Chapter 46

EQUILIBRIUM CREDIT RATIONING AND MONETARY NONNEUTRALITY IN A SMALL OPEN ECONOMY

YING WU, *Salisbury University, USA*

Abstract

This paper modifies the well-known Mundell–Fleming model by adding equilibrium credit rationing as well as imperfect asset substitutability between bonds and loans. When the representative bank's backward-bending loan supply curve peaks at its profit-maximizing loan rate, credit rationing can be an equilibrium phenomenon, which makes credit-dependent capital investment solely dependent upon the availability of customer market credit. With credit rationing, an expansion in money and credit shifts the IS curve as well as the LM curve even in a small open economy under a regime of fixed exchange rates, and the magnitude of offset coefficient between domestic and foreign asset components of high-powered money is less than one. In contrast, if there is no credit rationing, imperfect asset substitutability between bonds and loans per se cannot generate the real effect of money in the same model.

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46.1. Introduction

Is money non-neutral in a small open economy with international capital mobility and a fixed exchange rate regime? Can monetary policy affect real output in these circumstances? The answer to these questions is widely construed to be negative because the money supply has lost its role of a nominal anchor in this case.[1] In the orthodox money view, it is the interest rate that serves as the channel through which monetary policy affects the real sector of an economy; however, because the interest rate channel of monetary policy is highly correlated with exchange rates, and because the monetary authority commits to the maintenance of the fixed exchange rate, the consequent foreign exchange intervention by the monetary authority using official reserves necessarily washes out any real effect of the monetary policy that it has previously initiated. The same approach is used in most of the existing literature on small open economies, such as the traditional IS/LM analysis, which holds a lopsided view of bank liabilities and bank loans. Other than influencing interest rates via manipulating deposits (a money asset and bank liability), banks have no active leverage to play with; the role of bank loans escapes unnoticed since bank loans are grouped together with other nonmonetary assets such as bonds.

In contrast to the money view, the credit view of monetary transmission mechanism rejects the notion that all nonmonetary assets are perfect substitutes. According to the credit view, due to information asymmetries between borrowers and lenders in financial markets, banks can play a particular role in reducing information costs. It is financial intermediation that can help a firm with risk-sharing, liquidity, and information services; as a result, a large number of firms have in fact become bank dependent. Furthermore, although a rise in the loan rate increases, *ceteris paribus*, the bank's expected return by increasing interest payment when the borrower does not default, it lowers the bank's expected return by exacerbating adverse selection and moral hazard problems, and thus raising the probability of default. Hence, the bank's loan supply curve can be backward-bending, and credit rationing may occur as an equilibrium phenomenon.[2] Credit rationing *per se* makes monetary credit availability rather than interest rates in order to be the conduit for the real effect of money, therefore providing a major theoretical underpinning for the effectiveness of monetary policy under fixed exchange rates.

This paper begins with a study of the loan market setting with asymmetric information as a microfoundation for consumption and investment, and further develops a macromodel of a small open economy under a fixed exchange rate regime with perfect capital mobility in the bond market and imperfect asset substitutability between bonds and loans. As far as the credit view is concerned, this paper in spirit is close to Bernanke and Blinder (1988), who address the credit channel of monetary policy in a variant of the IS/LM model. They differ in several regards, however. Unlike Bernanke and Blinder, the model in this paper incorporates the possibility of equilibrium credit rationing while maintaining the assumption of imperfect substitutability of bank loans and bonds. With imperfect substitutability between bonds and bank loans, this paper nests both credit-rationed and credit-unrationed equilibrium regimes. Additionally, by placing the credit channel of monetary policy in the setting of a small open economy, this chapter allows the possibility to explore the relevance of the "monetary policy ineffectiveness" proposition in the existing mainstream small-open-economy literature.

Partly based on Wu (1999) by drawing on its microeconomic foundation setting, this study has made important and substantial revisions to its macroeconomic analysis. With the credit availability channel, this study shows that money in the fixed exchange rate model is not completely endogenous by appealing to the asymmetry between customer market credit and auction market credit under equilibrium credit rationing.[3] Incorporating bank credit into the fixed exchange rate model leads to two fundamental changes. First, it extends the scope for monetary policy to affect economy from the standard interest rate channel to the one including the bank lending channel and balance sheet channel as well; the latter two conduits can be independent of changes in interest rates. Second, and more importantly, monetary policy will no longer be deemed impotent since it can directly "shift" the goods market as well as money market equilibrium schedules in such a way that the targeted real effect could be achieved while the fixed exchange rate is sustained.

The next section presents the analytical structure of bank behavior and credit market; the following two sections explore how credit market conditions determine macroeconomic equilibrium in an open-economy IS/LM framework, and demonstrate the real impacts of monetary shocks through its credit channel, respectively. The final section concludes the study.

46.2. Bank Behavior and Credit Market

It is well known that due to the credit risk associated with adverse selection and moral hazard problems a banking firm has an inverse U-shaped loan supply curve with a backward-bending portion. This section essentially modifies the pedagogical model in Christopher and Lewarne (1994) by extending the spectrum of bank investment into the portfolio selection between bonds and loans.

The representative banking firm is assumed to hold exactly the required amount of reserves, and allocate all of its excess reserves between the two bank assets: bonds and loans. Thus, it chooses loans, l, subject to its balance sheet identity, to maximize its profits from lending

$$\Pi = \theta(\rho)l\rho + b_b r - dr - \frac{\gamma}{2}l^2 \quad \text{s.t.}\ b_b + l = (1-k)d, \tag{46.1}$$

where ρ is the loan rate, $\theta(\rho)$ the probability of loan repayment, γ the cost parameter of servicing loans, b_b denotes bonds held by the banking firm, r is the interest rate on bond, d represents total deposits, and k is the required reserve ratio for deposits.

Here, the low-risk or risk-free interest rate on bond holding is assumed to be the same as the interest cost of taking in deposits. Thus, deposits and bonds are perfectly substitutable assets to depositors so that they pay the same expected return per dollar. The key characteristic of the bank profit is that the repayment probability depends on the loan rate. Following the existing literature on equilibrium credit rationing, an increase in the loan rate makes it more likely for borrowers to default, hence the repayment probability is a decreasing function of the loan rate.[4] In addition, the representative bank takes the flow of deposits as given when making its portfolio decisions. Substituting the balance sheet identity into the bank's objective function and maximizing it with respect to l yields the banking firm's loan supply curve

$$l^S = \frac{\theta(\rho)\rho - r}{\gamma}. \tag{46.2}$$

Several implications of the loan supply curve can be derived. First, the loan supply curve is backward bending. The co-movement of the loan rate and loan volume hinges on the elasticity of the odds of repayment with respect to the loan rate. Only when the repayment probability is inelastic can a positive relationship exist between the loan rate and loan volume. To be specific, consider a linear repayment probability $\theta(\rho) = \phi - \psi\rho$, where ϕ is the autonomous repayment probability determined by noninterest factors such as the liquidity of balance sheet positions, and ψ measures the sensitivity of the repayment probability to the loan rate ($0 < \psi < \phi \leq 1$). Figure 46.1 depicts the loan repayment probability function. In the case of linear loan repayment probability function, the loan volume supplied increases with the loan rate until the loan rate achieves $\phi/2\psi$, after which a higher loan rate actually reduces the loan volume. In Figure 46.1, the loan rate at which the loan supply curve begins to bend backward points to the repayment probability halfway to its maximum within the possible range.

Substituting $\theta(\rho) = \phi - \psi\rho$ into (46.2) and differentiating (46.2) with respect to r,ϕ, ψ, and γ produces the responses of loan supply to the parameters of servicing loans. In particular, an increase in the bond interest rate, r, *ceteris paribus*, makes bond holding more attractive; accordingly, banks will reduce loans and hold more bonds. Another interpretation for the decrease of bank loans is based on the equivalence between the bond interest rate and the deposit rate: the higher the interest expenses of raising loanable funds by issuing deposits, the higher the economic cost of making loans. Next, banks tend to issue more loans when the autonomous repayment probability, ϕ, is higher, for example due to borrowers' increased net worth,. In addition, the larger the sensitivity of the repayment probability to the loan interest rate, ψ, the more deteriorating the problems of adverse selection and moral hazard, thus it is more likely for credit rationing to occur. Finally, an increase in the cost of servicing loans, γ, also tends to reduce loans as long as the expected return per dollar of loans exceeds the corresponding real opportunity cost.

Applying the envelope theorem to the representative bank's profit function in Equation (46.1) while incorporating Equation (46.2) and $\theta(\rho) = \phi - \psi\rho$ generates the following marginal bank profit with respect to the loan rate:

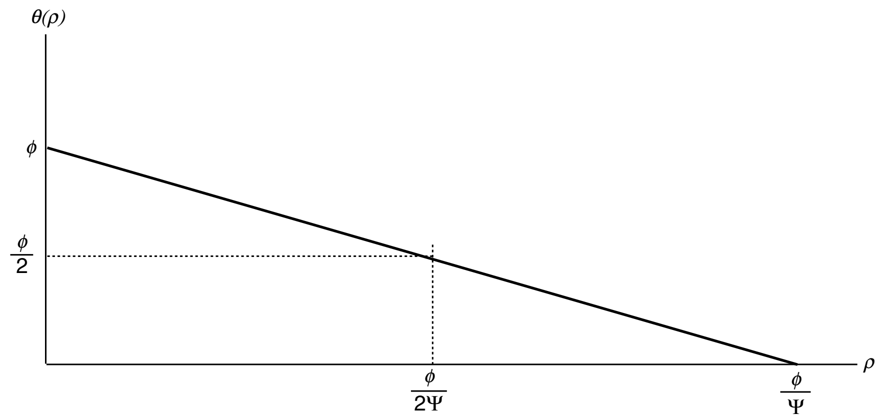

Figure 46.1. Loan repayment probability

$$\frac{d\Pi(\rho)}{d\rho} = \frac{1}{\gamma}[2\psi^2\rho^3 - 3\psi\phi\rho^2 + (2\psi r + \phi^2)\rho - \phi r]. \quad (46.3)$$

The bracket term on the RHS of Equation (46.3) is a cubic expression but two of the three roots are degenerated solutions at which loans are zero, respectively; thus the only feasible root for Equation (46.3) is $\rho^* = \phi/2\psi$, at which the bank's expected profits are maximized. Recall that the bank's loan supply curve peaks exactly at the same loan rate as the profit-maximizing loan rate here. Therefore, the result suggests the existence of equilibrium credit rationing. Further, the result for profit-maximizing loans also imply that the loan interest rate exceeds the bond interest rate such that $\rho > \sqrt{r/\psi} > r$, which captures the existence of risk premium of bank lending, and therefore signifies the imperfect substitutability between loans and bonds.

Moving from the representative bank to the aggregate banking system, the aggregated bank balance sheet identity shows $B_b + L + R = D$, where B_b represents the bonds held by banks, D denotes deposits, and L is the volume of loans. For simplicity, currency is abstracted from the model. The required reserve of the banking system, R, constitutes the monetary authority's liabilities, or high-powered money, H, which are generated by its acquisition of bonds (B_a) and foreign exchange (F). The high-powered money in this framework is composed of exclusively required reserves; the money supply can be expressed by H/k.

Suppose there are n banks, with the representative bank's supply of loans specified in Equation. (46.2) aggregating, and which generates the total supply of loans. A structural view of the aggregated balance sheet of banks suggests that if banks allocate a fraction of their excess reserves into loans and the rest into bonds, the aggregate supply of loans is given by $\varepsilon(1-k)\cdot(H/k)$, where ε represents the ratio of loans to excess reserves. Accordingly, the share of loans in excess reserves must characterize the banks' loan-making behavior and it is thus actually a function of the same set of variables that determine aggregate supply of loans.

$$L^S = \underset{\quad ?\;\; -\;\; +\;\; -\;\; -\;\; +}{\varepsilon(\rho, r, \phi, \psi, \gamma, n)}\left(\frac{1-k}{k}\right)H, \quad (46.4)$$

where the symbols underneath each of the arguments in $\varepsilon(\bullet)$ denote the signs of the partial derivatives associated with them. For simplicity, it is assumed that bank credit is the only debt instrument for firms to finance their investment; investment demand and the demand for bank loans are taken to be equal.[5] Thus, aggregate demand for loans is negatively related to the loan interest rate, and its standard linear form is

$$L^{D} = \alpha - \beta\rho. \tag{46.5}$$

Indeed, as demonstrated by the existing literature on markets in disequilibrium, the loan market may or may not be at the market-clearing equilibrium.[6] Nevertheless, unlike disequilibrium economics, the loan quantity traded in the market is not uniformly characterized by the minimum of demand and supply sides. Loan rationing can arise in an unrestricted market setting flawed only by plausible information asymmetries; the loan rate can always freely adjust to a level consistent with market forces driven by the profit-maximization incentives. Therefore, credit rationing could exist at the profit-maximizing loan rate, $\rho^* = \phi/2\psi$, and sustain as an equilibrium phenomenon. The excess demand fails to drive the loan rate upward because the associated credit risk would reduce banks' profits; however, if at the same loan rate there is an excess supply, the loan interest rate will adjust downward to clear the loan market, since holding excess reserves does not add to profits at all.

Consider the demand for and supply of loans specified in Equations (46.4) and (46.5), respectively, then the equilibrium interest rate in the loan market is given by

$$\rho = \begin{cases} \dfrac{\phi}{2\psi}, & \text{if } L^{D} \geq L^{S} \text{ at } \dfrac{\phi}{2\psi}; \\ \min(\rho_1, \rho_2 | L^{D} = L^{S}), & \text{if } L^{D} < L^{S} \text{ at } \dfrac{\phi}{2\psi}, \end{cases} \tag{46.6}$$

where ρ_1 and ρ_2 are the two roots of the quadratic equation given by $L^{D} = L^{S}$. Recall that $\rho^* = \phi/2\psi$ is the loan rate that corresponds to the maximum quantity of loans. If an excess supply exists at ρ^*, L^{D} must cross L^{S} once at a loan rate below ρ^* and once at a loan rate above ρ^*. Since ρ^* is the profit-maximizing loan rate, the bank has no incentive to raise the loan rate to any level above ρ^*, and credit is then rationed at the equilibrium. On the other hand, the profit-maximizing loan rate is not attainable if there is excess supply at ρ^*, since the bank cannot force the firms to borrow in excess of the amount that maximizes their profits. It follows that if a bank cannot maximize its profit at ρ^* due to deficient demand, the best attainable outcome for the bank is to allow a downward adjustment in the loan rate until the loan market clears. Therefore, the loan quantity traded is at the market-clearing equilibrium level if the market interest rate of loans is below the banks' desired level, ρ^*; otherwise, it would be determined by supply at the profit-maximizing loan rate.

46.3. Macroeconomic Equilibrium

Assume that investment is solely dependent on the availability of bank credit, and investment demand is equivalent to the demand for loans. Based on the analytical results in the preceding section, there is an implicit positive relationship between the interest rates on loans and bonds, which can be explicitly expressed as $\rho = \lambda(r)$. If credit demand is not rationed in the loan market, we have $I(\rho) \equiv L^{D}[\lambda(r)]$, with $I' = L'^{D}\lambda' < 0$, however, with credit rationing, investment demand is totally determined by the aggregate supply of loans.

46.3.1. Case for Credit Rationing

With credit rationing, the quantity of loans effectively traded is given by L^{S} as specified in Equation (46.4). In this case, the monetary authority can help loosen credit rationing through open market purchases: the nonbank public, which sells bonds to the monetary authority deposits the proceeds into banks, and the loan supply increases with the deposits. The rationing situation improves and the resulting increase in output increases money demand, and thus imposes upward pressure on the interest rate and the exchange value of the domestic currency. This in turn relieves the money market of the adjustment burden resulting from the monetary authority's commitment to the fixed exchange rate under the circumstances of open market purchases. Therefore, following the monetary authority's open market purchases, although there are market forces to purchase foreign bonds, which leads the monetary authority to sell foreign reserves, the authority's operation on foreign reserves does not fully sterilize its open-market operation on domestic bonds so that its net effects are to expand loans and increase output.

Credit rationing enhances originally existing imperfect asset substitutability between bonds and loans, and lending to domestic capital investment under rationing is expected to be more preferable for holding foreign bonds. Without losing generality, a thought experiment could be to assume credit movement to be "segmented" in such a way that the goods market takes only credit expansion from open-market purchases on domestic bonds whereas it is asset portfolio adjustment rather than disinvestments in real capital goods that responds to any credit contraction from open-market sales on foreign bonds.[7] Hence, grouping Equation (46.4) with the equilibrium conditions of the goods market and the money market yields the following simple macroeconomic models:

$$Y = C(Y) + \varepsilon\left(\frac{1-k}{k}\right)B_a + X(Y, eP^f) \tag{46.7}$$

$$B_a + F = kl(Y, r^f). \tag{46.8}$$

Note that the domestic price level is normalized at unity since price rigidity applies to the short-run macroeconomic model. Besides the derivatives property of L^S stipulated in (Equation (46.4)), the other relevant derivatives in the above model satisfy the following conditions: $C' > 0, X'_Y < 0$, $i_Y > 0$, and $l'_r < 0$. Equation (46.7) is the private-sector-only IS equation with the presence of the loan market in an open economy, where $C(\cdot)$ is consumption function, $\varepsilon[(1-k)/k]B_a$ is the supply of loans available to investment from the monetary authority's open market purchases, $X(\cdot)$ is the net export function, e is the domestic currency price of foreign exchange, and P^f is the foreign price level. Equation (46.8) represents the "monetary" version of the open-economy LM equation (or the balance-of-payments equation). r^f is the foreign interest rate on bonds, which equals to r by perfect capital mobility in the bond market, and $l(\cdot)$ is the demand for money, increasing in income and decreasing in the interest rate.

There are three endogenous variables when credit rationing exists in the loan market: income Y, loan quantity L, and the international reserve component in the monetary base F. These are determined simultaneously in three equations (Equations (46.4), (46.7), and (46.8)). Although money is partly endogenous due to perfect capital mobility in the bond market and the monetary authority's commitment to maintain fixed exchange rates, the endogeneity of money is not complete due to the credit channel of monetary transmission mechanism, and thus money is not completely neutral. Changes in the money supply serve to shift not only the LM curve but also the IS curve, so that the responsive change in money does not totally wash out the real effect generated by the monetary change associated with open-market purchases. Therefore, the credit channel rescues monetary policy from the charge of impotency.

46.3.2. Case for Nonrationing of Credit

In the regime in which loans are not rationed, both the loan quantity and the loan interest rate are endogenous variables in addition to income and the international reserves of the central bank. The general equilibrium system consists of the loan supply Equation (46.4), the monetary version of the balance-of-payments Equation (46.8), and two other basic equations given below:

$$Y = C(Y) + (\alpha - \beta\rho) + X(Y, eP^f) \tag{46.9}$$

$$\alpha - \beta\rho = \varepsilon(\rho, r, \phi, \psi, \gamma, n)\left(\frac{1-k}{k}\right)(B_a + F) \tag{46.10}$$

Equation (46.9) is the standard IS equation, unlike the credit-rationing counterpart in Equation (46.7), the interest rates play a role in the determination of income. In Equation (46.10), its LHS is the demand for loans, and the RHS the supply of loans. Equations (46.4), (46.8), (46.9), and (46.10) implicitly determine the equilibrium values of Y, L, ρ, and F.

46.4. Comparative Static Analysis

The present section examines the responses of the equilibrium income, loan quantity, loan interest rate, and international reserve component of the monetary base to a monetary shock initiated throughan open-market operation conducted by the monetary authority. These impacts vary with the rationing of credit.

Consider the credit-rationing model. Differentiating Equations (46.4), (46.7), and (46.8) with respect to L^S, Y, F, and B_a produces the following results:

$$\frac{dL^S}{dB_a} = \frac{kl_Y\left(\varepsilon\frac{1-k}{k}\right)^2}{1 - C' - X'} > 0 \tag{46.11}$$

$$\frac{dY}{dB_a} = \frac{\varepsilon\left(\frac{1-k}{k}\right)}{1 - C' - X'} > 0 \tag{46.12}$$

$$\frac{dF}{dB_a} = -1 + kl_Y\frac{\varepsilon\left(\frac{1-k}{k}\right)}{1 - C' - X'} < 0 \tag{46.13}$$

Under the fixed exchange rate system, changes in the official international reserves mirror the status of the balance of payments. Starting from the open-market purchase on the part of the monetary authority, the money supply (bank deposits) increases and multiplies through the money multiplier $1/k$ as high-powered money B_a increases. Banks usually tend to make more loans due to an expanded volume of deposits, and the increased loans relax the credit constraint facing the economy so that income rises, as measured in Equations (46.11) and (46.12). Finally, transaction demand for money also increases as a result of increased income but the generated money demand via the credit channel is less than the initial increase in money supply, i.e. the money created by the central bank outpaces the growth of money demand. The resulting excess supply of money must be spent on the purchase of foreign goods or financial assets. As the domestic residents exchange their domestic money for foreign money, the central bank loses international reserves and the money account of the balance of payment moves into a deficit ($dF < 0$). The consequent money contraction will sustain until the disequilibrium in the money market disappears and the balance of payments is back to equilibrium at the foreign interest rate, r^f.

Examining Equation (46.13) suggests that the credit channel per se plays a role to preserve the legacy of monetary policy. The increase in money demand generated from the credit-driven income expansion minimizes the adjustment burden that has fallen upon the official international reserves, so that the absolute value of the offset coefficient is less than 1 and monetary control is not completely lost.[8] The economics reasoning and the pertinent empirics suggest that the second term on the RHS of Equation (46.13) is a positive fraction, and in that term a large credit multiplier, $\varepsilon \cdot (1 - k)/k$, serves to reduce the magnitude of the offset coefficient given by Equation (46.13). Hence, the stronger the credit channel is, the more legacy of monetary policy can be reserved. However, without considering the credit channel, the endogenous change in foreign reserves would completely offset the initial change in the credit brought about by the central bank's open-market operations, and then the traditional result of monetary neutrality would follow.

Figure 46.2 summarizes the analytical results in a four-quadrant diagram. Quadrant I depicts the IS-LM-BP curves in the traditional general equilibrium framework, with the initial credit-rationing equilibrium as shown in Quadrant III, and Quadrant II depicts the linearized implicit function $\rho = \lambda(r)$. Consider an expansionary monetary policy initiated by the open market purchase. The LM curve shifts rightward initially to the position of the dashed line, causing the IS curve to shift in the same direction through the credit channel. This is reflected in Quadrant III by the downward shift of the aggregate loan supply curve, with the loan interest rate remaining at the profit-maximizing

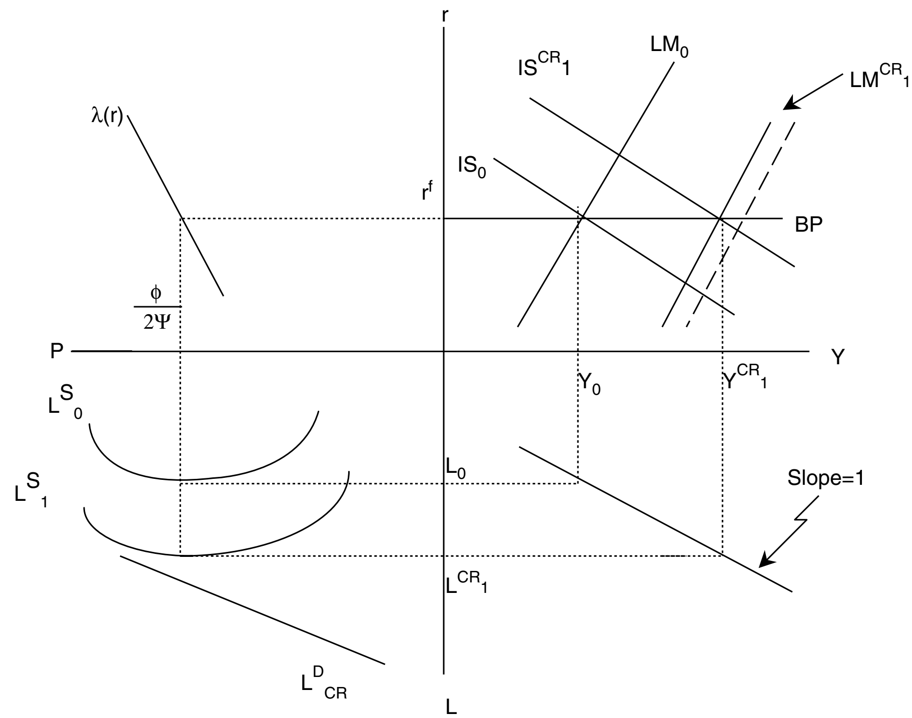

Figure 46.2. Monetary non-neutrality under credit rationing in a small open economy with a fixed exchange rate

equilibrium level. Due to the tight credit market, the resulting increase in loans directly translates into the corresponding increase in income at the full scale, as depicted in Quadrant IV.[9] The increased money demand mitigates the excess supply pressure on the money account of the balance of payments, though the equilibrium in the money market and foreign exchange market still entails a reduction of official international reserves held by the central bank. As a result, although the LM curve shifts backward away from its initial post-shock position as given by the dashed line, it does not shift all the way back to LM_0; instead, LM_1^{CR} meets IS_1^{CR} at Y_1^{CR} under the circumstances.

Now let us turn to the situation in which there is no credit rationing. Differentiating Equations (46.4), (46.8), (46.9), and (46.10) with respect to L, Y, ρ, F, and B_a generates the following comparative static results:

$$\frac{dL}{dB_a} = 0, \qquad (46.14)$$

$$\frac{dY}{dB_a} = 0, \qquad (46.15)$$

$$\frac{d\rho}{dB_a} = 0, \text{ and} \qquad (46.16)$$

$$\frac{dF}{dB_a} = -1. \qquad (46.17)$$

As shown by the comparative static results in Equations (46.14) through (46.17), there is a sharp contrast between the cases of credit rationing and nonrationing of credit in terms of monetary neutrality and the effectiveness of monetary policy. In the absence of credit rationing, the credit channel can only operate through its impact on the loan interest rate. Nevertheless, the loan interest rate is directly related to the world interest rate through $\rho = \lambda(r)$, and the world interest rate cannot be influenced by a small open economy's monetary authority. Following an open-market purchase, once the domestic interest rate tends to decline from the level of the world interest rate, and thus the exchange rate may deviate from its par accordingly, the monetary authority is obliged to contract money and credit by selling its foreign reserves until the asset prices restore their initial equilibrium levels, therefore rendering the intended monetary expansion ineffective.

46.5. Conclusion

This paper has demonstrated that equilibrium credit rationing plays a role in preserving the legacy of monetary policy even under a fixed exchange rate regime with perfect international capital mobility. Under equilibrium credit rationing, credit-dependent investment transmits a monetary shock into changes in real income, and thus transaction demand for money, therefore sharing the adjustment burden of maintaining the fixed exchange rate, which would otherwise completely fall upon the official international reserves. The magnitude of offset coefficient becomes less than 1 since any expansion of domestic credit and its real effect is only partially offset by the associated monetary contractions happening through international financial portfolio investment. The degree of retained monetary autonomy depends on the magnitude of the credit multiplier under rationing.

When there exists equilibrium credit rationing, monetary contractions resulting from the monetary authority's endogenous open-market sale of foreign assets will take a conduit of portfolio disinvestments rather than real capital disinvestments. Therefore, the asymmetry between domestic real capital investment (customer market credit) and financial portfolio investment (auction market credit) in responding to impulses of open-market operations holds the key for monetary nonneutrality.

In contrast, incorporating credit market without credit rationing into analysis fails to rescue monetary policy from its neutrality in a small open economy committed to fixed exchange rates. The assumption of imperfect substitutability *per se* between auction market credit (bonds) and customer market credit (bank loans) is insufficient for monetary autonomy in the Mundell–Fleming model, though it is adequate for the modified IS-LM type model (Bernanke and Blinder, 1988) in which the features of small open economy and fixed exchange rates do not appear.

NOTES

1. This line of analysis can be traced back to Fleming (1962) and Mundell (1963).
2. In their influential paper, Stiglitz and Weiss (1981) provide information-based analysis of equilibrium credit rationing. Blinder and Stiglitz (1983) further argue that monetary policy works through bank credit for there are no close substitutes for it at least as far as most medium and small firms with relatively high risk are concerned. For a comprehensive review of the credit view literature, see Kashyap and Stein (1993).
3. It is shown indeed in my earlier paper (Wu, 1999) that monetary policy can have real effects in both credit-rationing regime and the market-clearing regime if the central bank's foreign exchange reserves are independent of open-market operations. While considering the endogeneity of the monetary base, Ramírez (2001) argues that "monetary policy is still ineffective in influencing output under a fixed exchange rate, even with an operative credit channel." Nevertheless, in response to Ramírez (2001), this paper shows particularly how credit-rationing channel can save monetary policy from being charged with impotence even in a small open economy with complete capital mobility and fixed exchange rates.
4. As shown by Stiglitz and Weiss (1981) and others, the loan rate and intermediary charges may have both an adverse selection effect and a moral hazard effect on the risk of a pool of loans. Raising the loan rate shifts the mix of borrowers toward riskier firms and their projects to be financed by loans, thus reducing the lender's expected return. As a result, the intermediary may maximize its expected profits by setting an interest rate at a level that results in an excess demand for bank credit.
5. More generally, the demand side of the loan market is influenced by the interest rates on the two credit instruments, loans and bonds, as well as aggregate income, see Bernanke and Blinder (1988).
6. For studies on disequilibrium markets under price rigidity, see Barro and Grossman (1971), and Muellbauer and Portes (1978), among others.

7. Although the assumption of perfect capital mobility rules out the possibility of "home bias" that would otherwise explain the asymmetry between holding of domestic assets and holding of foreign assets, it is credit rationing that holds the key for the real effect of monetary policy here.
8. Some studies have provided the evidence for a certain degree of monetary autonomy under fixed exchange rates. For example, Cumby and Obstfeld (1983) and Rennhack and Mondino (1988) find that structural estimates of offset coefficients are less than one. Also, using Granger causality tests for a number of countries, Montiel (1989) and Dowla and Chowdhury (1991) report that some domestic financial aggregates like money and credit Granger-cause domestic real output.
9. For simplicity, the income multiplier effect is ignored here.

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