States ran persistent current-account deficits during the period from the breakdown of the earlier Bretton-Woods regime to the emergence of the revised Bretton-Woods regime, the size of

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[35] The qualifier "managed" is added to account for the fact that there were significant departures from floating. For example, prior to the adoption of the euro in 1999, the currencies of many European economies operated under a target zone arrangement.

the deficits was modest compared with those that emerged in the 2000s.[36] Floating exchange rates among most of the major currencies provide features on global imbalances.

In this paper, we have extended the DFG revived Bretton-Woods metaphor. We interpreted sharp spikes of global liquidity creation and booms in commodity prices as recurrent features of an international monetary system marked by the trinity of (1) a large periphery that maintains pegged, undervalued exchange rates, (2) a large hegemon, the currency of which is used by the periphery as the anchor for the peg, and (3) the absence of a convertibility requirement on the currency of the hegemon. Operating in the absence of the self-adjusting features of floating exchange rates against the economies that form the periphery and the discipline imposed by a convertibility requirement, the hegemon pursues domestic monetary policy unconstrained by its large current-account deficits, which are, in part, the result of a policy imposed by the periphery. Under the revived Bretton-Woods system the Fed has attained its inflation objective, but the interactions of its monetary policy, which essentially takes no account of external factors, and the policy of the periphery, have created a situation conducive to global imbalances, excessive global liquidity creation, and asset-price bubbles.

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[36] As noted above, since there is no official designation of the Bretton-Woods II regime, there is no precise period that corresponds to the operation of that regime. During the period 1973-2002, U.S. current-account deficits averaged 1.4 percent of GDP, compared with 5.4 percent in the five years ending in 2007.

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Table 1

Commodity Prices and International Reserves, 1969-2007
Annualised percent changes

	1960-1969	**1970-1974**	**1975-2002**	**2003-2007**
Reserves	6.8	30.5	9.7	17.1
Real GDP (world)	N/A	4.8	3.4	4.1
Nominal GDP (world, U.S. dollars)	7.5	13.8	7.1	9.7
Commodities	0.9	33.9	2.6	21.5
Commodities (excluding gold and energy)	1.4	20.9	0.1	17.9
Energy	-0.5	56.2	5.7	23.5
Gold	0.2	42.2	5.1	19.8

Notes: 1. *Reserves*; the data are from the IMF's *International Financial Statistics,* line 1ds; reserves are denominated in SDRs and exclude gold holdings

2. *Nominal GDP* (world) and real GDP (world) are from the World Bank online database, *World databank*

3. *Commodities, commodities* excluding gold and energy, and *energy* are from the European Central Bank database. The index for commodities is based on the prices of 30 commodities. The energy component of the index consists of the prices of coal and crude oil.

4. The price of *Gold* is from the IMF's International Financial Statistics. It is the spot price in U.S. dollars on the London market.

Table 2
Regression Results: Effects of Reserves and Demand on Commodity Prices

Dependant Variable	Constant	Change in Reserves	Change in Industrial Country Industrial Production	$\overline{R}^2$	Durbin-Watson	LM Stat (1 D.F.)	LM Stat (4 D.F.)	Bera-Jarque
Change in price of commodities (excluding gold)	-0.09 (4.0)	1.41 (3.1)	1.52 (1.65)	.31	1.23	8.5	7.7	21.8
Change in price of non-energy, non-gold commodities	-0.09 (5.2)	0.88 (2.8)	2.34 (3,6)	.42	1.30	5.6	6.8	2.1
Change in price of energy	-0.09 (2.8)	2.0 (3.0)	0.54 (0.4)	.22	1.61	2.1	2.9	54.6
Change in price of gold	-0.07 (2.2)	1.09 (1.8)	1.56 (1.2)	.14	1.40	3.5	7.0	3.6

Notes: - Figures in parentheses are absolute values of Newey-West corrected t-ratios.
- All variables are in first differences of logarithms. Prices of commodities and reserves are each deflated by the world price level as reported in the *International Financial Statistics.*
- The data are annual.
- The estimation period is 1970-2007.
- Definitions of variables are provided in Table 1.
- D.F. denotes degrees of freedom.

Table 3
 Current Account Balances and International Reserves, 2003-2007

United States Current Account		Change in reserves									
Year	Percent GDP	Amount (billions of SDRs)	World	China	Hong Kong	India	Korea	Malaysia	Singapore	Taiwan	Total of seven Asian economies
2003	-4.7	-372.4	265.5	60.6	-2.7	16.8	16.2	5.0	4.3	20.1	
2004	-5.3	-426.2	377.5	121.0	-0.1	14.9	23.8	12.9	7.7	16.7	
2005	-5.9	-506.8	581.2	179.1	7.4	11.7	19.0	6.5	8.8	21.5	
2006	-6.0	-546.2	455.4	135.5	1.6	21.2	11.6	5.9	9.3	-1.0	
2007	-5.2	474.7	745.1	258.1	6.1	55.5	7.1	9.3	12.5	-6.8	
Cumulative balance		-2,680.8	2,424.6	754.1	12.3	120.1	77.7	35.6	42.8	50.5	1,093.1

Table 4 Parameter estimates of the switching Dickey-Fuller model

	μ_0	μ_1	η_0	η_1	α_0	α_1	β_0	β_1
coefficient	0.14	-0.013	-0.027	-0.003	5.3	-1.13	1.6	0.9
t-ratio	2.0	0.9	1.84	0.8	5.3	2.3	1.5	0.9

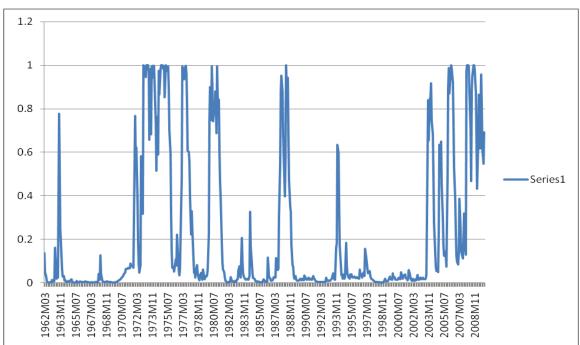*Note*: In these results the parameter ω has been restricted to 0.3.

Figure 1 : The probability of each regime