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Abstract

In the early nineties, the U.S. economy was emerging from a brief slump, monetary policy was easy, and economic activity recovered quickly during the decade, with GDP eventually reaching and then passing the consensus full employment level. Yet aggregate inflation remained surprisingly subdued. This moderation in prices at the aggregate level persuaded policy makers to allow the easy-money stance to continue in spite of the presence of inflation in non-tradables and in housing and construction in particular. This paper uses a flex-price, mixed-exchange rate model to examine some of the major contributing factors to economic developments in the two-decade period that ended in the financial meltdown and the great recession. It argues that Chinese exchange rate manipulation and China's preference for holding dollar reserves were important contributing factors. On the U.S. side, failure to understand the importance of differencial inflation patterns in tradables and non-tradables sectors, and especially failure to see inflation in housing and construction as goods rather than asset inflation, allowed monetary expansion to last much longer than it should have.

KEYWORDS: open-economy macro, mixed exchange rates, non-tradables, asset inflation

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1. Introduction

For two decades or more, the United States has operated within a dual exchange rate regime consisting of floating rates with the majority of its trading partners and a fixed rate with the Chinese yuan and a handful of other currencies. This *de facto* regime contrasts sharply with the *de jure* IMF classification of the U.S. as an independent floater.[1] This classification is an accurate description of U.S. policy and practice, because the People's Bank of China (PBoC) unilaterally manipulates movements in the bilateral exchange rate. This reality has important implications for macro adjustment and stability in the U.S. economy.

It is well-known that the effectiveness of monetary and fiscal policies depends on the nature of the exchange rate regime. But what is known about this issue has generally been explored in terms of models in which "the" exchange rate is either fixed or floating, rather than one in which both regimes exist side by side. The issue of policy efficacy in a dual-rate regime has been explored in two recent papers, the first examining the implications of China's fixing in a short-run, sticky-price Mundell-Fleming model (Arndt, 2010), and the second in a medium-run, flex-price model (Arndt, 2011).

The present discussion uses the flex-price model to explore the extent to which these exchange rate arrangements may have contributed to recent developments from the "great moderation" to the financial melt-down and the "great recession." A plausible case can be made that the dual exchange rate regime played an important role in shaping those developments, but a full explanation depends on the presence of other factors as well, including the sectoral structure of the U.S. economy, the nature of foreign competition, and policy makers' interpretations of and reactions to key economic indicators.

The paper proceeds as follows. Section 2 applies the model to the *de jure* case in which the dollar floats against both the euro and the yuan. The results provide a convenient benchmark against which to compare the dual rate regime in Section 3. Section 4 introduces and examines additional contributing factors. Section 5 concludes.

2. Fully Floating Rates Everywhere

In this flex-price version of the model there are three countries: the United States and trading partners China and the Eurozone. Capital mobility is assumed to be high between the U.S. and Europe, but low between the U.S. and China. The main features of the model are captured by equilibrium conditions for the goods

[1] See IMF (2008). See also Frankel and Wei (2007) and Levy-Yeyati and Sturzenegger (2005).

and services sector, for the money market, and for the two bilateral payments balances.

The Basic Model

The real economy (henceforth the "goods market") is described by the GG equation:

$$I(r^{exp}) + T(y, y^*, y^c, e^*, e^c) - S(y) = - G, \quad (1)$$

where real investment expenditure (I) depends negatively on the expected real interest rate $r^{exp} = i - \pi^{exp}$, defined as the difference between the nominal rate (i) and the expected inflation rate. The overall trade balance or current account (T) is related negatively to real home GDP (y) and positively to real GDP in the Eurozone (y*) and China (y^c), and positively related to the dollar's real exchange rates with the euro (e*) and yuan (e^c). The real exchange rate is defined as $e^i = E^i.P^i/P$, where E^i represents the respective bilateral nominal exchange rates, P^i the respective foreign price indexes, and P the equivalent U.S. price index.

The money market is represented by a standard liquidity-preference function (LL):

$$H/P = L(y, i), \quad (2)$$

where H is high-powered money and real money demand (L) is positively related to income and negatively to the nominal interest rate on non-monetary assets (i).

Under floating rates, the two bilateral current account balances are defined as follows:

$$T^*(y, y^*, e^*) + K^*(i, i^*) = 0 \text{ and} \quad (3)$$

$$T^c(y, y^c, e^c) + K^c(i, i^c) = 0, \quad (4)$$

where K^i represents capital flows into the U.S. which rise with i and fall with foreign interest rates.

Price flexibility is represented by a positively sloped "aggregate supply" curve,

$$P = P(y/y^f), \quad (5)$$

where y^f is the natural-rate or NAIRU level of domestic real GDP.

The last equation plays an important role in the cyclical adjustment process. When the output gap is large and/or prices are sticky, as in the short-run Mundell-Fleming model (Arndt, 2011), output responds to aggregate demand and can be increased without serious price repercussions. As the gap between actual and potential (or NAIRU) GDP shrinks, however, additional output can be obtained only at increasing cost. Hence, the trade-off between prices and output (P_y) worsens as resource utilization pushes against the limits of the economy's capacity.

Figure 1 presents a pictorial view of the *de jure* U.S. exchange rate regime of floating rates with all trading partners. It is the regime that U.S. policy makers

prefer, as evidenced by their continuing pressure on China to allow the yuan to float. Equations (1), (2), (3), and (4) are represented in the figure by curves GG, LL, B*B*, and B^cB^c, respectively. The B*B* curve has a relatively flat slope, reflecting the assumption of high capital mobility between the U.S. and the Eurozone. The steeper balance of payments function for China represents low capital mobility.

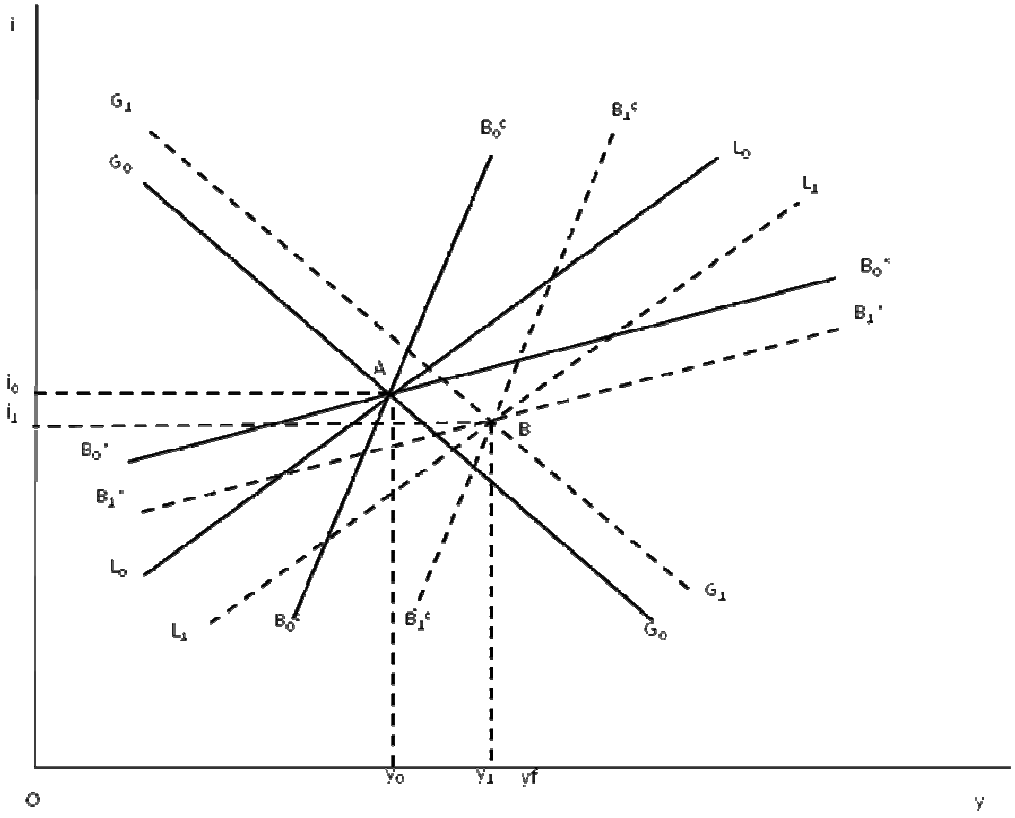

Fig. 1

A monetary expansion shifts the LL curve out in Figure 1. Restoration of "internal" balance requires a rise in income and decline in the interest rate, given at the intersection of the new L_1L_1 curve with the original G_0G_0 curve. As U.S. GDP rises, imports rise and the trade balance deteriorates with respect to both countries. As interest rates fall, capital outflows cause both financial accounts to deteriorate, causing the dollar to depreciate against both currencies. Depreciation shifts the GG, B*B*, and B^cB^c curves out and to the right, giving monetary policy the "turbo" charge celebrated in the open-economy literature.

In this model, inflation is stoked by currency depreciation and by internal cost pressures resulting from a shrinking output gap. An increase in the price

level reduces the real money supply and thus would shift the L_1L_1 curve to the left. It would also shift the G_1G_1 curve and the $B_1{*}B_1{*}$ and $B_1{}^cB_1{}^c$ curves to the left. Clearly, domestic inflation reduces the real depreciation associated with a given nominal depreciation. As inflation pushes the relevant curves inward, the effectiveness of a given monetary injection is reduced. The efficacy of monetary policy varies with the economy's position relative to full employment.

Under full floating, therefore, an easy-money policy at the beginning of the period following the short recession of the early nineties would have been very effective in raising economic activity and reducing unemployment, because the policy-induced depreciation of the dollar against all currencies, including the yuan, would have given the policy an extra boost. As the period progressed and the U.S. economy recovered, continued monetary laxity would have started to raise prices as the system approached capacity levels. Rising costs and prices in the U.S. would more and more have negated the benefits of easy-money policy itself and of nominal dollar depreciation. There would also have been some deterioration of the U.S. current account balance.

In the discussion thus far, policy makers have been assumed to target monetary aggregates. In the modern era, however, many central banks have shifted to interest-rate and inflation targeting. Such a policy regime may be represented in Figure 1 by a horizontal LL curve, with the federal funds rate pegged and thus exogenous and money supply endogenous. A monetary expansion then means reduction in the target interest rate, which shifts the LL curve down and causes output and employment to expand. As before, rising prices at high levels of employment diminish the effectiveness of the low-interest policy by reducing the real value of a given nominal quantity of money, but the resulting upward pressure on market interest rates forces the central bank to continually raise the nominal quantity of money.

It may be assumed that the presence of domestic inflation and nominal dollar depreciation would have been taken by policy makers as important signs of an overheating economy. Certainly, a central bank following a Taylor-Rule policy with an inflation target would be compelled to shift to a restrictive policy stance by virtue of both the rising inflation and the shrinking output gap. If such a central bank had nominal exchange-rate stability as an additional target, then the ongoing depreciation of the currency would have raised an additional warning flag.

3. China Fixes; the Euro Floats

The foregoing provides a scenario for the hypothetical case of a U.S. exchange rate regime that matches the IMF's *de jure* classification. In Figure 2, a suitably amended version of the model is used to examine adjustment under the

arrangements that were actually in place during the period. All previous equations continue to hold, except that equation (4) is now rewritten to take account of Chinese foreign exchange intervention.

$$T(y, y^c, e^c) + K^c(i, i^c) + R^c = 0, \qquad (4a)$$

where R^c stands for dollar reserves held by the central bank of China.

As before, a U.S. monetary expansion shifts out the L_0L_0 curve. While internal balance once again moves to the point where the new LL curve intersects the initial G_0G_0 curve, the two balances of payments are once again in deficit there. The dollar again depreciates, but only against the euro, causing the G_0G_0 and $B_0{}^*B_0{}^*$ curves to shift to the right and tending to strengthen the effectiveness of the monetary expansion. Note that the right-ward shift of the GG curve is unambiguously smaller than before, indicating that fixing the yuan reduces the

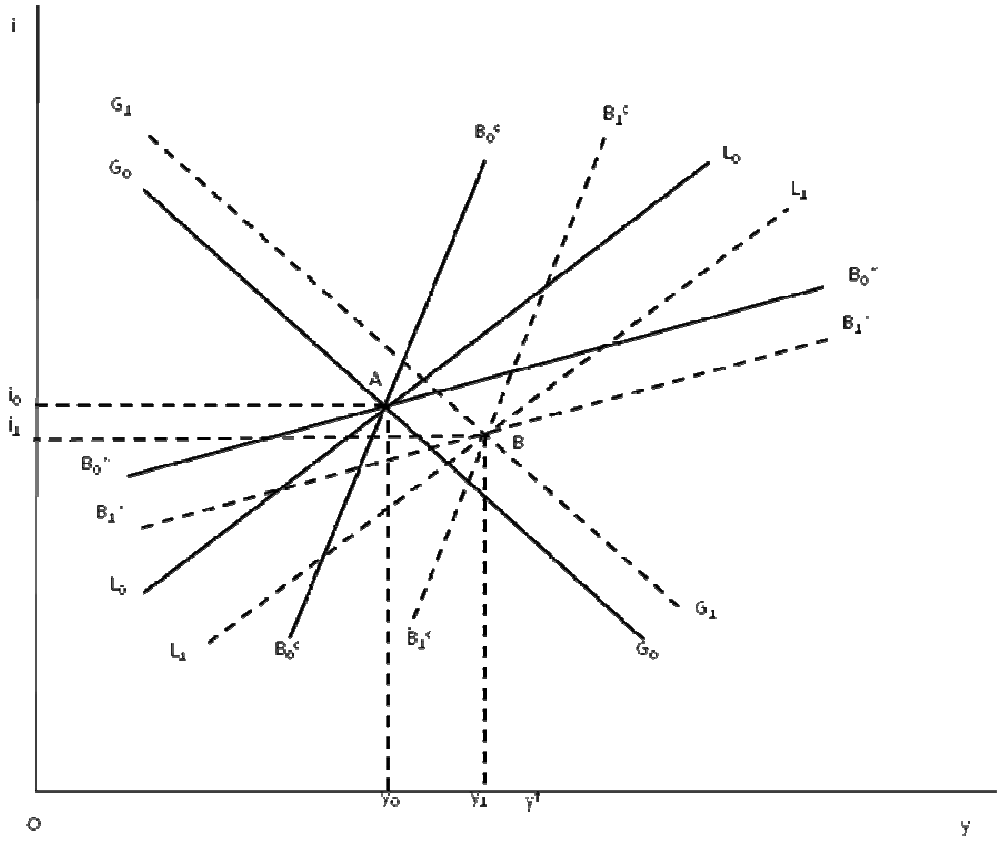

Fig. 2

efficacy of monetary stimulus relative to the case of universal floating.

With the dollar-yuan rate fixed, the bilateral current account deficit between the U.S. and the People's Republic persists and the central bank of China is obliged to intervene and mop up the excess of dollars looking for yuan. The

dashed B^cB^c curve represents *overall* equilibrium in the balance of payments with China, that is, balance in the sum of autonomous and official reserve transactions. The Chinese central bank's intervention pulls dollars out of circulation and thus has the effect of taking some liquidity back out of the system and undermining the ability of monetary policy to narrow the output gap.

That, at least, would be the case under a standard fixed-rate system in which the home central bank did the intervening. In the present case, however, the foreign central bank uses intervention dollars to purchase U.S. Treasury securities in the open market and thereby recycles lost liquidity back into the system. In other words, China's intervention prevents the fixed-rate adjustment mechanism from working properly and makes the bilateral payments deficit "permanent."[2]

Up to this point, China's recycling has helped make the Fed's stimulus stick. As before, however, price pressures will develop as the economy's expansion matures. One source of price inflation is depreciation of the dollar against the euro and the consequent rise in prices of imports from the Eurozone. Another comes from domestic cost pressures as the U.S. output gap declines. A domestic price increase shifts the LL, GG and external-balance curves left, reducing the effectiveness of the easy-money policy. Note that although the nominal dollar-yuan rate is fixed, price inflation in the U.S. causes the dollar to *appreciate* against the yuan in real terms.

4. Additional Considerations

The argument thus far suggests that Chinese exchange-rate policies made a material difference to economic developments during the period under review. Other factors, however, also played an important role.

Prices in a Globalized Economy

In the early part of the period, overall price pressures in the U.S. were astoundingly moderate. They were an important feature of what became known as the "great moderation." An important source of price moderation was the yuan-dollar peg. But even with floating rates – such as the euro-dollar rate, the extent of pass-through can be quite low, especially in the United States, where many of the country's imports are priced in dollars. Price moderation was further supported by the ability of China's large economy to supply vast quantities of a broad range of products at stable prices.

[2] The causes of global trade imbalances have been a major item on economists' and policy makers' research agendas. For samples from a fairly extensive literature, see Bernanke (2005), Obstfeld and Rogoff (2009), Borio (2011) and Andolfatto (2012).

As the U.S. expansion matured, however, the output gap fell and employment reached and then surpassed natural-rate levels. In our model, wages, other factor prices and costs generally begin to rise as actual output approaches full employment, with the rate of price increase itself rising steadily. Industries producing tradables are limited by foreign competition in their ability to pass cost increases through to higher prices. The current account deteriorates. In industries producing non-tradable goods and services, including health care, education, residential structures, commercial property and construction services, international trade is a less potent source of price moderation. One channel, however, along which trade may provide some cost moderation is through stability in prices of tradable parts and components used in the production of non-tradable goods and services.

In general, however, non-tradables firms are able to pass cost increases through to higher prices. As they seek to attract workers, capital and other productive resources in a high-employment economy, those resources can only come from the tradables sectors. This competition for factors of production spreads wage and cost inflation through the whole economy. Thus, output expansion in non-tradables comes increasingly at the expense of tradables production.

These developments – price inflation in non-tradables, a shrinking tradables sector, rising offshore sourcing and production, and a worsening current account – were not properly understood at the time. The shrinkage of jobs in U.S. manufacturing and in other tradables, for example, was blamed on unfair competition, especially by China. While this accusation was not entirely incorrect, it was too simplistic.

Stock-Flow Adjustment in Asset Markets

Two developments occurred toward the middle and end of the period, which are not typically covered in open-economy macro analysis. They were the asset price booms of the dot.com era in the middle of the period and the real estate boom of the housing bubble toward the end of the period. Rapid increases in the value of financial or real assets create capital gains, which wealth owners may decide to cash in so as to increase consumption expenditures. When they do so, governments collect capital gains taxes, which they often promptly spend on increased outlays. During the dot.com years, for example, many states ran unexpected budget surpluses and ended up committing some of these windfall gains to long-run expenditure programs such as reducing class-room size and hiring teachers.

The model represented in Figure 2, is easily adapted to include wealth effects. A wealth-driven rise in private and public expenditures shifts the GG

curve to the right, thereby adding to the expansionary forces pushing the economy forward. In the dot.com boom, wealth owners cashed in corporate shares; in the housing boom, they cashed in home equity in order to finance additional expenditures on goods and services. With wealth increasing rapidly, there was little need to "save," that is, withhold current income from current consumption. Indeed, by the end of the period, the household saving rate in the U.S. had dropped close to zero. In retrospect it would seem that these developments should have raised eyebrows among policy makers, but there would have been little in the macro policy literature to guide them.

There was a debate about whether so-called asset price bubbles should be of concern to policy makers. In thinking about this question, it is helpful to recall the familiar stock-flow distinction of economic analysis. At any point in time, there exists a stock of assets, be it corporate shares, government bonds or residential property. An increase in demand for *existing* stocks simply raises prices, increasing wealth in the manner discussed above. Over time, however, stocks are increased by new supply flowing into the system. As governments fund new expenditures by issuing debt, or corporations fund new investment by issuing equity, stocks of securities rise. In the case of residential and other types of property, construction of new houses, office buildings and factories adds to the existing real stock.

In these examples, the flow supply of financial instruments funds new expenditures of one type or another, injecting additional demand for productive resources into the system. In a high-employment economy, additions to overall demand for labor and capital cannot fail to raise wages and production costs throughout the economy. For policy makers, therefore, the trick is to distinguish the part that is pure asset inflation from the part that raises aggregate demand for productive resources. In this respect, U.S. policy makers failed rather significantly, although it must be said in fairness that there was not much to guide them in the macro policy literature.

Do Expectations Matter?

Expectations clearly played a powerful role throughout the period, but especially during the go-go years of the dot.com and housing booms. In models of the present type, expectations have received critical attention in the context of Lucas-type expectations-augmented aggregate supply curves and in covered and uncovered interest-arbitrage in foreign exchange markets. In the period in question, however, price expectations were far more complex than is typically assumed in those applications. One degree of complexity arises readily from the separation of tradable and non-tradable goods and services, which allows markets to form distinct expectations about prices in the two respective sectors. In the

period under review, a plausible mix of expectations would have been low inflation in tradables and high inflation in non-tradables. While the deflator in equation (2) would probably be some weighted average of the two prices, other decision variables might be deflated by the relevant sectoral price instead.

Consider, for example, one specific possibility in equation (1). For given expected returns on investment, the Fed's easy-money policy moves the system down along the GG curve, as we have seen. A rise in expected returns on investment shifts the curve out. A housing bubble, for instance, in which investors expect higher future prices, raises the demand for existing as well as new housing. The demand for new housing shifts GG out, adding to the overall demand boom. In general, the combination of easy credit and low interest rates, on the one hand, and expectations of rapidly rising equity values or house prices go a long way to explaining the unprecedented degree of leveraging that occurred at all levels of the economy. Of course, when the bubble collapses, and prices fall and are expected to fall further, the GG curve contracts, suggesting again that an asset-price boom can have non-trivial implications for the real economy.

5. Concluding Remarks

In the period of the "great moderation," both tradables and non-tradables prices rose, but inflation in the former was mild for the reasons discussed in the preceding sections. During the high-employment stages of the epoch, the *relative* price of non-tradables would be expected to rise in order to facilitate the inter-sectoral transfer of productive resources.

The combination of inflation in non-tradables prices, steadily worsening current account deficits, increased offshore sourcing and production, and job losses in many tradables industries was widely observed by policy makers, media, and market analysts, but the possible causal linkage to U.S. monetary policy never became a compelling consideration. The housing bubble, widely interpreted as asset inflation, was expected to deflate on its own without significant consequences for the rest of the economy.

Overall, therefore, it seems reasonable to assign some of the blame for those two momentous decades to China's exchange-rate manipulation. But it is clear, as well, that the easy-money policy lasted much too long and that U.S. policy makers made flawed judgments in their interpretation of key economic indicators.

This raises a question reminiscent of the old debate about rules vs. discretion in central bank policy making. If the Fed was following a Taylor Rule, a yellow light would have told it to slow down when actual output reached the consensus full employment level. Perhaps the reality of the great price moderation was enough to allow officials to discount the relevance of the warning signal,

which in itself raises questions about the extent to which the two right-hand-side variables in the Rule are truly independent. A second question arises over the usefulness of an aggregate inflation measure as the primary or sole indicator of overheating. In an open economy with significant links to global markets more attention might have to be paid to inflation in non-tradables and to designing better measures of economy-wide cost pressures.

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