Stabilizing the unstable small open economy[1]

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Abstract

An increase in the oligopolistic mark-up lending rate of interest increases the volatility of bank asset portfolio. Nevertheless, the central bank can utilize a compensation system to reduce the volatility, thereby contributing to financial stability. This system therefore creates the necessity for the central bank to have two nominal anchors – exchange rate and bank excess reserves – in a regime of de facto capital mobility. When commercial banks are the dominant traders of foreign exchange the nominal exchange rate could be sticky, thus allowing the monetary authority to implement the compensation system. The liquidity preference of banks imply that monetary shocks in the form of compensation lead to exchange rate undershooting instead of overshooting, thus further enhancing the possibility of using two anchors; therefore allowing for leaning against the trilemma. The stabilization problem involves a trade-off between compensation and bank asset portfolio volatility.

Key words: financial stability, compensation thesis, transmission mechanism, small open economy

1 Introduction

In a recent survey of the various monetary transmission mechanisms applicable to developing economies, Mishra and Montiel (2013) came away with a pessimistic view. The predominance of commercial banks as the main source of external finance would imply the bank lending channel would be important for the implementation of monetary policy. Yet the authors observed that this channel is weak at best. They noted that the persistence of excess bank reserves could be one of the reasons for the weak influence of monetary policy, especially interest rate policy, through the bank lending channel. Indeed empirical work done by Saxegaard (2006) and Khemraj (2007) have found that excess reserves have minimal effect on bank lending[2].

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[1] This work summarizes some ideas that are included in my forthcoming book: Money, Banking and the Foreign Exchange Market in Emerging Economies.

[2] Post Keynesians have long held that excess reserves do not influence bank lending; instead the central bank uses a short-term benchmark interest rate as its instrument (Palley 1996). There is also endogeneity of excess reserves (Pollin 1991).

These findings appear to be at variance with monetary policy practice in developing economies, many of which can be characterized as small open economies[3]. Often it is reported in the local and international press that a central bank somewhere in the developing world is 'mopping up' excess liquidity. Although theory and empirical evidence ascribe limited causal role for excess reserves in the transmission mechanism, central banks in developing economies, in particular, appear keen to frequently "mop up" excess reserves. Therefore, does excess liquidity play a role in macroeconomic and financial stabilization that is not recognized by the bank lending channel and the empirical literature?

This paper presents three theoretical arguments to reconcile the practice with the academic literature. Unlike the conventional view, excess liquidity does not influence the broader economy through the bank lending channel. Firstly, excess liquidity is crucial for the central bank to maintain a compensation system as outlined at the empirical level by Khemraj (2009) and Lavoie and Wang (2012). In addition, the paper explains the compensation mechanism within the context of an oligopolistic banking model, thereby incorporating a realistic scenario in which central banks implement monetary policy. Compensation is crucial because the global financial architecture which forces small open economies (SOEs) into a financial centre-periphery straightjacket in which the economies must obtain sufficient foreign exchange reserves if they are going to conduct in global financial transactions. For this purpose the central banks are required to hoard sufficient foreign currency reserves. Therefore, the issue of foreign exchange management is central to the macroeconomic stabilization agenda because the economies in question face a perpetual foreign exchange constraint. The constraint coupled with exchange rate volatility makes the management of exchange rate and a required level of international reserves even more crucial (Worrell 2012).

Secondly, the paper develops an open economy portfolio banking model to show how excess liquidity can reduce the variance (or volatility) of the portfolio of assets held by commercial banks. Using non-linear time series models applied to several Caribbean and Latin American economies, Moore (2007) found empirical evidence that indicate excess liquidity can dampen the impact of financial crises[4]. Thirdly, the liquidity preference of

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[3] Small open economies are often vulnerable to exogenous shocks for various reasons; resilience is defined as the ability of policy to help reduce the impact of the exogenous shocks (Brigulio *et al* 2009).

[4] Indeed, a main reason for quantitative easing was to supply the funding liquidity to the banking system after the collapse of Lehman Brothers that ushered in the sub-prime crisis. Quantitative easing has resulted in unprecedentedly high levels of excess reserves in the federal funds market.

oligopolistic banks could result in exchange rate undershooting instead of overshooting given a monetary shock. These three points help to explain why policy makers in developing countries are able to lean against the trilemma by having two simultaneous nominal anchors – typically an exchange rate and a money (or interest rate) anchor – in spite of *de facto* capital mobility[5].

Lavoie and Wang (2012) noted that the Peoples Bank of China is able to utilise a system of compensation to simultaneously target the domestic benchmark interest rate and the exchange rate even though there is *de facto* capital mobility. The phenomenon whereby the central bank can maintain two anchors in the long run is labelled the dual nominal anchor thesis by Khemraj and Pasha (2012) who tested the thesis for several Caribbean economies. The notion of dual nominal anchors was also tested by Khemraj and Pasha (2012) in which they estimated the sterilization coefficient for several Caribbean economies. The economies with noted fixed exchange rate systems also had a high sterilization coefficient indicating that they are also concerned with independent domestic monetary policy in addition to the exchange rate target. The money neutrality hypothesis, which gives the open economy trilemma, contravenes the possibility of two simultaneous nominal anchors in the long run. Nevertheless, this paper shows that oligopolistic banking systems with liquidity preference could explain the existence of two long run anchors in the regime of *de facto* capital mobility.

The paper is structured as follows. Section 2 presents an oligopolistic banking model of compensation. Section 3 develops a bank portfolio model showing how excess reserves help to reduce the volatility of the return of the asset portfolio. Section 4 presents a dynamic exchange rate model with bank liquidity preference. The model is used to illustrate the principle of undershooting of the exchange rate. Section 5 concludes.

2 The principle of compensation

For us to fully appreciate how compensation works we need to examine the foreign exchange market both at the macro and at the firm (or bank) level. The commercial bank is assumed to be the main or dominant trader of foreign currency buying and selling hard currencies. Households and firms take the rate as given. The central bank, however, has the market power to influence the nominal exchange rate; but we will assume its main objective is to maintain a managed float. In other words, the central bank pursues two anchors: the

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[5] Aizenman *et al* (2012) developed an index to explain the changing nature of the trilemma configuration. Their index also found evidence of leaning against the trilemma.

exchange rate anchor and a domestic liquidity management anchor. As noted earlier, the global financial architecture requires that the central bank hold ample foreign currency reserves. Assume the economy in question does not possess a national currency which is globally acceptable. Therefore, the central bank has to purchase foreign currencies in the domestic foreign exchange market as it cannot do so in the global trading centres.

The analysis that follows explains how these purchases, essential for maintaining sufficient foreign exchange reserves, lead to a foreign currency constraint in the domestic market. This is a financial constraint that is different from the more long-term structural foreign exchange gap, which forms an important component of structuralist literature (Taylor 1989). In the short-term the constraint manifests itself as a mismatch between the demand and supply of foreign exchange. In contrast, the foreign exchange gap manifests itself in a shortage of the total quantity for foreign currencies the economy generates through exports and capital inflows. Moreover, the long-term gap determines the trend path of output growth. In this paper we would focus only on the short-term or stabilization problem, of which compensation is at its core. When the central bank buys foreign exchange it injects excess reserves into the banking system. The commercial banks then use the excess reserves to buy government securities that yield a rate of interest unlike excess reserves which typically yield zero interest rate. The banks are compensated because of the foreign exchange constraint that is engineered by the central bank's demand for foreign currencies.

Assume the only shock that occurs is an increase in foreign assets held by the central bank, which involves purchasing hard currencies for the purpose of maintaining its regular stock for foreign reserves. This is a necessity if the central bank is to maintain macroeconomic stability (Worrell 2012). Assume further that no shock emanates from demand for bank loans or bank deposits. The central bank's balance sheet changes to reflect an increase in foreign asset. It pays for the foreign assets by crediting commercial banks with excess reserves (the monetary base increases). The central bank is aware that two situations will arise that could lead to an unstable foreign exchange market. Its purchase of foreign currencies reduces the stock available for commercial banks to hoard as foreign assets. The commercial banks have excess reserves which they can use to bid up the price of the scarce stock of foreign exchange. In this situation commercial banks will turn to buy up Treasury bills, an event that increases their price and reduces the compensating interest rate. The compensating interest rate is the Treasury bill rate at which the central bank sells the

securities. This rate could be interpreted as an implicit subsidy to the commercial banks for having to hold excess reserves due to the foreign exchange constraint.

Figure 1 presents an aggregate model of the foreign exchange market that is drawn to emphasize the level of hoarding of foreign exchange. Given the global financial architecture, the quantity of foreign exchange the economy hoards, in the aggregate, has to be positive in the long run; hence the diagram shows the long run aggregate foreign exchange market. Since the selling rate is an oligopolistically determined rate, it will be above where the competitive market rate could have been (This selling rate is derived in Appendix 1). This results in a situation in which the buying quantity is less than the selling quantity in the long run. The amount of foreign exchange purchased by the oligopolistic trader must be greater than that sold to households, firms and the government. This must be the case if the bank is to be able to pursue proprietary investments with foreign exchange. With the nominal exchange rate at S the quantity of foreign exchange bought by the commercial banks is F_B. This quantity is determined on the supply curve X_S, which is upward sloping to reflect that a nominal depreciation increases exports. The quantity sold by commercial banks is F_S; this quantity is determined on the foreign exchange demand curve X_D, which is downward sloping to reflect that depreciation makes imports more expensive in terms of the domestic currency.

Figure 1. The foreign exchange market and hoarding
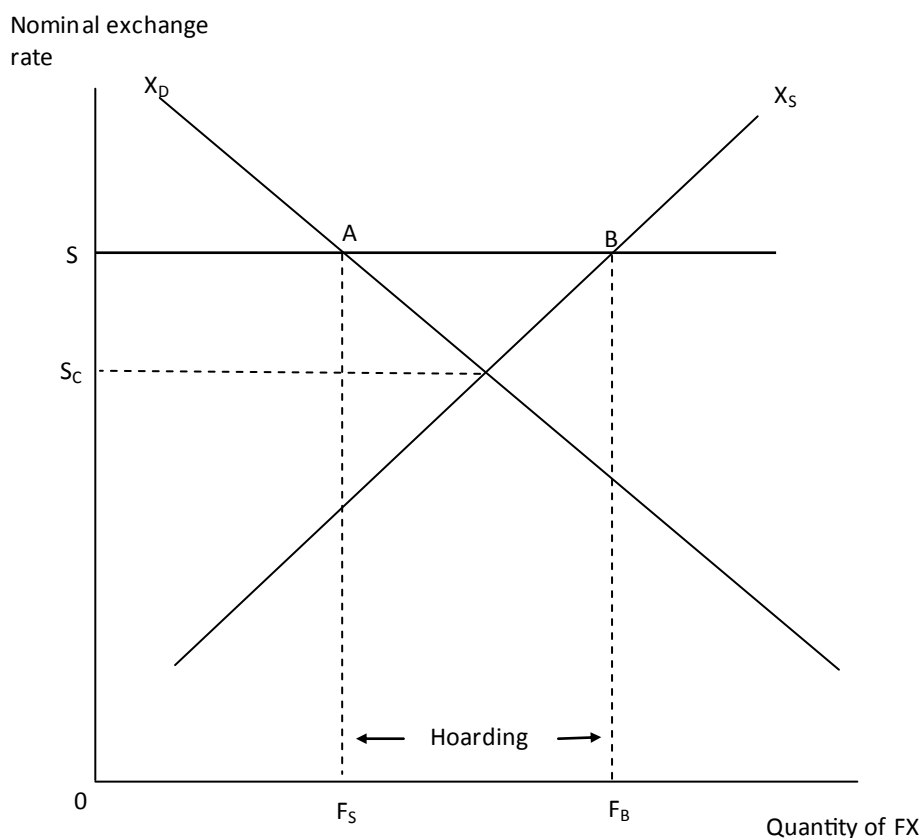
Let the quantity of commercial bank hoarding be given by the distance $F_B - F_S$. The spot exchange rate is above the purely competitive rate (S_C), thus creating a floor so that sufficient foreign currencies can be mobilized by the market for the purpose of hoarding. The exchange rate will also be sticky and tend not to change from S even when the monetary authority buys hard currencies. A demand shift between the distance AB would lead to no change in the exchange rate. However, the level of foreign exchange hoarded by commercial banks will decline. The central bank purchase is creating the foreign exchange constraint.

However, if the monetary authority presses too much it can cause a jump in the exchange rate. If its demand increases beyond point B the exchange rate will jump to a higher threshold so as to restore hoarding positions. This situation is illustrated by Figure 2. As the central bank's demand for foreign currencies increase beyond point B, the exchange rate jumps to a higher level (from S_1 to S_2) to re-establish the hoarding equilibrium of the commercial banks. Once hoarding is in equilibrium the exchange rate will not change. In other words, the nominal exchange rate will tend to be sticky most times, but at times experience a onetime jump.

Figure 2. Sticky exchange rate with a onetime jump
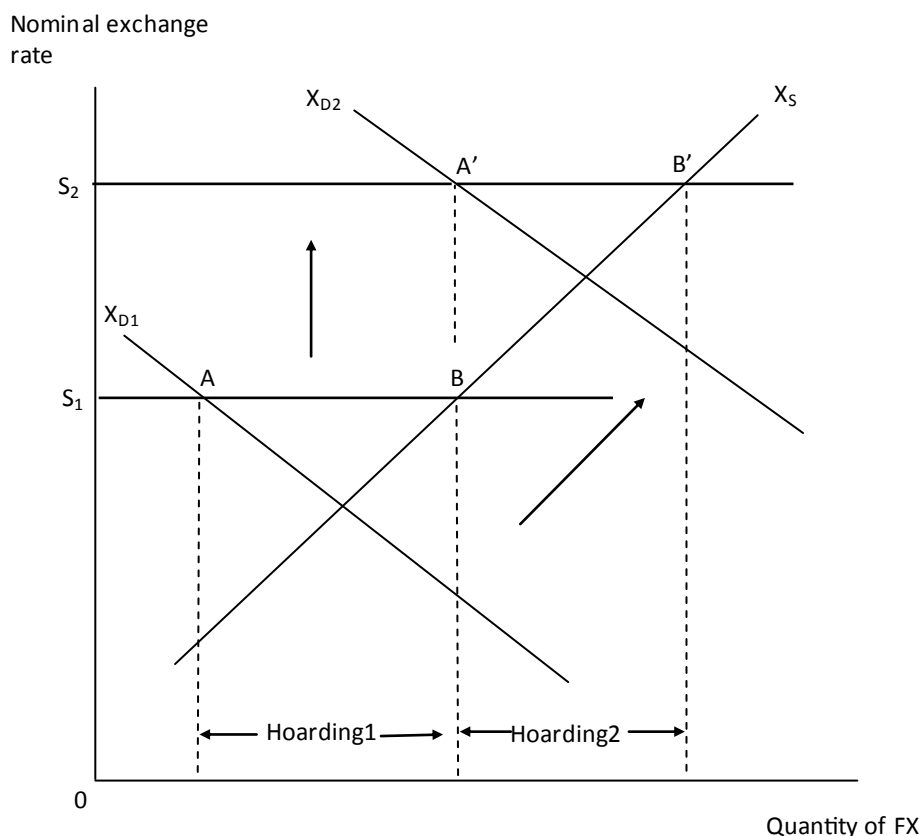
Let us, however, return to the analysis where the central bank does not purchase quantities large enough to exceed point B. Such a gradual intervention is intended mainly for maintaining sufficient international reserves. In the loan market, it implies the lending rate reaches the minimum mark-up threshold and the excess reserves lead to no substitution of loans, which is already allocated to the established borrowers[6]. The immediate impact of such an intervention would be to cause an outward shift in the foreign exchange demand curve the commercial banks face. This would cause a depreciation of the exchange rate since the banks have a smaller stock of foreign currencies for which they can hoard. Therefore, the central bank has to maintain some kind of a compensation system with an interest earning asset. In this case the monetary authority will "mop up" the excess reserves by selling to banks Treasury bills at a rate sufficient to stave off the depreciation.
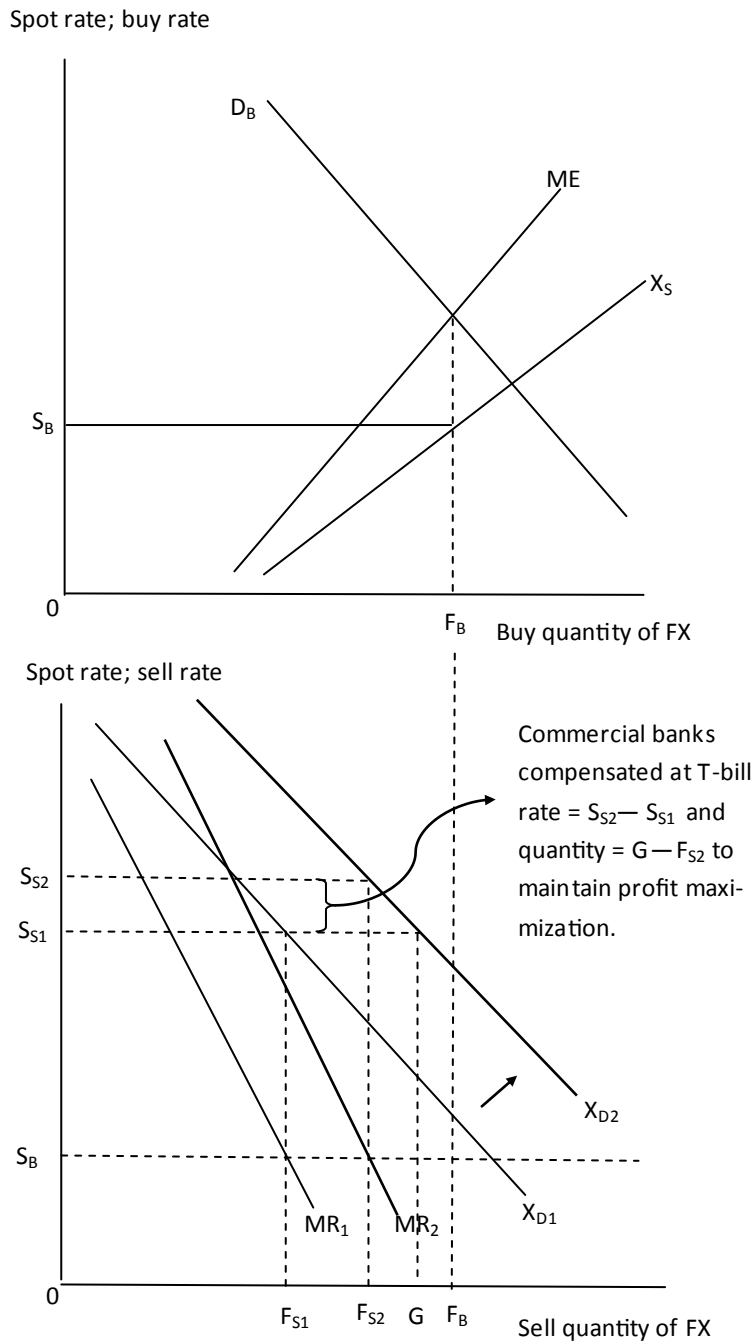
This situation is illustrated by Figure 3 below. While Figure 1 presents the foreign exchange market in the aggregate, Figure 3 gives the market at a micro or institutional level. It shows the buying and selling sides of the foreign exchange market. The quantity of currencies available in the domestic market is F_B, which the economy earned through exports, capital inflows and remittances. Therefore, the central bank must operate on the selling side of the market if it is to replenish its stock of foreign currency reserves. Demand for foreign exchange shifts outward from X_{D1} to X_{D2}, thus causing pressure in the market for a depreciation from S_{S1} to S_{S2}. To maintain the exchange rate at S_{S1}, the central bank has to compensate the commercial banks with Treasury bills to make up for the lost quantities of hoarding, which has declined from $F_B - F_{S1}$ to $F_B - F_{S2}$.

The Treasury bill rate will depend on the amount of pressure central bank purchases exert and the elasticity of demand for imports. The more inelastic the demand the higher will have to be the compensation interest rate. It is unlikely that a central bank which targets the exchange rate will destabilize its own target with erratic purchases that abruptly impact the foreign exchange needs of commercial banks. With an inelastic demand for imports the central bank would have to pursue subtle interventions so as to make sure the long run hoarding position of the commercial banks is not negative. This compensation mechanism allows the central bank to simultaneously target the exchange rate and have an independent domestic monetary policy since it is able to drain excess reserves. The quantity of Treasury

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[6] For an illustration of the mark-up lending rate and its effect on bank liquidity preference see Khemraj (2010).

bills associated with the implemented compensation is *G*. This is the quantity consistent with maintaining the profit-maximization of the commercial banks.

Figure 3. Central bank compensation of commercial banks

Spot rate; buy rate

D_B

ME

X_S

S_B

0

F_B Buy quantity of FX

Spot rate; sell rate

Commercial banks compensated at T-bill rate = S_{S2}— S_{S1} and quantity = G—F_{S2} to maintain profit maximization.

S_{S2}

S_{S1}

S_B

X_{D2}

X_{D1}

MR_1 MR_2

0

F_{S1} F_{S2} G F_B Sell quantity of FX

3 Financial stability and the bank portfolio

This section examines the effect of excess liquidity on the variance and expected return a representative bank's portfolio. The bank is assumed to hold four assets that when

expressed in ratio form can be written as follows $h + r + l + g = 1$. The four assets are foreign currency assets (hoardings) converted into local currency ($h = H / A$), non-remunerated reserves in domestic currency ($r = R / A$), loans in domestic currency ($l = L / A$) and domestic government securities ($g = G / A$). The expected return on each asset takes into consideration a probability of losing money on that asset. Therefore, the expected return on loans includes a discount representing the probability that some borrowers will not repay (this probability is denoted by ρ). Similarly the expected return on the government security is discounted by the probability the government will not repay or default (ψ_1). The expected return on hoarding FX takes into account the movements in the foreign exchange rate. When the nominal exchange rate depreciates ($\Delta S > 0$) the bank makes money on holding foreign exchange or foreign exchange assets. When the nominal exchange rate appreciates, however, ($\Delta S < 0$) the bank loses money on hoarding. Therefore, we must take into consideration the probability the exchange rate will depreciate (ψ_2) and the probability it will appreciate ($1 - \psi_2$).

The expected return on domestic currency loans is given as $E_L = (1 - \rho)r_L$. The expected return on the government security is $E_G = (1 - \psi_1)r_{GR}$. When the exchange rate is flexible the expected return on hoarding is given by $E_H = Er_F + \psi_2 \Delta S - (1 - \psi_2)\Delta S$, where Er_F represents the forecast or expected foreign benchmark rate. In a fixed exchange rate return on hoarding foreign asset is Er_F. Note that if the commercial bank merely holds foreign currency in its vault its return on hoarding is 0%. Given the ratio of each asset and the individual returns, the expected return on the portfolio can expressed as

$$E_P = E_L l + E_G g + E_H h \qquad (1)$$

Substitute into equation 1 the asset ratio constraint $h = 1 - r - l - g$. Rearranging the formula will give us the expected return in deviations from the expected return on hoarding

$$E_P = (E_L - E_H)l + (E_G - E_H)g + (1 - r)E_H \qquad (2)$$

In a completely fixed exchange rate the expected return is simply deviations from the benchmark foreign interest rate. The benchmark foreign rate could be, for example, the US Treasury bill rate. The stronger the oligopoly influence in the loan market implies that the bank can make more money. Moreover, we discussed above that the central bank can use the compensation mechanism to reduce the rate r_{GR} so as to discourage hoarding and also

compensate the banks with liquid government assets that pays the repressed or compensation interest rate. For the fixed exchange rate economy the expected returns is given as

$$E_P^f = (E_L - r_F)l + (E_G - r_F)g + (1-r)r_F \qquad (3)$$

Notice how bank reserves in domestic currency play a crucial role in reducing the influence of hoarding or the foreign asset on the portfolio return. Higher levels of excess reserves act as a constraint on bank demand for foreign asset. How could this be? By compensating the banks with government securities that pays the compensation interest rate. The difference between the loan rate and the foreign rate and the Treasury bill rate and the foreign rate is determined by the oligopolistic mark-up (Khemraj 2010). As the banking structure tends towards monopoly we can expect the mark-up to increase, thus increasing the portfolio return. However, increase in excess reserves reduces the effect of hoarding on the return of the portfolio even in an oligopolistic banking structure.

The variance of the portfolio can be expressed as follows

$$\sigma_P^2 = E(r_P - E_P)^2 = E[l(r_L - E_L)^2 + g(r_{GR} - E_G)^2 + h(r_H - E_H)^2] \qquad (4)$$

As usual E represents the expectations operator. The expression $r_H - E_H$ indicates the deviation of actual returns from expected returns on hoarding. The formula suggests that volatility results from the appreciation and depreciation of the exchange rate, increase in the default probability of borrowers, and the probability the government will default. The equation further suggests that a fixed exchange rate would remove some of the volatility in the bank's portfolio. A completely flexible rate results in more volatility. In a fixed exchange rate economy the portfolio variance becomes.

$$\sigma_P^2 = E[l(r_L - E_L)^2 + g(r_{GR} - E_G)^2 + h(r_F - Er_F)^2] \qquad (5)$$

The best forecast of the foreign rate reduces volatility further (that is $r_F = Er_F$). We observed above that the oligopolistic mark-up increases the return on the portfolio. Let us now examine how the variance is affected by the mark-up. Substituting $h = 1 - r - l - g$ into equation 5 and rearranging will give

$$\sigma_P^2 = E\left\{l[(r_L - E_L)^2 - (r_F - Er_F)^2] + g[(r_{GR} - E_G)^2 - (r_F - Er_F)^2] + (1-r)(r_F - Er_F)^2\right\} \qquad (6)$$

Expand the following expression $(r_L - E_L)^2 - (r_F - Er_F)^2$ which comes from equation 6 and then rearrange. It becomes obvious that the expression $(r_L - r_F)^2$ is embedded within the

measure of portfolio volatility. The expression $(r_L - r_F)^2$ represents the square of the oligopolistic mark-up of the loan rate over the foreign interest rate. Therefore, we can conclude that after controlling for the fixed exchange rate regime volatility will increase as the mark-up rises. Equation 6 also suggests that higher levels of excess reserves (that is a smaller ratio $1 - r$) are associated lower volatility. The compensation system, therefore, could be used to align the compensating interest rate with E_G so as to further reduce bank portfolio volatility.

4 Exchange rate undershooting

In this section a partial equilibrium model of exchange rate is adopted to explain the undershooting of the nominal exchange rate. Bank liquidity preference, with a minimum mark-up interest rate, plays a fundamental role in the undershooting thesis (Khemraj 2010). The size of the response of the exchange rate depends on where on the liquidity preference curve the liquidity shock occurs. In the conventional story of exchange rate overshooting – proposed in Dornbusch's legendary paper – the money demand function is linear[7]. However, we get a different result if the liquidity preference function of banks is expressed as a reciprocal function with the asymptote being the oligopolistic mark-up lending rate. Therefore, de-compensation or expansion of liquidity at the mark-up rate results in undershooting instead of overshooting. The Dornbusch model is often used to motivate exchange rate volatility induced by monetary policy. The model assumes sticky commodity prices but rapidly adjusting financial asset prices. Therefore, the nominal exchange rate is required to over adjust to monetary shocks.

In the approach proposed here the interest rate does not fall below the minimum mark-up rate. Therefore, expansion of liquidity at the mark-up would lead to no exchange rate adjustment or the positive impact response gets smaller and smaller. Once the interest rate does not adjust at the mark-up rate, monetary shocks would not result in offsetting capital inflows or outflows. The central bank can perform liquidity management to maintain the compensation mechanism that is associated with the targeting of the exchange rate. The exchange rate dynamics is given by the following partial adjustment model

$$S_t = (1-\varphi)S_{t-1} + \varphi\phi_3(r_F - r_L) \tag{6}$$

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[7] See Dornbusch (1976) and Rogoff (2002).

This equation is obtained by combining the long-term expected exchange rate, which is rooted in the uncovered interest parity condition $S_t^e = \phi_3(r_{Ft} - r_{Lt})$ and the adjustment process $S_t - S_{t-1} = \varphi(S_t^e - S_{t-1})$. The expected exchange rate S_t^e is determined by the differential in the foreign interest rate and the domestic lending rate. This long-term relationship comes from the well-known uncovered interest parity condition, a fundamental equation in open economy macroeconomics. Expectations are formed based on deviations of the domestic interest rate from the foreign rate, adjusted for the mark-up component. As usual the exchange rate is written as units of domestic currency divided by one unit of the foreign currency. Therefore, $\Delta S > 0$ indicates a depreciation of the local currency and $\Delta S < 0$ shows an appreciation.

The two parameters (φ and ϕ_3) take values between 0 and 1. The asymptotic liquidity preference function $r_L = r_M + \beta R^{-1}$ is substituted into equation 6. The mark-up rate and the level of excess reserves are represented by r_M and R, respectively. Also substituting the mark-up lending rate $r_M = [r_F + mc)]/(1+a^{-1})(1-\rho)$ into equation 6 gives the following

$$S_t = (1-\varphi)S_{t-1} + a_4 r_{Ft} - a_5 mc_t - a_6 R_t^{-1} \tag{7}$$

Where $a_4 = [1 - 1/(1-\rho)(1+a^{-1})]\varphi\phi_3$, $a_5 = [(1-\rho)(1+a^{-1})]^{-1}\varphi\phi_3$ and $a_6 = \varphi\phi_3\beta$. Marginal cost of lending and monitoring new loans is given by mc and the elasticity of demand for loans is given by a. The dynamics of equation 7 is determined by $1-\varphi$ which is assumed to be less than 1. Since $1-\varphi < 1$ shocks from the exogenous variables r_{Ft}, mc_t and R_t would eventually dissipate allowing the exchange rate to move back towards equilibrium.

Observing equation 7 allows for the partial effects or impact effect in period $t = 0$. Assuming everything else is held constant, an increase in the foreign interest rate relative to domestic rate would result in a nominal depreciation once $1 - 1/(1-\rho)(1+a^{-1}) > 0$. It is clear that the size of the depreciation is dependent on the probability of loan default (ρ) and the degree of competition in the banking sector (a).

An increase in the marginal cost associated with monitoring and screening of loans would cause the exchange rate to appreciate under the imperfect competition model. The higher marginal cost would increase the mark-up lending rate, thus deflating the economy. As the economy deflates the demand for foreign exchange would likely decline, thus easing the pressure in the domestic market. On the other hand, an increase in excess reserves would

cause a positive response in exchange rate. The positive response signals a depreciation of the exchange rate. This result of the model signals the importance of liquidity management within the reserve money program framework even under imperfect competition. If the central bank wants to stave off the depreciation as it accumulates foreign reserves it must compensate the commercial banks given that it has created a constraint in the foreign currency market.

In order to observe the exchange rate undershooting, let us examine the simulated dynamic multipliers showing how the exchange rate responds to a positive shock in excess reserves. It requires expanding reserves until the minimum mark-up rate is reached. The multipliers showing the dynamic adjustment of exchange rate given a shock in excess reserves is given as

$$\partial S_{t+i} / \partial R_t = (1-\varphi)^i \beta \varphi \phi_3 R_t^{-2} \tag{8}$$

Notice that R_t^{-2} remains in the formula. Equation 8 can easily be obtained using a recursive method[8]. Previously we have eliminated R_t^{-2} by multiplying by R_t^2. However, in this instance we do not want to eliminate R_t^{-2} because it shows the liquidity effect associated with the liquidity expansion; and moreover it helps us to obtain the multiplier for different levels of excess reserves. With the parameters constant, increasing the level of excess reserves will result in a smaller positive response in the nominal exchange rate. In other words, as the vertical liquidity supply curve is shifted outwards until the minimum mark-up rate is reached, the response of the exchange rate gets smaller or it undershoots. When the liquidity preference curve is flat, shocks to excess reserves result in no change in the nominal exchange rate. This implies that the central bank could pursue an exchange rate target at the same time as it manages excess reserves through the compensation framework.

This behaviour is illustrated by Figure 4. Assume $\varphi = 0.5$, $\phi_3 = 0.85$ and $\beta = 3$. The figure shows the simulation of the multiplier for three levels of excess reserves. It can be seen that as $R \to +\infty$ the impact response of the multiplier approaches 0. The situation is interpreted as the undershooting of the nominal exchange rate given positive liquidity shocks. In other words, each level of higher de-compensation results in a smaller response in the

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[8] This is a first-order linear difference equation and can be solved for a solution (given an initial value) using a recursive method. After solving for one solution we can obtain the dynamic multipliers by differentiating the solution equation with respect to the exogenous variable.

nominal exchange rate. Eventually monetary shocks at the mark-up interest rate will result in no change in the exchange rate.

Figure 4. Exchange rate undershooting
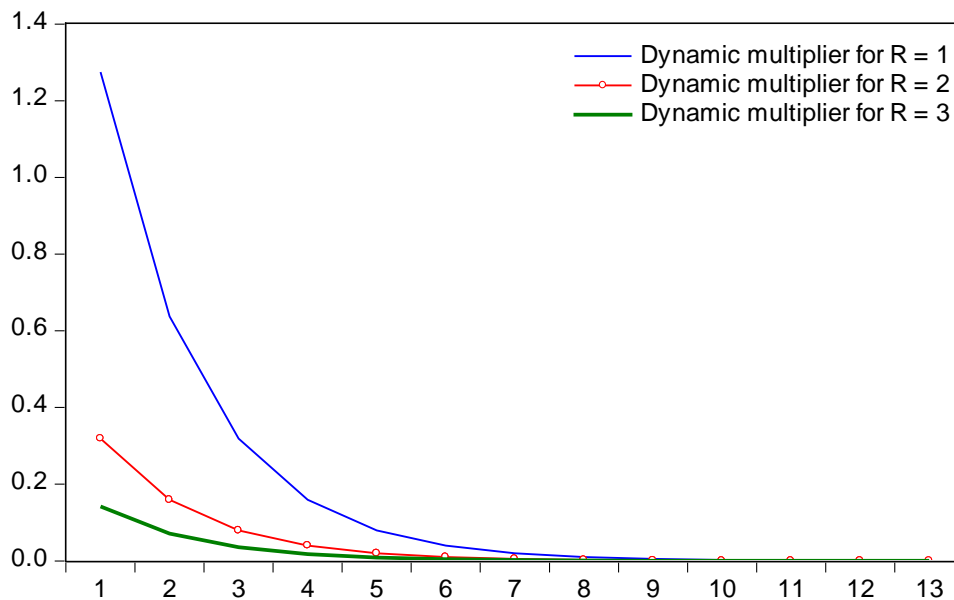
5 Conclusion

This work explains the stabilization role of monetary policy for small open economies. In keeping with the stylized facts, the banking sector was assumed to be oligopolistic in which the commercial bank marks up the lending rate over the risk-adjusted marginal cost of lending. The analysis then explains stabilization in the context of liquidity preference of banks that are oligopolistic. It was demonstrated using a bank portfolio model that although the mark-up rate increases volatility, a system of compensation could be used to manage excess liquidity so as to reduce the system risks. Compensation results because of the global financial architecture that requires a central bank to maintain sufficient foreign exchange reserves.

In order for the central bank to obtain the foreign currencies to meet the reserve target, it must purchase the currencies by creating the national unit of account. In doing to so the monetary authority injects excess reserves into the banking system. It is at this stage it can use a system of compensation because it has created a foreign currency constraint by intervening into the foreign exchange market. The commercial banks can be sold Treasury bills to mop up the excess reserves. Compensation, therefore, allows the central bank to pursue two nominal anchors in the long run – an exchange rate and an independent domestic

monetary policy in the face of *de facto* capital mobility. Liquidity preference of banks assists in this regard because monetary shocks would elicit an undershooting when the mark-up lending rate is binding.

The stabilization problem involves a trade-off between higher bank asset portfolio volatility and lower intensity of compensation. This trade-off occurs because the global financial system forces small open economies into a financial bind known as the foreign currency constraint. The central bank has to accumulate a sufficient level of foreign exchange reserves to guard against instability and for credibility. However, the process of accumulation injects excess reserves into the banking system. For the central bank to maintain stability it has to compensate the commercial banks which are also the dominant traders in the foreign exchange market. The compensation process will however decrease the level of excess reserves, thus increasing the volatility associated with commercial bank assets.

Appendix

Derivation of the FX selling rate

The foreign exchange market selling rate is derived using an imperfect competition model. The trader is assumed to possess market power in the foreign exchange market. The expected return on hoarding is given by the following expression $E_H = Er_F + \psi_2 \Delta S_S - (1-\psi_2) \Delta S_S$. Er_F is the expected or forecast foreign interest rate; ψ_2 is the probability the exchange rate will depreciate $(1-\psi_2)$ indicates the probability of appreciation. $\Delta S_S > 0$ denotes depreciation and $\Delta S_S < 0$ represents appreciation. These can be interpreted as percentage change. Let us now write out the profit function of the bank trader as follows

$$\Pi = S_S(X_S)X_S - S_B(X_S + H) + E_H H \tag{A1}$$

Where S_S is the selling rate, S_B the buying rate, X_S is the quantity of foreign currencies sold and H indicates the quantity hoarded. The quantity of foreign currencies bought is equal to $X_S + H$.

The first-order conditions are given as

$$\frac{d\Pi}{dX_S} = S_S(\varepsilon_S^{-1} + 1) - S_B = 0 \tag{A2}$$

$$\frac{d\Pi}{dH} = -S_B + E_H = 0 \tag{A3}$$

From equation A3 we have $S_B = E_H$. This equation suggests that the buying rate is equal to the expected return on hoarding. Substitute the latter into A2 to obtain the selling rate

$$S_S = \frac{E_H}{\varepsilon_S^{-1}+1} = \frac{Er_F + \psi_2 \Delta S_S - (1-\psi_2)\Delta S_S}{\varepsilon_S^{-1}+1} \qquad (A4)$$

Since this rate is a mark-up it lies above where the purely competitive rate would have been. This allows for the hoarding equilibrium to be established. The system requires that the amount of foreign exchange purchased be greater than that which is sold in the long run so that the commercial bank can retain a certain amount of hard currencies for its own proprietary activities.

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