The US-China Trade Imbalance: Will Revaluing the RMB Help (Much)?

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Abstract: The large US-China trade imbalance is a common cause for concern and regularly blamed on the undervaluation of the RMB. We estimate a simple model of the trade balance and simulate the long-run effects on the trade balance of RMB revaluations in the range of 10-50%. We find that improvements in the trade balance following plausible revaluations are likely to be modest.

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1. Introduction

Bilateral trade flows between China and the US have expanded considerably over the past two decades but the increasingly unbalanced nature of this trade has caused considerable concern in American political circles. It has been widely argued that the imbalance is largely the result of the supposed undervaluation of the renminbi (RMB) which has been effectively pegged against the US dollar, giving Chinese manufacturers an "unfair advantage". [1]

The aim of this paper is not to resolve the question of whether the Chinese RMB is indeed misaligned, nor if it is, to evaluate the extent of such misalignment, nor even to consider whether bilateral trade deficits are a legitimate matter for concern. Rather, we take others' estimates of the undervaluation and assess the likely impact on the Chins-US trade balance of the re-alignment of the RMB US dollar exchange rate. We argue that this is an interesting exercise both as a contribution to the debate about how serious the supposed misalignment is and also in light of the likely future movement of China to a more market-oriented exchange rate which should see any undervaluation disappear. We find that even large changes in the real exchange rate are likely to have modest effects on the trade deficit.

2. The model

The model we estimate is a reduced-form equation for the trade balance between China and the US derived from a simple two-country model of trade based on work of Rose and Yellen (1989). The fact that both countries have important trading relationship with third countries is likely to introduce important specification bias into the empirical model

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[1] For its part, the US has long alleged that the RMB is undervalued by as much as 40%; see for example Testimony of Franklin J. Vargo before the House Committee on International Relations, United States Congress (2003). It is reported that China's foreign exchange reserve topped $853.7 billion US at the end of February 2006; see People's Daily Online (2006).

based on only two countries and we therefore extend the two-country model to account for the possible importance of a third country (the "rest of the world").

Denoting demands for imports by country i from country j by D_{ij}, supply of exports by country i to country j by S_{ij}, corresponding import prices relative to domestic prices by m_{ij}, export prices relative to domestic prices by x_{ij}, and real exchange rates by q_{ij} where, in each case, $i, j = u, c, w$ (denoting the US, China and the rest of the world), we can write the three-country version of the Rose and Yellen (1989) model as:

(1) $D_{uc} = D_{uc}(m_{uc}, m_{uw}, Y_u) = D_{uc}(q_{uc}.x_{cu}, q_{uw}.x_{wu}, Y_u)$

(2) $D_{uw} = D_{uw}(m_{uc}, m_{uw}, Y_u) = D_{uw}(q_{uc}.x_{cu}, q_{uw}.x_{wu}, Y_u)$

(3) $D_{cu} = D_{cu}(m_{cu}, m_{cw}, Y_c) = D_{cu}(x_{uc}/q_{uc}, q_{cw}.x_{wc}, Y_c)$

(4) $D_{cw} = D_{cw}(m_{cu}, m_{cw}, Y_c) = D_{cw}(x_{uc}/q_{uc}, q_{cw}.x_{wc}, Y_c)$

(5) $S_{uc} = S_{uc}(x_{uc}, x_{uw})$

(6) $S_{uw} = S_{uw}(x_{uc}, x_{uw})$

(7) $S_{cu} = S_{cu}(x_{cu}, x_{cw})$

(8) $S_{cw} = S_{cw}(x_{cu}, x_{cw})$

(9) $D_{ij} = S_{ji}, \quad i,j=c,u,w \ (i \neq j)$

In each case the second equality in (1) to (4) follows from:

$$m_{ij} = q_{ij}.x_{ji} \text{ and } q_{ij} = 1/q_{ji}.$$

The model consists of 12 equations which allow us to solve for the D_{ij}, the S_{ij} and the x_{ij} in terms of the q_{ij} and Y_u and Y_c. The US-China trade balance is defined as the ratio of US exports to imports which has the advantages that the measure is unit-free and that its magnitude is independent of scale effects (Brada *et al.,* 1993).

Thus, the equation of interest is:

(10) $TB_{uc} = TB_{uc}(\overset{+}{q_{uc}}, \overset{+}{q_{uw}}, \overset{-}{q_{cw}}, \overset{-}{Y_u}, \overset{+}{Y_c})$

where the indicated signs follow from standard restrictions on the demand and supply functions (1) to (8). Log-linearising and adding a random error term, we obtain the following estimating model:

(11) $lnTB_{uct} = \alpha_1 + \alpha_2 (lnY_{ut}) + \alpha_3 \, ln(Y_{ct}) + \alpha_4 \, ln(q_{uct}) + \alpha_5 \, ln(q_{uwt}) + \alpha_6 \, ln(q_{cwt}) + \varepsilon_t$

3. The data

Quarterly data were used for the period to 1987(1) to 2003(4). Quarterly observations, seasonally adjusted where relevant, for all variables except Y_c and q_{uc} were obtained from the IMF's *International Financial Statistics* and *Direction of Trade Statistics*. Quarterly real GDP data for China are not available until 1999(1) so that annual data were interpolated using the regression approach.[2] The real exchange rate was based on annual Chinese CPI data interpolated using a moving average approach. The real exchange rates for the US and China with respect to the rest of the world were measured by real effective exchange rate indexes for each country. Finally, data for bilateral trade between the China and the US are problematic.[3] There are major discrepancies between trade flows reported by China and by the US but the consensus is that US figures are more reliable that the Chinese ones and we therefore used the US-derived figures for the trade balance.

4. The results

4.1 Estimated trade-balance equations

Following Shirvani and Wilbratte (1977), we begin by estimating equation (11) using OLS. The resulting estimates are shown in Table 1. A trend is included to allow direct comparison to estimates based on cointegration analysis reported below.

[Table 1 near here]

All variables have their predicted signs and, with the exception of q_{cw} and Y_c, they are significant at 1%. In particular, the real exchange rate's coefficient displays the hypothesised sign and is significant.

Before using these estimates to draw conclusions regarding the effects of an RMB revaluation on the trade balance between the US and China, however, we need to consider the stationarity of the variables. Except for TB, all variables were found to be I(1) irrespective of the lag length and the presence or absence of a trend. TB was found

[2] Cf Chow and Lin (1976), Bahmani-Oskooee (1986) and Brada *et al.* (1993).

[3] See Feenstra *et al.*(1999) and Fung and Lau (2001, 2003).

to have a significant trend and when lags were chosen to eliminate autocorrelation, was found to be clearly non-stationary. We therefore proceeded to test for cointegration and, using the Johansen procedure, we found evidence for a single cointegrating relationship. The cointegrating regression estimated using the Phillips-Hansen FMOLS estimator is reported in the second set of results in Table 1. It is clearly similar to the OLS results; in particular, the coefficient of the real exchange rate is significant and of similar magnitude. A third estimate is given by the cointegrating vector estimated by the Johansen procedure which is also reported in Table 1. Again, the results are similar, particularly the estimate of the coefficient of the real exchange rate which is significant and almost the same magnitude as that estimated by FMOLS.

We can, therefore, be confident that there is a significant long-run effect of the real exchange rate on the trade balance and that the magnitude is in the range 0.83 to 1.1. We now explore the implications of these estimated coefficients for the response of the trade balance to a change in the exchange rate.

4.2 The effect of a revaluation on the trade balance

There are three preliminary matters. First, the *real* exchange rate appears in the equations while a revaluation directly affects only the nominal rate. We can use the coefficient of the real exchange rate only if we can assume that the price levels are largely unaffected by the revaluation. Himarios (1989) found this to be a reasonable approximation in his work and we proceed under this assumption.[4]

Second, the assumed revaluation of the RMB. On the basis of estimates in existing work[5] it appears that a broad consensus is that the RMB is undervalued by something in the range of 10-50%.

[4] Note that if the assumption is violated the effects of the revaluation are likely to be smaller to the extent that subsequent price changes offset the revaluation, an effect which will strengthen our general conclusions.

[5] See Chang and Shao (2004) and Coudert and Couharde (2005).

Third, the method of computing the effect on the trade balance. Our estimated coefficient gives us an elasticity for the trade balance in ratio form with respect to the exchange rate. Thus our model allows us to predict $\Delta TB/TB = \Delta D/D - \Delta X/X$ while for the change in the dollar value of the trade balance we need ΔX and ΔD separately. We compute our effects under three alternative identification assumptions: that $\Delta D/D=0$, that $\Delta X/X=0$ and the $\Delta D/D=-\Delta X/X$ and apply the percentage changes to the final quarter's trade balance. The results are in Table 2.

[Table 2 near here]

The results show clearly that the improvement in the trade balance would be very modest unless there were a very large revaluation – even with a 50% revaluation, the trade deficit would fall by only about 37% under the assumption of equi-proportionate import and export contributions. At more realistic revaluations of, say, 10-20%, the change in the trade balance would be marginal, certainly not of the order that one might expect from the political rhetoric.

7. Conclusions

This paper has estimated the effect on the US-Chian trade balance of a revaluation of the RMB, supposedly undervalued. We present a range of computations but likely changes in the value of the RMB are not predicted to make much inroad into the trade imbalance between the US and China – a 10% revaluation is likely to improve the trade balance by less than 10%.

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Table 1: Regression Results

	OLS		FMOLS		Cointegration	
Variable	coefficient	p-value	coefficient	p-value	coefficient	p-value
CONST	48.8203	0.000	73.5661	0.000	NA	NA
TREND	0.0562	0.004	0.0941	0.000	0.0837	0.002
Y_u	-5.9689	0.000	-8.7017	0.000	-6.2032	0.009
Y_c	0.0632	0.614	0.0134	0.916	-0.5056	0.015
q_{uw}	0.7986	0.099	0.7817	0.112	0.1995	0.757
q_{cw}	-0.4303	0.120	-0.6464	0.021	-0.5967	0.106
q_{uc}	0.8298	0.003	1.0767	0.000	1.0774	0.011
R^2	0.8745		NA		NA	
DWS	1.5185		NA		NA	

Note: the p-values for the OLS and FMOLS regressions are derived from a t-test while those for the cointegrating regression are derived from a Chi-squared test for the exclusion of the variable from the cointegrating vector. The intercept is omitted from the cointegrating regression since the VECM was specified with unrestricted intercepts so that the intercept for the cointegrating vector is not separately identified. Values for R^2 and the Durbin-Watson statistics (DWS) are not available for the FMOLS and cointegration estimates.

Table 2: Increases in the US-China trade balance for various real appreciations of the RMB

	OLS elasticity = 0.8298			FMOLS elasticity = 1.0767			Cointegration elasticity = 1.0776		
$\Delta q_{uc}/q_{uc}$	$\Delta D = 0$	$\Delta X = 0$	$\Delta X/X = -\Delta D/D$	$\Delta D = 0$	$\Delta X = 0$	$\Delta X/X = -\Delta D/D$	$\Delta D = 0$	$\Delta X = 0$	$\Delta X/X = -\Delta D/D$
0.05	254	1581	918	329	2052	1191	329	2054	1192
0.10	507	3163	1835	658	4104	2381	659	4107	2383
0.20	1015	6326	3670	1316	8208	4762	1317	8215	4766
0.30	1522	9488	5505	1975	12312	7143	1976	12322	7149
0.50	2536	15814	9175	3291	20519	11905	3294	20536	11915

Note: Numbers in the body of the table are increases in the US-China balance of trade compared to the value for 2003(4) when exports were 6113 billion USD, imports were 38115 billion USD and the trade deficit was 32002 billion USD.