Economics Bulletin

Volume 29, Issue 2

When banks are patients: The factors that determine treatment

Victoria Miller
UQAM

Abstract

The paper argues that the factors that determine treatment priority in socialized medicine, namely gravity of complaint and patient "importance" are similar to those that determine whether or not a frail banking system will be bailed out in a fixed exchange rate regime.

Citation: Victoria Miller, (2009) "When banks are patients: The factors that determine treatment", *Economics Bulletin*, Vol. 29 no.2 pp. 1063-1069.
Submitted: Dec 22 2008. **Published:** May 19, 2009.

1. Introduction

What factors determine which patients receive emergency medical treatment in socialized medicine? When resources are abundant, all patients seeking assistance are seen. However, when resources are limited, as in Canada, then patients are assigned a priority status and some are turned away. Apart from time of entry, what determines priority? Certainly the seriousness of the complaint matters. However, while it has not been tested, an admitting physician may also have a "healthy" bias in favour of patients that he/she deems "important" in an economic or social sense. Certainly, "importance" should not matter for all human life is of equal value and attention should be accorded first to the patient with the more life-threatening condition. However, if two patients are in a similarly dire situation, it is plausible that the healthcare practitioner will attend first to the political official, financial executive or even personal friend before the street urchin; just as it is likely that between two fortune-500 CEOs, attention will be accorded first to the patient with the more urgent situation. Yes it seems that both patient importance and problem severity will determine emergency treatment.

The present paper illustrates that the same factors that likely determine medical treatment priority, are similar to those that determine whether or not a banking system will receive a bail-out or "cash infusion" in a fixed exchange rate regime. It is shown that if foreign exchange reserves are abundant (i.e., a bailout can be engineered without incurring a cost in terms of currency instability) then any banking sector or bank needing assistance will be bailed-out. However, if foreign exchange reserves are insufficient to bailout banks without compromising the currency, then only very important and feeble banks will receive medical attention and be bailed out.

The note proceeds as follows: In section 2, a framework is presented to determine how output and the exchange rate are affected when the central bank does and does not recapitalize a fragile banking sector. The analysis is done for the cases in which central bank reserves are sufficient and then are not sufficient to recapitalize banks without compromising the currency peg. A loss function is then specified to determine how policy makers will respond to bank fragilities given the level of foreign exchange reserves. It will be shown that in a constrained optimization (i.e., foreign exchange reserves are insufficient), only very sick and very important banking sectors (or banks) will be bailed out. In a final section, the nineteen-nineties banking crises in China and Argentina are discussed to provide anecdotal support for the model.

2. Model

To determine bailout likelihood, a simplified version of the framework used in Miller (2008) is presented. The model is based on the following five equations:

$$m - p = \alpha - \gamma i \tag{1}$$

$$p = p^* + e \tag{2}$$

$$i = i^* + \rho(\chi), \rho \geq 0, \rho' > 0, \rho(0) = 0 \tag{3}$$

$$m = \ln(R + D) \tag{4}$$

$$y = \tilde{y} - \delta i \tag{5}$$

The first two equations are the standard money market equilibrium condition and purchasing power parity respectively. m is the log of the money supply which equals the sum of central bank foreign exchange reserves, R, and domestic credit, D, as shown in equation (4). p is the price level, e the exchange rate, i, the domestic interest rate and, y and ỹ are actual and "natural" levels of output respectively. All lower case variables except interest rates are in logs and asterisks indicate foreign variables.

Equation (3) is the modified interest parity condition assuming perfect capital mobility and instantaneous price adjustment. It includes a risk premium, ρ, which is an increasing function of χ, the amount by which the banking sector is undercapitalized. The premium represents bankruptcy or insolvency fears. Finally, equation (5) is the output equation and demonstrates that interest rate hikes reduce output. δ in that equation measures output's sensitivity to interest rate changes and will be larger the more important the banking sector for financing economic transactions.

As i* and p* do not play a role in the analysis that follows, both are set equal to zero. Thus, substituting equations (2), (3) and (4) into equation (1), yields equation (6), the relationship between the central bank's monetary policy, the risk premium and the equilibrium exchange rate.

$$\ln(R + D) - \bar{e} = \alpha - \gamma\rho(\chi) \tag{6}$$

Before any unfavorable shock to capital adequacy ratios, equation (6) is

$$\ln(R_0 + D_0) - \bar{e} = \alpha \tag{7}$$

where a 0 subscript indicates a starting value and ē is the officially fixed exchange rate.

Equation (7) is the economy's starting point. Then, the representative banks become short an amount χ_0, for their capital ratios to be adequate and so the risk premium to $\rho(\chi_0)=\rho_0$. Asset market equilibrium can then be reestablished by either a decrease in the money supply, an increase in the exchange rate and/or a decrease in the risk premium. Notice that the more important (i.e., the larger γ) and the sicker (i.e., the larger ρ) the banking sector, the more the money supply must decrease or the exchange rate increase to clear asset markets. We now examine which of these adjustments will occur in each of the policy options available to central banks: Doing nothing or recapitalizing/bailing-out banks by printing money. For expositional purposes, it is assumed that a decrease in the money supply of X_0 will cause the interest rate to increase by ρ_0 and that an amount Z_0 of new capital is needed to fully recapitalize banks. Z_0 will be an increasing function of ρ_0. For simplicity, X_0 is assumed to be less than R_0. The reader is referred to Miller (2006 and 2008) to see how the analysis may change if this assumption is relaxed.

We now consider the effects of the two policies: First, for the case in which reserves are sufficient to recapitalize banks without causing a violation of the fixed parity; and then for the case that a bailout will compromise the peg.

If $R_0>Z_0$, then the central bank can adopt either policy without compromising its currency peg. However, new credit must be extended to banks for the premium to revert to zero. If the central bank does nothing, then capital will flow out of the economy until the interest rate increases by ρ_0. Here the money supply will fall to $R_0+D_0-X_0$ and the risk premium will remain positive. If on the other hand, the central bank lends new domestic credit to banks, then while the domestic credit component of the money supply will increase to D_0+Z_0, as the premium will be zero, the equilibrium money supply will remain equal to its starting value. Thus, the increase in central bank credit will be offset by an equivalent decrease in foreign exchange reserves of Z_0. That is for the case that $R_0>Z_0$, output will be $\tilde{y}$ and $\tilde{y}-\gamma\rho$ when the central bank does and does not bail-out banks respectively.

If on the other hand, foreign exchange reserves are insufficient to recapitalize banks, then R_0 will be less than Z_0. Here, the central bank will be unable to fully recapitalize banks without compromising the currency peg. If the central bank does nothing, then again capital will flow out of the economy until interest rates increase by ρ_0. Since X_0 is assumed to be less than R_0, the outflow will not compromise the peg. The money supply will again fall to $R_0+D_0-X_0$, output will be given by $\tilde{y}-\gamma\rho$ and the exchange rate will remain fixed and equal to $\bar{e}$.

If instead of doing nothing, the central bank uses new domestic credit to fully recapitalize banks, then the premium will revert to zero. However, as domestic credit will be higher than initially and foreign exchange reserves can only fall to zero, the exchange rate will have to increase to clear asset markets. In the case of a bailout with insufficient reserves, output and the exchange rate will be given by $\tilde{y}$ and $\ln(D_0+Z_0)-\alpha$ respectively. It is readily verifiable that this exchange rate is greater than $\bar{e}$.

To ascertain how policy-makers will react to a drop in capital adequacy ratios, the following loss function is specified:[1]

$$L=(y-\tilde{y})^2+C, \quad \begin{array}{l} C=0 \ for \ e=\bar{e} \\ C=c \ for \ e>\bar{e} \end{array} \tag{8}$$

Equation (8) indicates that policy-makers wish to keep output close to its natural level and suffer a loss of credibility if the currency peg is violated.

Substituting the above findings into equation (8), we can now calculate the loss associated with each of the policy responses available to the central bank when reserves

[1] Here it is implicitly assumed that today's policy response does not affect future bank behavior and so we completely abstract from moral hazard considerations. For a paper which looks at how policy-maker objective function affects bank behavior see Miller (2008).

are and are not sufficient. Assuming first that foreign exchange reserves are sufficient to recapitalize banks, the losses associated with the two policy options are $L_{NS}=(\delta\rho_0)^2$ and $L_{DS}=0$, the loss of doing nothing and then the loss of doing something when reserves are sufficient. As the loss of doing something is trivially less than the loss of doing nothing, the central bank will always respond to any loss of bank solvency and bailout banks when resources are abundant. That is when the demands on the system are not too demanding and resources are sufficient, then all patients will receive medical attention.

If, on the other hand, foreign exchange reserves are insufficient to recapitalize banks (i.e., $R_0 < Z_0$), then the results are less clear. Substituting the resulting values for output for this scenario into equation (8) and given that $e > \bar{e}$, the losses associated with the policies are $L_{NI}= (\delta\rho_0)^2$, the loss of doing nothing, and $L_{DI} = c$, the loss of doing something when reserves are insufficient. Thus, if $(\delta\rho_0)^2 > c$, then a capital infusion will be administered. Otherwise, the "patient" will be denied treatment. In other words, for a given credibility cost of printing money, the more important and ill the banking sector, the more likely a bailout will occur when reserves are limited. Moreover, as Z_0 is an increasing function of ρ_0, the sicker the banking sector, the more likely resources will be insufficient.

3. Discussion and Conclusion

Above we argued that extrapolating from moral hazard considerations, the same factors that determine medical treatment priority in socialized medicine (i.e., severity of affliction and patient importance), are similar to those that determine whether or not the banking sector will be bailed out in a fixed exchange rate regime. It was shown that when resources are abundant (i.e., $R_0 > Z_0$) and so there is a no "cost" of recapitalizing banks, then a banking sector needing assistance will be bailed out (i.e., all sick patients will receive medical attention). Moreover, as Z_0 is an increasing function of ρ_0, the less ill the banking sector, the more likely resources will be sufficient to bailout banks. If however banks are very sick (i.e. ρ_0 and Z_0 are large), then resources will likely be insufficient and a bailout will only come at the cost of currency instability. When this is the case, then only the very ill (i.e., large ρ_0) and very important (i.e., large δ) banking sectors will be bailed out at the expense of currency peg credibility.

In the above analysis, it was implicitly assumed that there is one representative bank (i.e., banks are identical) and policy-makers decide whether or not to bailout the entire banking sector. The analogy to healthcare is therefore imperfect since in a constrained healthcare system, physicians see as many patients as possible and turn away those with less pressing "emergency" situations when resources are constrained. However, if we allow for heterogeneous banks, then the analogy can be made more exact.

Let δ and ρ_0 now denote economy-wide averages and Z_0 the cost of bailing out all insolvent banks. δ_i is then the economic importance of bank i, ρ_{0i} is bank i's risk premium and Z_{0i} denotes the cost of bailing out bank i. Now allowing for banks of different sizes and frailties, if $R_0 > Z_0$, then policy-makers will bailout all banks needing assistance. If however $R_0 < Z_0$, then policy-maker will bailout as many banks as possible

without derailing the peg. Such bailouts will be administered on an urgency and importance basis as determined by $\delta_i\rho_{0i}$ which measures the economic costs of bank i's frailties. Therefore, ordering banks according to the size of their $\delta_i\rho_{0i}$, policy-makers will bailout those banks with largest $\delta_i\rho_{0i}$ until $\sum Z_{0i}$ just exhausts R_0. Letting ρ_0' and δ' denote the modified economy-wide averages after initial bailouts have been administered, if $(\delta'\rho_0')^2 \rangle c$ then all other banks needing assistance may receive aide at the expense of the currency peg.

Anecdotal support for these assertions is provided by the nineteen-nineties banking crises in Argentina and China; two countries with highly credible exchange rate pegs. Many of China's banks were frail and ailing throughout the nineteen-nineties. At the end of 1998 China's four large state-owned commercial banks which accounted for almost 70 percent of its banking system assets, were deemed insolvent and the net losses associated with their difficulties were estimated to reach 47% of GDP in 1999 (Caprio and Klingebiel (2003). Seen within the context of the model presented in the previous section, China's ρ_0 was extremely large. Moreover, banks are extremely important financial intermediaries in China's as their deposits are more than 100% of GDP! Thus, the economic costs of bank fragilities are great in China and its δ is large. Finally, the Bank of China's foreign exchange reserves were so large during the period that it was able to bailout all of its state-owned banks without derailing its peg. Hence, in 1998 the Bank of China administered a $32.6 billion bailout of its four state-owned banks leaving its yuan/dollar peg unchanged.[2]

Throughout the nineteen-eighties and –nineties, the Argentine economy also suffered a series of banking crises. However, central bank foreign exchange reserves were insufficient for a money financed bailout of the entire banking sector and the continued functioning of its currency peg was seen as crucial for its newly obtained credibility and economic reforms (i.e., C was large in the model). Moreover, in Argentina, bank deposits are only around 20% of GDP and so banks are not as important financial intermediaries in Argentina as in China (i.e., Argentina's δ is relatively small compared to China's). Finally, while state-ownership is also important in Argentina, Argentine banks tend to be smaller and homogeneous than their Chinese counterparts. Hence, many Argentine banks were allowed to collapse, merge or close during the nineteen-nineties. However, when bank difficulties inflamed into a series of runs and deposit suspensions, ρ_{0i} and ρ_0 spiked and the losses of continued banking malaise outstripped those of lost credibility (i.e., $(\delta\rho_0)^2$ became greater than c). Policy-makers therefore stepped in and launched a $7.7 billion dollar bailout of most of its banks in 2002 that contributed to a collapse of its currency peg in the following days.

To conclude, the same factors that determine medical treatment priority in socialized medicine determine which banks receive a bailout or cash infusion in a fixed exchange rate system. When resources are abundant, all patients needing assistance are seen without unreasonable delay. However, when resources are limited, then patients with less pressing medical conditions or are of less "importance" are turned away,

[2] The Bank of China again lent $45 billion of its foreign exchange reserves to its two largest banks in 2004 (Economist Jan 2005).

assigned long treatment delays or given some other discouragement to seeking emergency services. In China, resources were sufficient to bailout the most important and frailest banks needing assistance and their situation was urgent. Therefore, Chinese policy-makers bailed out their four largest banks without affecting their currency peg. In Argentina, on the other hand, resources were insufficient to bailout all banks and so many banks were left to fail or close. Moreover, many banks that were did receive treatment were given "band-aide" remedies such as mergers or take-overs. However, when general sickness gave way to a full-blown epidemic, policy-makers stepped in with a bailout that cost them the peg. That is resources had to be called in from other parts of the medical system or other government programs to prevent the epidemic from developing into pandemic.

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