Is Singapore the Model for China's New Exchange Rate Policy?

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1. Introduction

Few economic events of recent years have attracted as much attention as the announcement by the People's Bank of China on July 21, 2005, that henceforth the exchange rate of the Renminbi (RMB) would not be kept fixed in relation to the U.S. dollar, but would be managed relative to a basket of currencies and adjusted more frequently via a "managed float" arrangement. Various commentators picked up on statements by informed observers to the effect that the new system would be somewhat like that of Singapore. Burton (2005), for example, stated that China and Malaysia "... adopted a version of its [i.e., Singapore's] managed floating exchange rate system after abandoning their fixed currency pegs against the US dollar." (Also see Areddy, et. al. (2005).) The central aims of the present paper are to explain the Monetary Authority of Singapore's exchange rate/monetary policy system, which has been unique among the world's central banks, and to consider the likelihood that Chinese exchange rate policy will in fact closely resemble that of Singapore. It will be argued that in practice the degree of similarity is likely to be very small, at least for several years to come.

Before beginning, it might be of some interest to explain why some newspapers (such as the Financial Times) refer to the Chinese currency as the Renminbi while others (including the Wall Street Journal and The Economist) usually refer to the Yuan. To the Chinese, renminbi is the name of the currency, "ren min bi" meaning something like "the peoples' money," whereas the yuan is the unit of account. Thus the Renminbi (RMB) exchange rate was (prior to July 21) about 8.28 yuan/dollar. Evidently, some newspapers find this usage tedious or confusing. From a Chinese perspective, however, to use "yuan" as the name of the currency would seem to be grammatically incorrect.

2. The Singapore System

Let us begin with an informal description of the Singapore system, before presenting it in terms of an analytical model. I will quote from a one-page summary by the Monetary Authority of Singapore (MAS) itself, as follows.

> "Since 1981, monetary policy in Singapore has been centered on the management of the exchange rate. The primary objective has been to promote price stability as a sound basis for sustainable economic growth. The exchange rate represents an ideal intermediate target of monetary policy in the context of the small and open Singapore economy.... First, the Singapore dollar is managed against a basket of currencies of our major trading partners and competitors.... Second, MAS operates a managed float regime.... The trade-weighted exchange rate is allowed to fluctuate within a policy band, the level and direction of which is announced semi-annually to the market.... Third, the exchange rate policy band is periodically reviewed to ensure that it remains consistent with the underlying fundamentals of the economy." (MAS, undated)

A careful reading of the foregoing, plus additional descriptions by MAS, reveals a crucial aspect of this procedure. It is that the band, within which the Singapore dollar (S$) exchange rate is kept, is not constant through time. Instead, the band may move upward or downward automatically as time passes (to allow for expected ongoing appreciation or depreciation) and, more importantly, both the level and slope of the band—and even its width—may be discretely adjusted each decision period. These adjustments are made so as to keep inflation low—i.e., to promote price stability. Some adjustments of the band may, as well, be made in response to prevailing (or forecasted) behavior of real variables such as aggregate output or

employment. Thus the type of exchange rate management employed by MAS is very different from a traditional fixed exchange rate. In fact, it would appear that the MAS operates with policy objectives quite similar to those of the Federal Reserve or the European Central Bank or the Bank of England, i.e., to maintain low inflation as a priority, with some attention also paid to output/employment considerations. Furthermore, the MAS procedures seem very much like those of these other central banks except that its policy management involves periodic adjustments in the exchange rate, rather than a short term nominal interest rate. The reason for this difference in policy behavior is, moreover, quite straightforward and simple: the Singapore economy is much more open to foreign trade than those of the United States or the euro area, or the United Kingdom. Instead of an export/GDP ratio of about 0.15 (or about 0.25 for the UK), for Singapore the value is currently about 1.4–1.5! Thus the exchange rate channel of monetary policy transmission is much more important, relative to the familiar interest-rate channel, than in larger economies that are less open to international trade. Accordingly, making open-market purchases or sales in the foreign exchange market, rather than the domestic money market, may be a relatively more effective way of managing aggregate demand.[1] The policy comparison will be illustrated below.

The foregoing suggestion that the MAS policy framework is basically one in which inflation is the main target variable, with the exchange rate being used primarily as an instrument or indicator for specifying policy changes that are designed to keep inflation close to target, is supported by the behavior of the exchange rate over the years 1981-2004. The period discussed begins with 1981 because that is the year in which the current MAS policy regime was put in place, according to MAS (undated, 2001). The statistics indicate that, over

[1] One should not infer, however, that adjustments in the exchange rate are necessarily implemented by open market purchases in the foreign exchange market. Except when interest rates are at (or near) zero, they could alternatively be implemented by purchases in the domestic money market.

the span from 1981 to the middle of 1997, the S$ appreciated in value by about 80 percent relative to the policy basket, despite a large drop in 1985-87. This appreciation was needed to prevent inflation since foreign inflation was proceeding at a rate higher than the Singapore target and also because rapid productivity growth in Singapore was bringing about an ongoing appreciation in real terms due to the Balassa-Samuelson effect. After a fall during the Asian financial crisis of 1997-98, the value of the S$ levelled off and has not changed much since. Even so, the value of the S$ remains about 70 percent higher in 2005 than in 1981 in terms of the (trade-weighted) basket.

The most common formulaic description of monetary policy procedures for more typical economies is provided by some variant of the "Taylor rule," introduced by John Taylor (1993), which relates periodic adjustments in a money-market interest rate in response to existing (or predicted) inflation and output-gap measures. A common formulation is

$$(1) \qquad R_t = r + \Delta p_t + \mu_1(\Delta p_t - \pi^*) + \mu_2(y_t - \bar{y}_t) + \eta_t \qquad \mu_1, \mu_2 \geq 0$$

where R_t is the interest rate, Δp_t is the current inflation rate, π^* is the target inflation rate (at which the central bank wishes to keep inflation on average), and $y_t - \bar{y}_t$ is the output gap, i.e., the percent (or fraction) by which real output exceeds the "natural rate" of output that represents an efficient, market-clearing level. The term η_t represents random policy influences by the central bank, which in principle should be very small.

In comparison to (1), the Singapore policy rule might be represented as follows:

$$(1') \qquad \Delta e_t = \Delta e - \Delta p_t + \mu_1(\Delta p_t - \pi^*) + \mu_2(y_t - \bar{y}_t) + \eta_t, \qquad \mu_1, \mu_2 \geq 0.$$

Here e_t is the nominal exchange rate, expressed as foreign currency units per unit of home-country money (e.g., yen/dollar if the United States is taken as the home country). Accordingly, Δe is the average rate of appreciation of the currency (perhaps negative) that

reflects the sum of the long-run rate of appreciation of the real exchange rate plus the average inflation rate abroad. Clearly, monetary policy designed to reduce inflation when it is above its target value would call for an increase in Δe_t under this rule, rather than an increase in R_t. This desired increase could in principle be brought about by the central bank by conducting an open-market sale of foreign exchange, although in normal circumstances it could be effected by a sale of short-term securities, as would usually be the case with the Taylor rule (1).[2] It should be emphasized that the policy behavior described by (1') is not intended to keep the exchange at any particular value other than whatever would be consistent with the inflation and output gap targets specified on the right-hand side of the relationship.

Is there any reason to believe that in reality MAS behaves in a manner similar to the rule (1')? In that regard, MAS Staff Paper No. 31, 2004, written by Eric Parrado of the IMF, uses monthly data for 1991-2002 to estimate a rule of the form (1') but with inclusion of an additional Δe_{t-1} term to reflect smoothing of the exchange rate. (Also, his preferred equation uses the expected inflation rate nine months into the future, rather than the current rate.) Parrado's instrumental-variable estimates are as follows:[3]

$$\Delta e_t = -0.006 + 1.89 E_{t-1}\Delta p_{t+9} + 0.42(y_t - \overline{y}_t) + 0.85\Delta e_{t-1}$$

$$(0.009) \quad (0.55) \qquad (0.14) \qquad (0.022)$$

$$R^2 = 0.86 \qquad \text{J-stat p-value} = 0.85$$

Clearly these provide strong support for the suggestion made above.

It must be said that the MAS normally does <u>not</u> describe its policy in this manner, instead emphasizing the "BBC" aspects (basket, band, crawl) regarding the exchange-rate

[2] If foreign exchange and domestic short-term securities were perfect sustitutes, then a purchase (of a given size) of either would have the same effect. This paper's analysis presumes that these two assets are close but not perfect substitutes.

[3] Here the figures in parentheses are standard errors, the R^2 statistic is unadjusted, and the reported p-value is Hansen's J statistic for testing the hypothesis that the assumed orthogonality conditions are valid.

that have been emphasized in the work of Williamson (1999)—see Khor, Robinson, and Lee (2004). But if the band and its crawl are designed primarily so as to achieve targets for Δp_t and $y_t - \bar{y}_t$, then this amounts to the same thing (as is argued above).

3. Open-Economy Model

Let us now indicate how either of the foregoing policy rules could be combined with a formal model, of an economy open to foreign trade, for the purpose of monetary policy analysis. One particular example of such a model is the one utilized by McCallum and Nelson (1999) or McCallum (2005), which differs from many other optimizing models by treating imports as raw materials for the production process rather than finished consumer goods. It is a small-open-economy model that can be summarized with the following equations:

(2) $c_t = E_t c_{t+1} + b_0 - b_1 r_t + v_t$

(3) $y_t = \omega_1 c_t + \omega_2 g_t + \omega_3 x_t$

(4) $im_t = y_t - \sigma q_t + \text{const}$

(5) $q_t = s_t - p_t + p^*_t$

(6) $x_t = y^*_t + \sigma^* q_t + \text{const}$

(7) $\bar{y}_t = (1-\alpha_2)^{-1}[\alpha_1 a_t - \sigma\alpha_2 q_t] + \text{const}$

(8) $\Delta p_t = (1+\beta)^{-1}[\beta E_t \Delta p_{t+1} + \Delta p_{t-1}] + \kappa(y_t - \bar{y}_t) + u_t$

(9) $R_t - R^*_t = E_t \Delta s_{t+1} + \xi_t$

(10) $r_t = R_t - E_t \Delta p_{t+1}$

A very brief description of each will be provided. Equation (2) is a consumption (c_t) Euler equation, reflecting intertemporal optimization, while (3) is a log-linearized approximation to

an identity that splits output y_t—not value added!—into three components: consumption, government consumption g_t, and exports x_t.[4] Next, in (4) import demand im_t is given by cost minimization for a production function of the CES type with σ as the elasticity of substitution between imports and labor. An analogous relation (6) governs demand from abroad for home-country exports. Equation (5) defines the log of the real exchange rate q_t in relation to the log of the nominal exchange rate s_t and the logs of home and foreign price levels, p_t and p^*_t. Equation (7) specifies the natural rate (i.e., flexible-price) value of the log of real output, $\overline{y}_t$, with this value depending upon a stochastic term a_t that reflects the results of technology shocks (assumed to follow an exogenous AR(1) process with autocorrelation parameter 0.95) and the real price of imported inputs to production. A variant of the Calvo model of nominal price stickiness appears as (8) while (9) represents uncovered interest rate parity, with a stochastic disturbance.[5] Finally, (10) is the Fisher identity that defines the one-period real rate of interest r_t in relation to the nominal rate R_t and expected inflation.

Together with the Taylor style policy rule (1), this model provides 10 structural equations to generate values of the system's 10 endogenous variables, namely, c, y, g, x, im, p, s, q, R, and r. Thus we can very simply establish the main point of this section, which is that adoption of the Δs_t policy rule (1') would not alter the lists of endogenous and exogenous variables. Consequently, it follows that use of s_t as the policy-rule instrument, rather than the more standard R_t, is perfectly sensible and coherent. Which of the two instrument/indicator variables would be more desirable will be determined by quantitative aspects of the economy under consideration.

[4] Domestic investment would also be included in a model that distinguishes between consumption and investment spending.
[5] This disturbance incorporates our assumption that foreign and domestic securities are not perfect substitutes.

To make such a determination for the model given above, quantitative values have to be assigned to each of the model's parameters, including those that describe the stochastic behavior of the exogenous variables and shocks that impinge upon the system. In McCallum (2005) I have calibrated the model (2)-(10) to represent a "typical" industrial economy, setting the average ratio of imports (and exports) to production (not value added) at 0.15.[6] For Singapore the comparable figure is approximately 0.6.[7] It will be of interest to compare the performance of policy rules (1) and (1'), with smoothing added in each case, under these two specifications of the economy's degree of openness, with the other aspects of the calibration kept the same.

The relevant comparison is provided in Table 1. There X/Y denotes the ratio of the economy's exports (and imports) to production, which is varied over a wide range in

Table 1: Effects of Openness on Policy Rule Performance
Cell entries are standard deviations of Δp_t, $\tilde{y}_t$, R_t, Δs_t

	X/Y = 0.01	X/Y = 0.15	X/Y = 0.30	X/Y = 0.60
R_t rule (1)	2.72 2.11 2.96 19.36	2.34 1.95 2.45 18.46	2.22 2.37 2.30 17.75	2.30 4.81 2.42 16.01
Δs_t rule (1')	4.27 2.76 9.37 1.83	3.61 2.41 9.28 1.65	3.25 2.21 9.29 1.56	2.62 2.20 9.26 1.44

the different columns. For a given calibration of the model, described in McCallum (2005), the two rows of cells report the variability of inflation, the output gap, the interest rate, and the exchange rate's rate of appreciation. With all variables measured as percentage

[6] The model also includes a feature representing habit formation in consumption behavior.
[7] Singapore exports (X) and imports (M) are each about 1.5 times as large as GDP, implying a value of 0.6 for M/Y. To see this, note that GDP = Y – M, so Y/M = 1 + GDP/M.

deviations from steady-state values, quarterly but in annualized units, the figures for inflation and the output gap represent root-mean-square deviations from target. Thus small values are more desirable than large values.

Going across the top row, we see that with an interest rate instrument rule poorer performance is realized with highly open economies. Moving from X/Y of 0.15 to 0.60, to be specific, results in approximately no change in inflation variability but a major increase in output gap variability. Effects on the variability of interest and appreciation rates are minor. In the second cell row, by comparison, the exchange rate rule is increasingly effective in stabilizing inflation and output as the degree of openness is increased. Thus for the model at hand, it is clearly the case that an increased degree of openness makes use of the exchange rate rule relatively more attractive.

Does the very high level of openness reflected by X/Y = 0.6 also make rule (1') more attractive in absolute terms? From the last column of Table 1 we see that in that case variability of inflation is (slightly) higher but variability of the output gap is (greatly) reduced by use of the exchange rate rule. The answer will then depend upon the weight assigned by the relevant objective function to output-gap variability.[8] If the value were 0.1 for the latter relative to inflation variability (in terms of variances), then the exchange rate rule (1') would be preferable. Weights somewhat lower than 0.1 are not uncommon in the literature, however, so the absolute superiority of (1') is not a foregone conclusion. Also, it is possible that the variability of R_t and Δs_t or s_t would be taken into account by the relevant central bank. Accordingly, no conclusion of the absolute type can be made on the basis of our simple study. For this type of comparison, a more precise numerical calibration of the model

[8] If X/Y were assumed to be 0.75, however, the exchange rate rule would would result in inflation and output standard deviations of 2.08 and 2.15, both smaller than the values 2.56 and 7.11 provided by the interest rate rule.

and a more careful consideration of the appropriate objective function would have to be developed. These are tasks that are beyond the scope of this paper.

4. Relevance for Chinese Policy

The past two sections have developed a characterization of Singapore monetary policy and illustrated its relative effectiveness for economies with very high ratios of trade to domestic production. In light of these findings, we now return to the suggestion that China's new exchange rate policy is or will be similar to that of Singapore.[9] In that regard, the first point ot note is that China does not have a very high ratio of trade to domestic production so a major reason why Singapore's system is attractive does not apply to China. Next it is important to recognize that the MAS policy regime is entirely different from a fixed exchange rate. In fact, the MAS does not even rely upon autonomous target values for the exchange rate, but merely values that are believed to be helpful (temporarily) in achieving MAS objectives for inflation (and possibly output). Some writings, such as Williamson (1998, 1999), have argued that such an arrangement is not a "pure float" of the exchange rate, but it is not clear what is meant by that objection . As Robert Mundell frequently emphasizes, the term "floating exchange rate," is highly incomplete as a description of a policy regime.[10] The term "fixed exchange rate" constitutes a description of monetary policy, since monetary policy and exchange rate policy are not two independent entities, but "floating exchange rate" is a highly incomplete policy specification.[11] It is my argument that, for the MAS, the exchange rate is important primarily in its role as an intermediate information or instrument variable that is involved in the procedures used to achieve the objective of low inflation, augmented perhaps by output gap considerations. The Singapore

[9] Thus we are using our normative analysis to provide suggestions about what will be done in practice.
[10] See, for example, Mundell (2001, p. 13).
[11] Actually, there are significant variants of fixed-rate regimes: currency unions, currency boards, pegs, etc.

system is, therefore, one variant of a floating exchange-rate regime.

For a system of the type just described, it is crucial that adjustments in the central bank's setting of the exchange rate must be made promptly and vigorously. This does not mean than no high-frequency smoothing is admissible, but that (say) quarterly averages need to conform reasonably well to the dictates of the policy rule. The latter, moreover, has in the case of Singapore resulted in sizeable adjustments, as discussed above. In the case of China, by contrast, we know that the regime of a fixed exchange rate was given up in July 2005 with great reluctance.[12] Furthermore, it seems clear than the Chinese authorities—not necessarily the People's Bank of China, but government authorities more generally—remain strongly concerned with the demand from abroad for Chinese exports. In part, this is because of a perceived need to keep the demand for labor high and rising so as to prevent political unrest. Accordingly, it would appear that the likelihood, that China is now or will be managing its exchange rate (and monetary policy) in a manner similar to the practice of Singapore, is very small. Some type of floating exchange-rate regime may well be adopted eventually for the Chinese economy, so as to permit monetary policy actions that are appropriate domestically. But in that case the system would probably be unlike Singapore's, since China's degree of openness is much smaller. In sum, there seems to be little or no reason to believe that a system like Singapore's has been adopted by China or will be adopted by China in the near future.

[12] Perhaps this fact accounts for the prevalence of press commentaries suggesting that the RMB vs. basket exchange rate will be held fixed, despite the announcement that it will float. (See, for example, "Chinese Puzzles," The Economist 376, August 13, 2005, p. 61, which states: ""In theory, if the dollar falls against the other currencies, the People's Bank of China should let the yuan [sic] rise against the dollar in order to hold the overall value of the basket steady.")

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