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ON THE RENMINBI:
THE CHOICE BETWEEN ADJUSTMENT
UNDER A FIXED EXCHANGE RATE AND
ADJUSTMENT UNDER A FLEXIBLE RATE

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On the Renminbi: The Choice between Adjustment under a Fixed Exchange Rate and
Adjustment under a Flexible Rate
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ABSTRACT

Fixed and flexible exchange rates each have advantages, and a country has the right to choose the regime suited to its circumstances. Nevertheless, several arguments support the view that the de facto dollar peg may now have outlived its usefulness for China. (1) China's economy is on the overheating side of internal balance, and appreciation would help easy inflationary pressure. (2) Although foreign exchange reserves are a useful shield against currency crises, by now China's current level is fully adequate, and US treasury securities do not pay a high return. (3) It becomes increasingly difficult to sterilize the inflow over time, exacerbating inflation. (4) Although external balance could be achieved by expenditure reduction, e.g., by raising interest rates, the existence of two policy goals (external balance and internal balance) in general requires the use of two independent policy instruments (e.g., the real exchange rate and the interest rate). (5) A large economy like China can achieve adjustment in the real exchange rate via flexibility in the nominal exchange rate more easily than via price flexibility. (6) The experience of other emerging markets points toward exiting from a peg when times are good and the currency is strong, rather than waiting until times are bad and the currency is under attack. (7) From a longer-run perspective, prices of goods and services in China are low -- not just low relative to the United States (.23), but also low by the standards of a Balassa-Samuelson relationship estimated across countries (which predicts .36). In this specific sense, the yuan was undervalued by approximately 35% in 2000, and is by at least as much today. The paper finds that, typically across countries, such gaps are corrected halfway, on average, over the subsequent decade. These seven arguments for increased exchange rate flexibility need not imply a free float. China is a good counter-example to the popular "corners hypothesis" prohibition on intermediate exchange rate regimes.

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On the Renminbi:
The choice between adjustment under a fixed exchange rate
and adjustment under a flexible rate

An exchange rate that is de facto fixed has served China well over the last eight years. Nevertheless, four major reasons have been given to suggest that it may now be time to allow the yuan to appreciate.   First, calculations based on the Balassa-Samuelson relationship suggest that the real value of the renminbi is (and has for some time been) low -- not just low compared to the U.S. dollar or other rich countries, but substantially below even the equilibrium value for a country at China's stage of development.   Second, although history shows that foreign exchange reserves are a useful shield against currency crises, China's level of balance of payments surplus and reserve acquisition has by now been very high for several years, so that the country is currently giving up a lot when it buys (low-return) US treasury securities with the proceeds it raises from (high-return) inward investments.   Third, the domestic economy is in danger of overheating. While the necessary cooling off could be attempted through shrinkage of government spending, tighter domestic credit and higher interest rates rather than through a higher value of the currency – and China has started to make some appropriate efforts along these lines – a strategy that continues to exclude appreciation from the policy response mix will become increasingly difficult. The country is in the range where monetary inflows and inflation are likely to accelerate if the renminbi is not allowed to appreciate. Fourth, a country as large as China probably requires an exchange rate regime with some flexibility, and the experience of other emerging markets suggests that it is better to exit from a peg when times are good and the currency is strong, than to wait until times are bad and the currency is under attack.

This need not mean a move to pure floating. An intermediate regime such as a target zone has many attractions for the time being.   Indeed the case of China well-illustrates the limitations of the popular "corners hypothesis." [1]

The author is not necessarily endorsing recent urgings of American politicians. US trade deficits and unemployment are not substantially attributable to China's exchange rate policy.[2]   Furthermore, any country is free to choose to peg its currency if it wishes. Thus allegations of "illegal exchange rate manipulation" are probably inappropriate.   It is not even true that an appreciation of the renminbi against the dollar would have an immediately noticeable effect on the overall US trade deficit or employment (and especially not in time for the 2004 presidential election!), though the effect on the US trade balance would eventually be moderate if other Asian countries were to respond by letting their currencies appreciate against the dollar as well.   But in

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[1] Among many others urging appreciation of the renminbi are Goldstein (2003), Goldstein and Lardy (2003) and Merrill Lynch (2004), all of whom suggest an initial step appreciation followed by a move to a band around a basket.

[2] The recent US position on the Chinese yuan has a precedent 15 years earlier when US policy urged appreciation and liberalization of the Korean won: Frankel (1993). And before that, the Japanese yen: Frankel (1984).

any case, the first order of business for China should be to determine what policy is in its own interest.

This is not to say that surplus countries have no obligations under the international monetary system[3], nor that no country can ever be asked to take into account the interests of others, as part of a reciprocal system that has gains for all. But in the author's view it is not appropriate to use the language of WTO violations for the question of balancing the pros and cons of fixed exchange rates, which is inherently much less clear-cut than the question of balancing the pros and cons of free trade.[4]

It should be conceded from the outset that a regime of fixed exchange rates has a number of advantages.[5] Probably two advantages of fixing the exchange rate in terms of a particular major currency like the dollar are most important. First is the provision of a nominal anchor to prevent inflationary monetary policies and expectations thereof. But there are other possible alternate candidates for nominal anchor, including nominal GDP, the CPI, and an export price index.[6] Second is the facilitation of trade with those countries that use the dollar, or at least are pegged to the dollar.[7] Other advantages of fixed rates include facilitating financial integration, forestalling competitive appreciation or depreciation, and preventing the sort of speculative bubbles that seem occasionally to afflict floating exchange rates. There is of course a corresponding list of advantages of floating rates.

The paper presents the arguments for exchange rate flexibility in a general context. The freedom to depreciate when the balance of payments is in deficit, or output has fallen below potential, is as important as the freedom to appreciate in the opposite circumstances. But we emphasize the specifics of China's current macroeconomic situation, particularly the features of payments surplus and rapid growth. In the latter part of the paper, we consider the long-run implications of the Balassa-Samuelson effect, offering some simple calculations that shouldn't be novel, but apparently are.

The Need For Two Policy Instruments: Exchange Rate As Well As Spending

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[3] Goldstein (2004) argues that there is an obligation not to manipulate the currency to frustrate adjustment, and that a fixed exchange rate is not proof against such charges.

[4] Frankel (2004) is a more comprehensive survey of the pros and cons of exchange rate regimes among emerging market countries.

[5] McKinnon has long argued the advantages of dollar links for Asian countries; e.g., McKinnon and Schnabl (2003).

[6] Of these three candidates for nominal anchor, inflation targeting, by which is usually meant the CPI, has caught on internationally; and the others have not. Setting a target for the CPI suffers the disadvantage that in the event of an increase in the world market price of imported commodities such as oil, the rule says to tighten monetary policy enough to appreciate the currency (so as to leave the price of imports unchanged in local currency), whereas precisely the opposite response is called for in response to such an adverse shift in the terms of trade. The two old favorite candidates for nominal anchor, price of gold and money supply, have been largely discredited

[7] Since Rose (2000), we have come to realize that the empirical effect of a fixed exchange rate on the quantity of trade is stronger than had been previously thought, at least in the case of a common currency. Clark, Tamirisa, and Wei (2004) find little effect of variability versus a regular fixed exchange rate.

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It is sometimes pointed out that changes in exchange rates are not necessary or sufficient to adjust the trade balance. This proposition is true, so far as it goes, but is much less helpful than at first appears. It is true that other policies, especially those that affect the level of spending, are important. A trade deficit can indeed be viewed as an excess of spending over income, and a trade surplus as the reverse. Thus changes in spending affect the trade balance. But this does not mean that changes in the exchange rate are not important too. We will see that, because any country has other goals in addition to trade balance adjustment, the real exchange rate does have an important role to play. That will mean giving the nominal exchange rate a role to play as well, for a majority of countries – especially countries as large as China.

The claim that the exchange rate is unimportant for adjustment can arise from two – mutually inconsistent – views of trade. One polar view is that trade elasticities, which describe the response of exports and imports to relative prices, are extremely low, and so of little help in adjustment. The other extreme view is that the trade elasticities are extremely high – so high that firms are forced to adjust all prices instantaneously in response to fluctuations in the exchange rate or else face the loss of all their customers. Reality, as so often, lies in between these two extremes. The price level adjusts partially to changes in the exchange rate, especially in the short run. This paper will proceed on that assumption. A simple and standard model focuses on the distinction between goods that are internationally traded and those that are not. It is assumed that the short-run adjustment of prices to exchange rate changes is complete within the traded good sector, so that variability in the real exchange rate arises entirely from the nontraded goods sector. But all the points I wish to make in this paper could as easily be made with other models, so long as elasticities are greater than zero but less than infinite and the price level in the short run adjusts only partially to changes in the exchange rate.

The more general point is the classic framework of targets and instruments.[8] Assume that the People's Bank of China has at its disposal two policy instruments: the exchange rate, and the interest rate. The interest rate is used as shorthand here for all of monetary policy including domestic credit, reserve requirements placed on banks, etc., and indeed for other policies that affect the level of domestic spending. Figure 1 shows the two instruments on the two axes. If we were only interested in one policy goal or target, then life would be simple. Consider as the first target the trade balance, as a criterion for external balance. For simplicity, let us say the target for the trade balance is zero. In fact, it may be appropriate for a rapidly growing country with a low capital/labor ratio and a high return to investment to run a trade deficit and finance it by borrowing from abroad. But whether the target level is zero or some other number does not matter for the analysis.
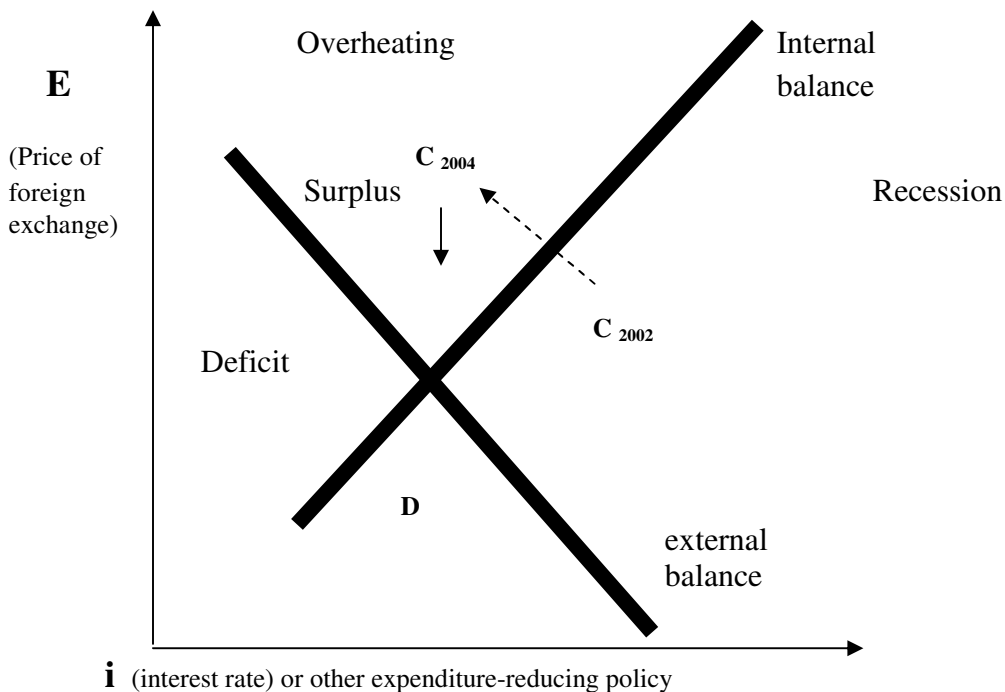
Trade balance equilibrium schedule

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[8] The targets and instruments framework goes back to Tinbergen, Meade and Mundell (1968). Our version will be based on the diagram of Swan (1963). See Krugman (1987) for a cogent and still-relevant application to the question of how the US should adjust to its current account deficits.

There are different combinations of the real exchange rate and the real interest rate that are consistent with a zero trade balance, and they are represented by the downward-sloping TB line in Figure 1.   (We are defining the nominal and real exchange rates as the domestic price of foreign currency or goods, respectively; so an increase is a depreciation.)   To see that the line slopes down, consider a deficit country at point *D*, e.g., Asian crises victims Thailand or Korea in 1997 (or the U.S. today!) At point *D*, the country can eliminate the trade deficit either by real appreciation -- a movement upward -- or by expenditure reduction, a movement rightward.

Imagine now that the country finds itself with too large a trade surplus.   Then it is located above or to the right of the TB schedule, at a point like *C*. It can get back to equilibrium either by lowering the real exchange rate or by lowering the interest rate. Lowering the interest rate would operate by stimulating domestic spending, some of which would spill abroad as increased imports (or as increased consumption of goods that might otherwise be exported), thereby reducing the trade balance.   Lowering the real exchange rate could, in turn, be achieved either by appreciating the currency or allowing prices to rise; either way, domestic goods lose competitiveness on world markets and the goal of reducing the trade balance is again achieved.   Thus the authorities can either lower the interest rate or lower E; the more of one, the less of the other. An inverse tradeoff between *i* and *E* characterizes the combination of points that give equilibrium in the trade balance.   That is the external balance relationship

Figure 1. *Attaining Internal and External Balance*

E

(Price of foreign exchange)

Overheating

Internal balance

C 2004

Surplus

Recession

C 2002

Deficit

D

external balance

i (interest rate) or other expenditure-reducing policy

Which way of achieving a change in the real exchange rate is to be preferred, a reduction in the nominal exchange rate or an increase in the price level? The choice between flexible and fixed exchange rates depends on a number of further factors, which vary from case to case. Many of these criteria fall within the general title of Optimum Currency Area theory. A very small, very open, economy -- such as Hong Kong [S.A.R.] -- will find it relatively more costly to give up an exchange rate peg, and would find it easier to let the price level adjust instead. China is a large country with a large internal market, indicating that adjustment via the exchange rate is relatively more attractive.[9]

If the trade balance were the sole objective, then perhaps there would be no need to adjust the real exchange rate. The nominal exchange rate could be fixed – with all the advantages that entails. There would also no be need to undergo changes in the price level either. Adjustment could take place in the level of expenditure, rather than through expenditure-switching. In terms of central bank instruments, monetary policy could do all the work.

Internal balance schedule

The big problem with the attitude that one needs only a single kind of policy instrument, such as those instruments that work through the level of spending, is that the trade balance is not the sole objective. Governments should and do have other macroeconomic objectives. We consider now internal balance. Because the country has more than one policy objective, it will need more than one category of policy instrument to achieve them. The interest rate alone is not enough. (Subsequently we will turn to a third objective: the capital account or overall balance of payments.)

The target for internal balance can be defined as output equal to potential output, or as employment equal to the natural rate of employment, or as an absence of inflationary or deflationary pressures. Let us say that the country in question finds itself with output above potential , $Y > \bar{Y}$, i.e., there is excess demand for goods. As a result the economy is overheating. To cool off the economy, the government can either raise interest rates or undergo a real appreciation. In terms of Figure 1, we are talking about an economy that finds itself to the left of the upward-sloping $Y = \bar{Y}$ line; it can get back to internal balance either by moving to the right in Figure 1, or by moving down. Not long ago, in 2002, it was possible to argue that China was to the *right* of the $Y = \bar{Y}$ curve, in the zone of Excess Supply of Goods. At that point, some easing of monetary policy was called for, to increase spending and restore internal balance. By 2004, however, China had clearly moved to the other side of the line, to a point like C_{2004}. As a result, some combination of an increase in interest rates or a real appreciation is called for.

There is only one point on the graph that achieves the desired settings for both objectives, and that is where the two lines intersect. The key lesson is that, in general,

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[9] The emphasis on the share of traded goods in the economy as an optimum currency area criterion dates from McKinnon (1963). The term "optimum currency area" itself dates from Mundell (1961), who focused on a high level of cross-border labor mobility as his criterion for giving up a monetary independence.

one must use two sorts of policies -- expenditure-reduction and expenditure-switching, as represented by the two axes -- to attain both goals simultaneously. China's economy has recently occupied the upper quadrant of the graph: a combination of trade surplus and excess demand. Without more precise information it is not possible to know what direction of movement in the interest rate is entailed by the optimal combination of adjustment in the two instruments.   It depends exactly where in that quadrant China lies. But it is possible to know what direction of movement is called for in the real exchange rate: downward, i.e., real appreciation. (Below we will consider another argument why a move to equilibrium for China today would imply real appreciation: the Balassa-Samuelson effect.)

Some real appreciation took place in the 1990s, in the form of inflation, and that may now be starting to happen again.   But it is probably not desirable that the real appreciation take this form. Inflation is not good.   Especially if one of the leading arguments for a fixed exchange rate is as an anti-inflationary anchor for monetary policy, the argument for abandoning the peg is reinforced if economic circumstances imply high inflation even under a peg. Those circumstances in China today are increases in the international reserve component of the monetary base as opposed to the net domestic asset component.   Such increases are helping drive up inflation.   Hence the argument for nominal appreciation instead.

Target for the overall balance of payments

The Government of China announced that the trade surplus had disappeared in the first quarter of 2004.   Perhaps the trade surplus will soon return. Or perhaps the goal for a rapidly growing country like China is a trade deficit, financed by borrowing from abroad. The phasing in of WTO commitments is likely to explain some deficit in goods and services.   Or perhaps some American representatives would dispute the statistic, or would emphasize the bilateral deficit (although the only case for the latter emphasis would be political, not economic).   Let us set any such arguments aside, and assume for the moment that the trade balance is where it should be.   There is still the question of the overall balance of payments, the sum of the current account and the private capital account.

The statistics show that the foreign exchange reserves held by the People's Bank of China continue to increase.   This says that China is running a surplus on its overall balance of payments.   If it is true that the current account balance is small or zero, the surplus must currently be taking the form of capital inflows.   Although portfolio capital inflows are still heavily restricted by the government of China, they are nevertheless finding their way in through one route or another; and in any case inward Foreign Direct Investment is large.   Which measure of external balance is the right one?   One cannot definitively assert that it is correct to have an objective for the current account but not for the overall balance of payments, or vice versa.   Both measures are of interest to policymakers.
Why does the balance of payments matter?   One disadvantage of a balance of payments deficit, for any country, is that the central bank is running down its reserves. If

this process continues indefinitely, it will eventually have to adjust course. Under conditions of open capital markets, if reserves reach a critical level (which need not be as low as zero), a sudden speculative attack could force the adjustment to take place rapidly, and under unpleasant conditions.[10] In the East Asian crisis of 1997-98, for example, the economies that had run down their reserves suffered sharp crises (Thailand, Korea, etc.), while the economies with high levels of reserve holdings were the ones able to ride out the storm (China, Hong Kong SAR, and Taiwan Province of China).

One disadvantage of a balance of payments *surplus*, on the other hand, is that the reserves, which are typically held in the form of US Treasury bills and bonds and other dollar securities, pay a low rate of return. Interest rates on US treasury bills are low because the market is so liquid and because default is assumed to be very unlikely -- and also, during the period 2001-2004, because the Federal Reserve has held short-term interest rates well below normal historical levels. The Chinese authorities have evidently already diversified out of Treasury bills, into agency bonds and other longer term securities, which will probably help the yield somewhat. But it is more likely than not that the dollar will depreciate over the next ten years (not necessarily in the short run), in light of the large US trade deficit, which would reduce even further the return to holding dollar securities. (Diversification into the euro or other currencies has evidently not yet gone far.) Meanwhile, China is presumably paying to foreign investors on their inward investment a higher return than it is earning, which means that the arrangement is a losing deal for the country in the aggregate.

The author's feeling is that China has not been irrational -- in light of the observed volatility of the preceding decade -- to want to accumulate reserves. Thus one can rationalize a balance of payments surplus above and beyond the trade surplus (though I would guess that exports and employment are the more important motivations in the minds of Chinese policy-makers when they intervene to maintain the de facto peg[11]). In any case, by now the level of reserves is so high that further accumulation would seem to accomplish very little by way of increased security.   So I will assume in the analysis that the target for the overall balance of payments is now zero.

Another consideration in selecting the desired level of the overall balance of payments is the implications of reserve flows for the monetary base. If reserves are flowing in through a balance of payments surplus, that puts upward pressure on the monetary base. Conversely, if reserves are flowing out through a balance of payments deficit, that puts downward pressure on the monetary base. If the central bank wishes to makes its domestic monetary policy decisions unencumbered by changes in foreign exchange reserves, that may be a further argument for a target of zero for the balance of payments.   (We return to this issue shortly.)

Balance of payments equilibrium schedule

Regardless what numerical target is selected for the overall balance of payments, the combinations of *i* and *E* in Figure 1 that correspond to that target are, as for the trade

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[10] This is predicted by most theories of speculative attacks.   Chapter 23 of Caves, Frankel and Jones (2002) is a brief survey of crises in emerging markets.

[11] Dooley, Folkerts-Landau, and Garber (2003) surmise on these grounds that Asian central banks will happily absorb ever-more dollars indefinitely.

balance, downward sloping. We have already seen that the real exchange rate and the interest rate have the same direction of effects on the trade balance (via competitiveness and spending, respectively); so if one goes up the other must go down to maintain equilibrium. But in addition, they probably also have the same direction of effects on the capital account: an increase in interest rates attracts a capital inflow, other things equal, while an increase in the exchange rate also makes domestic assets more attractive (cheaper) to foreign residents. Again, if one goes up the other must go down, if the capital account is to remain equal to some particular number. Thus the relationship governing the overall balance of payments has the same negative slope as the relationship governing the trade balance. [One might choose to draw the *BP=0* curve more steeply than the *TB=0* curve. This is somewhat arbitrary, but is motivated by the thought that currency depreciation can sometimes engender expectations of further depreciation and/or inflation, which might work to discourage capital inflows, rather than the reverse.]

If we substitute the balance of payments objective for the trade balance objective, then we again find China today in the upper quadrant of the Figure, at a point like C. Again, an appreciation of the currency is called for.

Sterilization

We have already mentioned that a balance of payments surplus implies that the reserve component of the monetary base is increasing. Some expansion in the monetary policy may be entirely appropriate, especially in an economy with strong long-term growth. But in an economy that is in danger of overheating, the central bank may wish to sterilize the inflow, so as to prevent expansion in the overall money supply. Sterilization could be defined narrowly, as reduction in the net domestic assets of the central bank, e.g., by selling bonds, so as to keep the monetary base from rising. Or sterilization could be defined more broadly, as reduction in domestic credit of the consolidated banking system, e.g., by raising reserve requirements on banks, so as to keep M1 from rising.

Sterilization can be a good response to an inflow, for a period of time. It can help the country maintain its exchange rate target without abandoning a target for the money supply or interest rate. But it can become increasingly difficult over time, especially if traditional barriers to capital flows have been gradually eroded. One problem is that it just prolongs the balance of payments disequilibrium, because it by-passes the automatic mechanism of adjustment that reserve flows provide under the monetary approach to the balance of payments. Another potential problem is the quasi-fiscal deficit: if the central bank has to pay high interest rates to get domestic residents voluntarily to absorb "sterilization bonds," while receiving low interest rates on its reserves of US treasury securities, then it is running a deficit. Some governments are able to force their bonds down the throats of their banks without paying market interest rates, a form of financial repression; but this just weakens the balance sheets of banks and raises the odds of a banking crisis somewhere down the road. So far, the PBoC seems to have had little difficulty selling its sterilization bonds, but this could change.

Avoiding currency crises

Asian countries are understandably anxious to avoid crises such as those that afflicted much of the continent in 1997-98.   Many areas of policy are relevant for trying to minimize the probability and severity of crises.   Some decisions, such as the speed of liberalization of the capital account, are highly controversial.   Others are more widely agreed upon, such as the desirability of strong banking regulation, holding adequate reserves, and tilting the composition of capital inflows away from short-term dollar-denominated bank loans and toward Foreign Direct Investment and longer-term securities.

Although much ink has been spilled over the question of exchange rate regime, there is no clear verdict.   The late-1990s saw the development of a surprisingly wide consensus in favor of the corners hypothesis: hard pegs or pure floats, in preference over intermediate regimes. But the author has been skeptical of this view all along.   China, for one, is too large a country to dollarize or adopt a currency board, but is probably not ready for pure floating yet either.   That leaves intermediate regimes: either the current adjustable peg, on the one hand, or alternatives such as a target zone, centered either on the dollar or on a basket, on the other hand.[12]

Baskets tend to be less transparent and less credible than defining a parity in terms of a single existing currency.   Asia currently lacks a currency in use that is a suitable anchor for individual countries.   China does not yet have the necessary developed and open financial markets to make the renminbi a regional anchor currency, while Japan's yen fluctuates too much versus the dollar and euro. As a possible pathway to Asian monetary integration, I have proposed that Singapore unilaterally adopt a firm and transparent basket peg (with weights on the dollar, euro, yen and renminbi), and that other countries in the region then use the Singapore dollar as their anchor to whatever extent they wish to target their own exchange rates.[13]

Some have argued that for China to minimize the probability of crisis, it would have to avoid appreciation, so as to keep the current account as strong as possible.   It is true that overvalued currencies played a role in the East Asia crisis of 1997, even though some westerners had urged appreciation for surplus countries in the past.   It is also true that real appreciation is likely to lead to trade deficits and net borrowing from abroad, and that countries that borrow from abroad are more likely to have crises. But there is another respect in which moving to a regime of increased flexibility now might reduce the chance of future crises rather than increase it.

If and when inflow turns to outflow, as part of the cycle that so many developing countries have gone through so many times before, it is important not to cling to a peg for too long. Many countries procrastinate, postponing adjustment either through devaluation or expenditure reduction.   The crisis comes when reserves have been run down to low levels. By then the national balance sheet is so weak (lots of short-term and dollar-denominated debt) that the adjustment options are no longer attractive: the result is often a sharp recession regardless of the mix of devaluation and expenditure-reduction.[14]   The lesson is not to procrastinate.

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[12] Williamson (2000) has been a consistent defender of the intermediate regimes, even when the corners were most in fashion (which was just before the collapse of Argentina's currency board).

[13] At the end of Frankel (2004).

[14] Why can't the authorities maintain internal balance even after a "sudden stop" of capital inflows has shifted the external balance line adversely, in terms of Figure 1, by the right mix of devaluation and

There is an understandable temptation to cling to an exchange rate peg that has worked well for some years, economically and politically. Mexico in 1994 is one of many examples.   One lesson from past experience is that of the exit strategy. If an eventual exit from a peg, to a regime with greater flexibility, is likely to occur eventually anyway, it is better to do it at time when the balance of payments is strong and the initial movement is likely to be appreciation. The alternative of waiting for a time of balance of payments deficit often turns out to mean exiting the peg under strong downward speculative pressure, with the result that confidence is undermined and the national balance sheet is weak.[15]   Hence the argument for being safe, and increasing flexibility before any cut-off in capital flows.

These points are drawn largely from the experience of emerging markets such as Colombia and Korea in the early 1990s. Those countries were able to sterilize capital inflows only for a year or two, before it became too difficult, due to high interest rates on the sterilization bonds and the prolongation of strong capital inflows (as in standard macro models).   Chinese officials may be correct that their case is somewhat different, due to a financial system that is less open and less market-oriented.   The capital inflow has consisted largely of Chinese citizens bringing capital flight money back home, speculating on a revaluation, and so far the authorities have not had to pay high interest rates locally to sterilize it. But they mind it increasingly difficult to sterilize further inflows.

The foregoing logic was predicated on the assumption that China is running a substantial balance of payments surplus.   Events in the world economy are changing rapidly. The last year has been a time when low US interest rates encouraged money to flow to a wide range of assets and countries, including into emerging market debt, as reflected in very low sovereign spreads (below 400 basis points, for the first time since before the Thai crisis of 1997).   Over the coming year, the trend is likely to be sharply upward in US interest rates.   In several past episodes, Fed increases in interest rates have helped trigger "sudden stops" in lending to emerging markets, such as the 1982 international debt crisis and the 1994 Mexican peso crisis.   As this paper was written, the correction in emerging market debt had already begun, in early May, in anticipation of the increases in US interest rates that began June 30. In this light, China might want to wait to see if its balance of payments surplus persists after the actual tightening has begun, before liberalizing its system, and in particular before further removing controls on outflows.

The Balassa-Samuelson relationship

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increase in the interest rate?   The problem is that in the presence of a lot of dollar-denominated debt, devaluation is contractionary. This balance sheet effect makes the internal balance line slope down rather than up.   As a result, it may be hard to find a sensible intersection between the two lines.
[15] Eichengreen and Masson (1998).

Purchasing Power Parity (PPP) is often calculated as a guide for what the equilibrium level of the exchange rate, for China as for other countries. But the overwhelming majority are estimates of *relative* PPP, that is, based on price indices. They do not necessarily show the yuan to be strongly undervalued. But that may be because they use the past as the benchmark, and the yuan may have been undervalued in the past.

Comparisons of price levels across countries are difficult, because such *absolute* PPP data are much less available than *relative* PPP data (for which one only needs price indices and exchange rates). But some data are available. As of 1990, China's price level was reported as only .119 of the US price level, according to the Penn World Tables, Mark 5.6.[16] That prices are lower in China is not in itself a surprise. Even if we thought that markets in internationally traded goods were perfectly integrated, there is no mechanism to arbitrage disparities in prices of nontraded goods. There is abundant empirical evidence, along both the cross-section and time-series dimensions, that prices of non-traded goods, and thereby of general price levels, rise with levels of productivity, real wages and real income. This robust empirical regularity is called the Balassa-Samuelson effect, and is most often explained by the assumption that productivity growth is more rapid in traded goods than non-traded goods.[17]

Estimation for 1990

The news is that China's prices have been, not just low, but well below the level that one would predict from the country's per capita income and the cross-country empirical relationship between the real exchange rate and real income. According to the same source, China's real per capita income in 1990 was .125 of the US level. Rogoff's (1996) regression estimates that for every 1 percent increase in a country's real per capita income (in a cross-section), its real exchange rate is stronger by 0.366 per cent. Notwithstanding the relatively good fit of this univariate regression (R^2=.42) there are some substantial outliers. China is one of them, though far from the most egregious.

We have re-run the Rogoff regression for 1990 (with data from the year 2000 Penn World Table), as reported in the Econometrics Appendix. The estimate is a highly significant .317: every one percent increase in income is associated with a real appreciation of .317 percent. We confirm that China is an outlier: apparently undervalued by 42 % in logarithmic terms, or by 34% in absolute terms.[18]

Few economists would seriously recommend a revaluation over a short period of time of the yuan on the order of magnitude suggested by this interpretation of the Balassa-Samuelson equation. In the first place, a sudden revaluation of the currency of this magnitude would be disruptive. In the second place, other considerations matter in addition to the Balassa-Samuelson regression, including current monetary conditions. In

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[16] China's prices showed up as the lowest of 31 countries; the next lowest was Bangladesh at .154. Summers and Heston (1991) describe the data. See Rogoff (1996, p. 659-660).

[17] Useful references include Balassa (1964), De Gregorio, Giovannini, and Wolf (1994) and Kravis and Lipsey (1988).

[18] The word "undervaluation" or "overvaluation" has no single agreed upon definition among economists. But the renminbi seems now to qualify for most of the various possible definitions of undervalued.

the third place, one would first have to investigate the reliability of the Chinese price data. It is possible that the numbers in the Penn World Table have been extrapolated extensively from a slender base.[19]   The possibility of measurement errors in the level and growth of real GDP has also been widely discussed.   If China is indeed lagging far behind other countries in the extent to which it has allowed or encouraged the sort of detailed gathering of good price data that is necessary for international comparisons of China's absolute price level and real income, then this should be rectified.

Nevertheless, the numbers are suggestive of a disequilibrium that in the very long run may have to be corrected one way or another.   Even if the adjustment is drawn out over a long period of time, to correct the disparity with no change in the nominal exchange rate would imply substantial inflation, not desirable as a long-term trend. Thus the Balassa-Samuelson calculation seems another reason to plan on a transition to a more flexible exchange rate regime.

The yuan appreciated in real terms during the course of the 1990s. In nominal terms, the currency depreciated substantially, particularly in 1994 when the official rate was unified with the already-depreciated parallel rate, as reported in Table 1 of the Data Appendix.   In 2000 the nominal exchange rate was 8.28 (the level at which it has been pegged since 1998), as compared to an official rate of 4.78 in 1990.   But the cumulation of inflation during the 1990s has been greater than the depreciation, implying a real appreciation.[20]   China has also experienced rapid growth in real income, as reported in Data Appendix Table 1. Thus the real exchange rate predicted by the Balassa-Samuelson equation has changed. The gap between the current real exchange rate and the level predicted by Rogoff's equation appears to have been (very roughly) as big at the end of the decade as it was at the beginning.

Estimation for 2000

We can do better at updating the calculation than simple extrapolation. The Penn World Tables, Version 6.1, report absolute PPP data for 2000.   China's absolute price level in 2000 was .23, relative to the U.S., and its real income per capita was $3747.3, which was .11 relative to the US.

We have run a new regression for the year 2000 on a cross-section of 118 countries. (Details are available in the Econometrics Appendix.) The regression yields a highly significant coefficient of 0.382 on the log of relative income. In other words, every one percent increase in real per capita income is associated with 0.38 percent in real appreciation.   The price level (relative to the United States) that is predicted for China by the equation is 0.362 (derived from -1.015 in logs). China's actual price level is 0.231 relative to the US (derived from -1.464 in logs).   The residual of the log was -

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[19] As a rough check MacPPP suggests that Chinese prices are about .56 of US prices. Parsley and Wei (2004).

[20] If the base is the real exchange rate in the 1990 Penn World Tables, adding the cumulative changes in price levels and the exchange rate from 1990 to 2002 produces an estimate that China's prices are now up to .181 of US prices: He (2004).   But it makes more sense to work off of the 2000 PWT.

0.448. In other words the regression suggests that the yuan was undervalued by 44.8 %
in logarithmic terms (36.1% undervalued in absolute terms) in 2000.

To fine-tune this calculation, one must allow for whatever movement in the real
exchange rate has taken place since 2000, the year of the last Penn World Table.   The
cumulative change over the last four years turns out to have been relatively small, as
reported in Tables 2 and 4.   The nominal exchange rate is virtually unchanged vis-à-vis
the dollar, due to the peg, and the Chinese price level is evidently not far from where it
was in 2000, because deflation in 2002 offset inflation in 2000-01 (and 2003). Thus,
amazingly, that leaves as the dominant component of the change in the real exchange rate:
US inflation, which cumulated to 5 % from 2000 to 2002.   It would be foolish to rely too
much on the precision of these numbers.   On the one hand, official statistics suggest that
Chinese inflation has by now pulled ahead of US inflation (in the last quarter of 2003
and the first quarter of 2004), which would imply that the 5% has begun to reverse a bit.
On the other hand, Chinese real growth has again zoomed ahead, so the target is receding
even farther away.   The important point is that the "undervaluation" in the sense of the
Balassa-Samuelson equation has, if anything, widened since the calculation of the gap on
2000 data.

Regression toward the mean

To characterize the empirical literature on the Balassa-Samuelson effect, the
relationship between the real exchange rate and real income is fairly robust on a cross-
section basis, but is more uncertain on a time series basis, even when changes are
observed over intervals as long as ten years.   This raises the question of the predictive
power of the relationship for a given country over time. But a plausible interpretation is
readily at hand. Most economists believe that real exchange rates are influenced not
solely by the long-term trend of the Balassa-Samuelson effect nor solely by the short-
term fluctuations of monetary policy and nominal exchange rate changes, but rather are
influenced by both.[21] A reasonable characterization is that in the long run Balassa-
Samuelson factors dominate, but in the short run monetary factors can pull the real
exchange rate away from the Balassa-Samuelson equation.   This framework contains the
powerful prediction that if a country lies substantially off the Balassa-Samuelson
regression line in one year, it can be expected to return part way – not necessarily all the
way – to the regression line over the subsequent decade.   This claim has important
implications for our ability to make predictions, and furthermore is testable with data
from the last decade.

We have tested whether residuals from the 1990 regression have explanatory
power for the year 2000.   On a cross-section (of countries with data available for both
years), we regressed the 2000 real exchange rate against the fitted values from the 2000
regression (which is also equivalent to regressing them against 2000 income levels, as

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[21] One does not necessarily need prices of non-traded goods to be sticky – let alone prices
of traded goods – to get the result that devaluations or changes in monetary policy can
have transitory effects on the real exchange rate in the short run.   Dornbusch (1973).

before) *together with the residuals from the 1990 regression.* The results are also reported in the Econometrics Appendix. The coefficient on the predictions from 2000 incomes is .98, insignificantly different from 1, as expected. The coefficient on the 1990 residual is .48, which is not only highly significantly greater than zero, but is also highly significantly less than 1. This provides confirmation for the theory, and also provides the useful prediction that, in expected value terms, approximately half of any deviation from the Balassa-Samuelson regression line is corrected over the subsequent decade. For the case of China, it says that even if the big differential in productivity growth between China and its trading partners were to disappear tomorrow, Balassa-Samuelson factors nonetheless would predict that by 2010 the yuan would undergo an expected real appreciation of about half of the year-2000 gap, which is half of 44.8 percent, or 22.4%.

A real appreciation toward long-run equilibrium could be accomplished with no change in exchange rate regime, by an inflation rate of 2.24% per year in excess of the US level, which is not especially large compared to recent swings in China's inflation rate. Nevertheless, the theory predicts that more movement in the same direction would have to continue over the subsequent decade, and, more importantly for present purposes, that an allowance for Chinese growth to continue on the order of 6 % greater than US growth would require adding another 2.3 % of real appreciation per year (.38 times the relative growth rate). Adding together the correction of the past undervaluation and the continued trend gives a real appreciation in excess of 4% per year. A 4% differential above the US inflation rate seems too high to be desirable as a long-term inflationary bias. Again, the implication is that the yuan would have to appreciate in coming years.

This idea of gradual "regression toward the regression line" bridges the gap between the first half of this paper and the second half. The Balassa-Samuelson calculation suggests real appreciation on the order of 4% a year averaged over the next decade or more, better achieved through nominal appreciation than through inflation. The targets and instruments framework of the first half of the paper suggests that appreciation is needed to curtail excessive build-up of reserves through the current balance of payments, and the dangers of excessive monetary expansion, overheating, and inflation. Perhaps past devaluations (or deflation, as recently as 2002) help explain how the yuan got so far off the equilibrium line in the first place. At least as important is that China's rapid productivity growth and increased trade integration mean that levels of the nominal exchange rate that might have been consistent with long-run equilibrium in the past have now become undervalued. In terms of Figure 1, the external and internal balance lines have been shifting down, so that a decline in the real exchange rate (i.e., real appreciation) is necessary just to keep up with the point of intersection. This could explain how China finds itself at a point like C in Figure 1, despite having already undergone some real appreciation in the 1990s. Either way, if this gap is real, better to address it through appreciation than inflation.

* *

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Data Appendix
Real exchange rate and real income for China, 1990-2000

Nominal Ex Rate Nominal		Exchange rate in RMB /$
P (US=1)		Price Level of Gross Domestic Product relative to US
Real GDP/capita ($ chain)		Real GDP per capita (Constant price: Chain series)

Table 1 -Real exchange rate and Real Income for China, 1990-2000

year	Nominal ExRate	p	Real GDP/Capita	US Real GDP/Capita	Real GDP/Capita rel. to the US
1990	4.7832	0.2351	1786.5474	26457.82	0.0675
1991	5.3234	0.2112	1975.3807	25897.92	0.0763
1992	5.5146	0.2154	2202.6613	26488.70	0.0832
1993	5.7620	0.2380	2455.4704	26956.07	0.0911
1994	8.6187	0.1925	2644.9477	27877.94	0.0949
1995	8.3514	0.2282	2818.1204	28408.86	0.0992
1996	8.3142	0.2433	2968.5394	29193.91	0.1017
1997	8.2898	0.2454	3109.6103	30190.34	0.1030
1998	8.2790	0.2396	3275.9917	31090.66	0.1054
1999	8.2782	0.2351	3414.9809	32127.90	0.1063
2000	8.2785	0.2314	3747.2977	33292.99	0.1126
averg.	7.2539	0.2287	2763.5953	28907.6	0.0946

1 Data Source: Alan Heston, Robert Summers and Bettina Aten, Penn World Table Version 6.1

Table 2 - Real Exchange Rates for China, 2001-2003

	USA			China				Change in LogRER rel 2000	RER
	Inflation	Pu		Inflation	Pc		NomEx		
2001	2.8	119.458		0.5	128.18		8.277	0.050	0.243
2002	1.6	121.353		-0.8	127.20		8.277	0.027	0.238
2003	1.2	122.809		1.2	128.73		8.277	0.027	0.238

[1] Data Source: IMF – International Financial Statistics, Country Tables: http://imfstatistics.org/

Table 3 – Chinese Real Exchange Rates - Log Form, 1990-2000

year		Log RER		Log GDP		Log relative real GDP
1990		-1.4477		7.4880		-2.6953
1991		-1.5547		7.5885		-2.5734
1992		-1.5354		7.6974		-2.4871
1993		-1.4354		7.8061		-2.3959
1994		-1.6475		7.8804		-2.3552
1995		-1.4774		7.9438		-2.3106
1996		-1.4134		7.9958		-2.2859
1997		-1.4051		8.0423		-2.2730
1998		-1.4290		8.0944		-2.2503
1999		-1.4478		8.1359		-2.2416
2000		-1.4637		8.2288		-2.1843
average		-1.4779		7.9001		-2.3684

1 Data Source: Alan Heston, Robert Summers and Bettina Aten, Penn World Table Version 6.1

Table 4 - Real Exchange Rates for China-Log Form, 2001-2003

	USA			China			Log (NomEx)	Change in LogRER rel 2000	Log RER
	LogPu			LogPc					
2001	4.783			4.853			2.113	0.050	-1.413
2002	4.799			4.846			2.114	0.027	-1.437
2003	4.811			4.858			2.113	0.027	-1.437

[1] Data Source: IMF – International Financial Statistics, Country Tables: http://imfstatistics.org/

Econometric Appendix:
Estimates of Balassa-Samuelson Effect

Cross-Country Regression for Year 2000

Data Definitions:

RER – Real Exchange Rate is obtained by dividing *Price Level of Gross Domestic Product* for each country by that of the US (normalised to 100).
LogRER – Log of Real Exchange Rate
rgdpch – Real GDP per capita (Constant price: Chain series)
Loginc – Log of real GDP per capita

Data source: Alan Heston, Robert Summers and Bettina Aten, Penn World Table Version 6.1, Centre for International Comparisons at the University of Pennsylvania (CICUP), October 2002.

The regression logRER vs. loginc was run for 118 countries, based on their year 2000 data for RER and Real GDP per capita.   It yields:
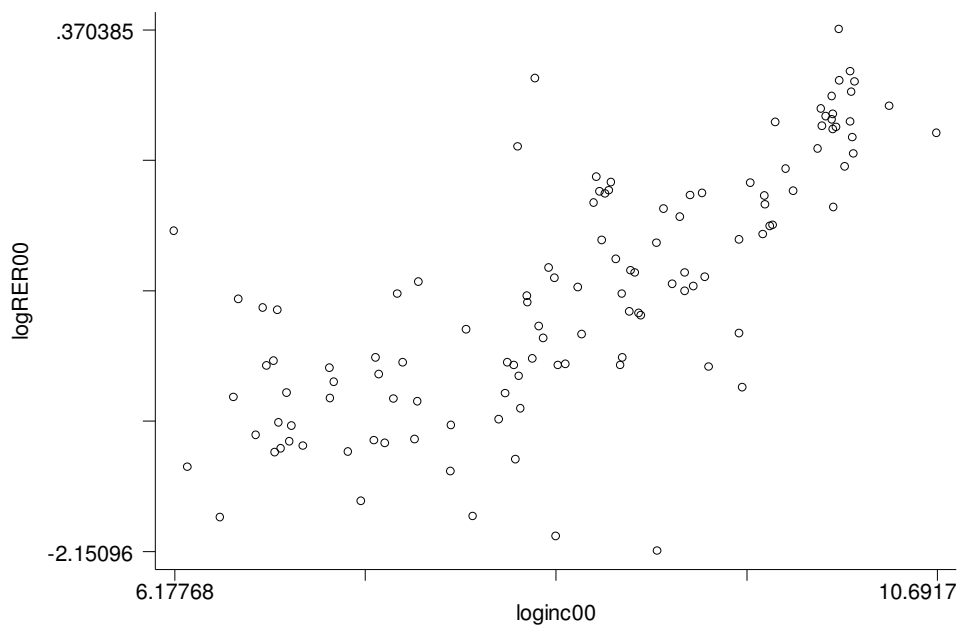
$$\log \text{RER} = -4.15 \ + \ 0.382 \ \text{loginc}$$

The coefficient on loginc is statistically significant.

```
. reg logRER00 loginc00

Number of obs =      118
F(  1,   116) =  151.14              Prob > F      =  0.0000
R-squared     =  0.5658              Adj R-squared =  0.5620
Root MSE      =  .393
------------------------------------------------------------------------
    logRER00 |     Coef.   Std. Err.      t
-------------+----------------------------------------------------------
    loginc00 |  .3820538   .0310764    12.29
       _cons |  -4.159057   .2686416   -15.48
------------------------------------------------------------------------
```

The residual for each country was calculated.
Particularly interesting is the residual for China (-0.448)

```
. predict loginchat00, residual
```
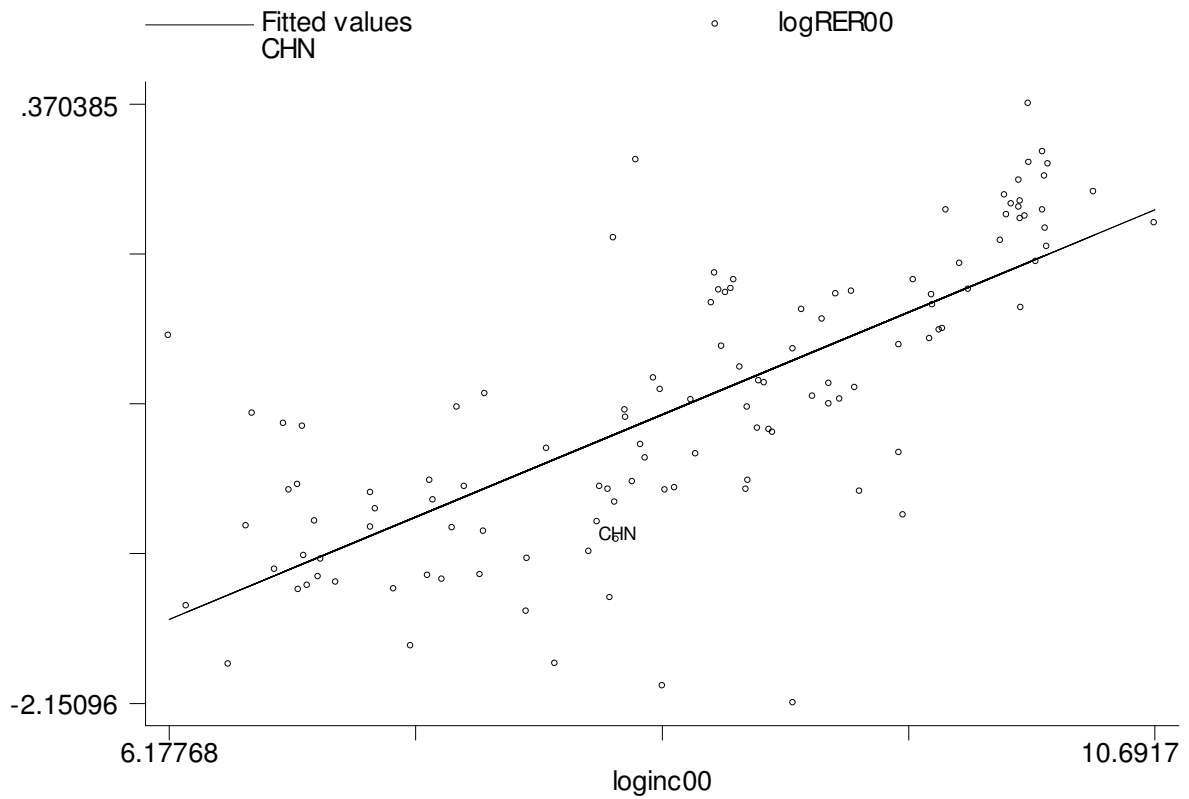
```
di logRERhat[18]    =    −1.0152169
```

```
di logRER00[18]−logRERhat[18]    =    −.4484849
```

This means that

$$\log RER00 - \log RERhat = -0.448$$

$$(\frac{RER00}{RERhat}) = 0.639$$

or in other words, the real exchange rate is 64% of the value predicted by the regression.

Cross-Country Regression for Year 1990

The regression logRER vs. loginc was repeated for the same for 118 countries, based on their year 1990 data for RER and Real GDP per capita.
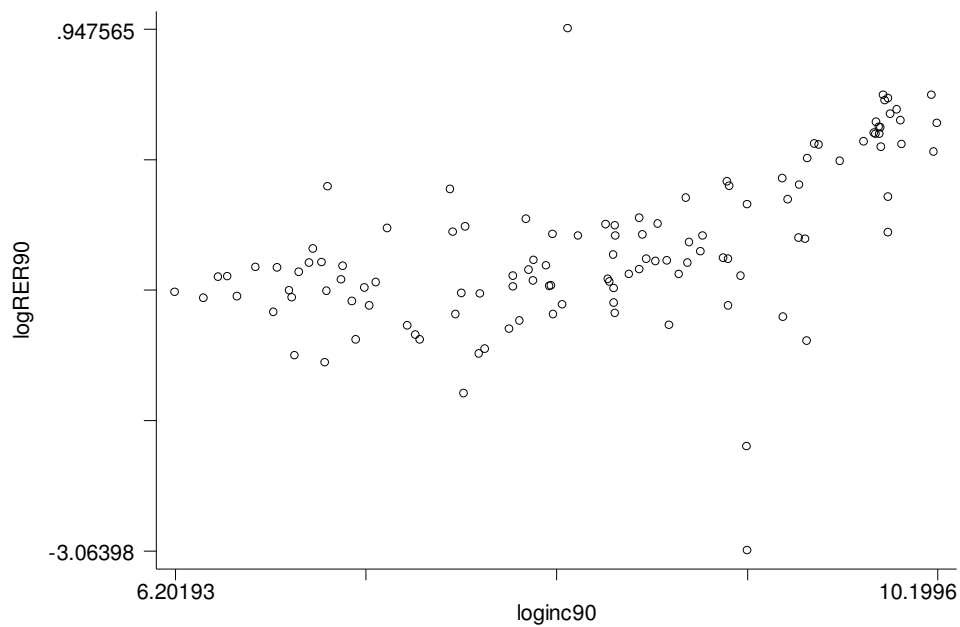
The regression yields: $\log \text{RER} = -3.40 + 0.317 \log\text{inc}$

The coefficient on loginc is again statistically significant.

```
. reg logRER90 loginc90

Number of obs =      118
F( 1,   116) =   55.33          Prob > F      =  0.0000
R-squared    =  0.3230          Adj R-squared =  0.3171
Root MSE     =  .50591

------------------------------------------------------------------------
    logRER90 |     Coef.    Std. Err.      t
-------------+----------------------------------------------------------
    loginc90 |   .3169071   .0426029      7.44
       _cons |  -3.398784   .3621096     -9.39
------------------------------------------------------------------------
```

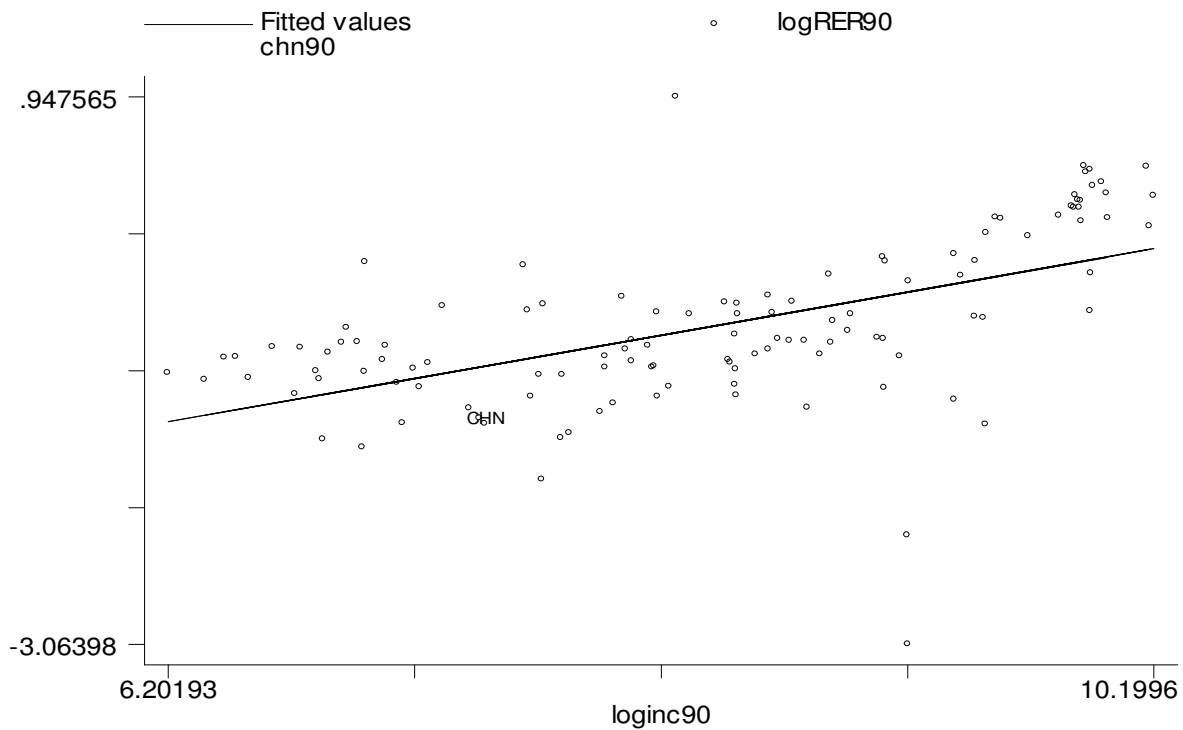Again, the residual for each country was calculated and this value for **China is (-.422)**

. di ehat90[18]   =   **−.42194867**   Thus

$$\log RER00 - \log RERhat = -0.422$$

$$(\frac{RER00}{RERhat}) = 0.656$$

or in other words, the real exchange rate is 66% of its predicted value by the regression, very close to the value found for the 2000 data.

Exchange Rate Deviations for China

	Price level relative to US = 1/RER (in logs)	Predicted Price level by the B-S regression (in logs)	estimated real "undervaluation" (% in logarithmic terms)	implied fall in RER needed for B-S equil. (% in absolute terms)
1990	-1.448	-1.026	42.2%	34%
2000	-1.464	-1.015	44.8%	36%

Predictive power of deviations from the 1990 regression

To examine whether the deviations from the regression in 1990 have predictive power, we run a regression of logRER in 2000 vs. two variables: a) deviations from the 1990 regression and b) the fitted values of the 2000.

```
. reg logRER00 ehat90 logRERhat

Number of obs =     118
F( 2,   115) = 153.50          Prob > F      =  0.0000
R-squared    = 0.7275          Adj R-squared =  0.7227
Root MSE     = .31276

------------------------------------------------------------------------------
    logRER00 |     Coef.   Std. Err.      t     P>|t|    [95% Conf. Interval]
-------------+----------------------------------------------------------------
      ehat90 |   .4744686   .0574358     8.26   0.000     .3606993    .5882379
   logRERhat |   .9811399    .064758    15.15   0.000     .8528668    1.109413
       _cons |   -.016719    .064222    -0.26   0.795    -.1439305    .1104924
------------------------------------------------------------------------------
```