

# 3.1

## Monetary Policy in a Multi-Polar World

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► **Abstract:** *This paper focuses on monetary policy in the context of a global economy with two or more large countries. It attempts to deal with several questions raised by the domestic ineffectiveness and unintended global results of the United States' policy of quantitative easing. Our analysis shows that in a world of truly free capital mobility, the effects of monetary policy may be different – typically weaker – than in a closed economy. Restrictions on free capital may therefore be advantageous.*

**Keywords:** central banking; flow of funds; globalization; managing the crisis; monetary policy; open markets

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That monetary policy in an open economy is markedly different from that in a closed economy has long been recognized – but typically, discussions have focused on small economies, where the effects are mediated largely through the exchange rate.<sup>1</sup> After all, with perfect capital markets, a small country takes the global real interest rate as given. An increase in the supply of its currency naturally leads to a decrease in its price. Dynamics can be complicated, since the cost of holding on to a currency entails capital gains and losses as well as foregone earnings.

This chapter focuses, by contrast, on a global economy with two (or more) large countries, where the action of each has a non-negligible effect on the global equilibrium, in a context in which the market equilibrium, in the absence of government action, would not itself be Pareto optimal.<sup>2</sup> Thus, we explicitly focus on situations where markets are not self-correcting, and there is a need to use monetary policy (e.g., to bring the economy closer to full employment).<sup>3</sup>

The motivation for this chapter's inquiry is partly the consequences of the US policy of quantitative easing (QE). In a closed economy, central bank purchases of long-term government bonds would drive up the price, lowering long-term interest rates, and encouraging long-term investments, like housing. Banks, rather than investing in long-term government bonds (the value of which may well fall in the future when the monetary policy is reversed) are induced to lend, making funds more available, on better terms.

The chain of reasoning linking expansionary monetary policy in the United States with increased activity in the United States is complicated. Several questions must be answered: (a) Why should central bank purchases of long-term bonds lower long-term interest rates? (b) Why should the lowering of long-term government rates actually lead to more lending, at more favorable terms? (c) Why, in a globalized world, should the increased liquidity lead to increased investment in the United States (or more generally, the country making available the increased liquidity)? (d) Why, in a globalized world, shouldn't the effect of the increased liquidity be offset (at least partially) by counteractions on the part of other central banks?

(There are, of course, a number of other mechanisms through which the effects of QE are allegedly felt, which we discuss later in this chapter. Even if present, they are likely to be small, and indeed, some of the effects are likely to be adverse.)

Thus, critics of the US QE<sub>2</sub> and QE<sub>3</sub> claim: (a) the effects on long-term government interest rates have been small; (b) the effects on rates

at which private parties can borrow has been even smaller;<sup>4</sup> (c) it has not led to substantial increases in lending to the only sector which is really constrained, small and medium sized enterprises;<sup>5</sup> (d) the major impact of the increased liquidity has been to increase demand in emerging markets (and perhaps to support asset price increases globally), and (e) in response to the overheating to which it has contributed in the emerging markets, the central banks there have engaged in "currency wars," and have constructed impediments to the free flow of capital. In effect, they have tried to undo the effects of what they view as the United States' competitive devaluation, and to offset, in their country, the expansionary effect of US Fed policy. In short, money has been going where it's *not* needed, and not going where it *is* needed.

Why should an investor with access to funds invest them in the United States or Europe, where there is excess capacity and a long-term slump, rather than in the booming, high-return emerging markets? In the older, closed economy models, they had no choice, but in a globalized world with free capital markets, they do.

By the same token, some have criticized the attempt of emerging markets to protect themselves against a surge of capital inflows by imposing a variety of forms of capital controls. They have suggested that there are externalities imposed by such controls on others,<sup>6</sup> and that such measures should either be banned or severely restricted.<sup>7</sup>

This analysis has four broad implications: First, in a world of truly free capital mobility, the effects of monetary policy may be markedly different – and typically weaker – than in a closed economy. Second, restrictions on the free flow of capital may therefore have an advantage, in that they may enhance the ability of the government to maintain the economy near full employment, possibly more than offsetting any disadvantages of such controls.<sup>8</sup> Third, it emphasizes the benefits of coordination among monetary authorities. Not surprisingly, the uncoordinated Nash equilibrium is Pareto inferior to a coordinated equilibrium. Fourth, by expanding the set of instruments (to include capital controls and quantitative instruments) countries can both reduce the impact of unwanted externalities imposed on them by foreign central banks, and increase the scope for cooperative agreements on monetary policy among central banks.

An analysis of the effects of monetary policy must be predicated on an understanding of the structure of the economy and the channels through which the effects of monetary policy are exercised. Much of the

recent literature has focused on impacts through “the” interest rate, and earlier literature emphasized the major determinant of that as the supply of money, “M.” But there are compelling reasons to believe that these models do not really capture one of the main mechanisms by which monetary policy exerts its effects – through the effect on the availability of credit, especially via the banking system (Greenwald and Stiglitz 2003). Indeed, an earlier theoretical literature, described briefly in section V, explains why, under the conventional perfect markets model, an extension of the Modigliani-Miller theorem demonstrated the ineffectiveness of monetary policies, including “operation twist” and QE. The financial crisis has heightened awareness of the importance of the credit channel and market imperfections. But credit availability is affected not just by the T-bill rate, but by a host of government regulations, as well as by changes in banks’ net worth, portfolio valuations, and risk perceptions. Hence, an analysis of monetary policy has to expand beyond just a focus on the interest rate to include a host of regulatory measures (capital adequacy requirements, reserve requirements, and liquidity requirements) and how they are implemented and enforced. We include this entire panoply of instruments within the umbrella of what we refer to as “monetary policy.” The instruments of monetary policy thus include not just the standard ones (open market operations, discount rates, and reserve requirements) but also those that are sometimes referred to as prudential regulations, macroprudential regulations, and capital controls.

This chapter thus touches on a number of distinct literatures:<sup>9</sup> on those entailing optimal macro and monetary policy within closed and open economies, on global coordination of macroeconomic and monetary policies, and on regulatory policies and their coordination, especially when they touch on cross-border flows. Each of these literatures has developed largely in isolation. There have, for instance, been important developments in the analysis of monetary policies in closed economies with credit constraints, and in the analysis of coordination in simple models with a single (or limited number) of instruments. One of the contributions of this chapter is to argue that these strands have to be brought together, and in contexts in which the credit channel and credit market imperfections play a central role.<sup>10</sup> Thus, while there is a body of literature identifying the benefits and costs of financial market liberalization, that literature has not addressed either the impact of such liberalization on the magnitude of spillovers from monetary policies or

the impact that such liberalization might have on the ability to achieve cooperation.

This chapter is divided into five sections. In the first, we explore a limiting and peculiar case, a country with two central banks, which highlights the need for cooperation. In the second, we consider the more general case where there are two or more large countries, each with their own currency. In the third, we focus on the role of credit and related constraints. In the fourth, we note that there may be positive as well as negative spillovers, but so long as there are spillovers, there are benefits to coordination. In the final section, we argue that the analysis of monetary policy must focus on market imperfections (such as credit, collateral, and regulatory constraints). In the absence of such "imperfections," there is a strong presumption that monetary policy would have, at most, very limited effects; hence, the magnitude and nature of the impacts of different policies depends critically on the magnitude and nature of the market imperfections.

## 1 A limiting case

Consider, for a moment, a large closed economy sharing a single currency, but suppose it decided to create two independent central banks (CBs) – one providing liquidity to the East and the other to the West. It should be obvious – at least in the standard model – that something was awry. There would be no reason that the money (we'll call it dollars) created in the East would remain there. Since  $M_E$  and  $M_W$  are perfect substitutes, all that matters (in the standard model) is  $M_E + M_W = M$ , the total money supply. Surely, one might argue, the two monetary authorities would understand that, and act together. But assume that the two monetary authorities have utility functions, each representing the interests and circumstances of their part of the country.<sup>11</sup> While each knows that what matters is the total money supply, each knows that it can influence the money supply with its own actions, which might not be in accord with what the other monetary authority wishes. For simplicity, we assume that there is a simple relationship between the level of aggregate activity in each region and the aggregate money supply. The two utility functions are  $V^i(M, T, \theta^i)$ , where  $T$  is the net transfer received (paid) by one region to the other, and  $\theta$  is the state of nature in country  $i$ , a random variable affecting the state of the  $i$ th economy.  $V$  is a reduced form representation

of societal welfare, a function of the one control variable: the money supply. Societal well-being could depend, for instance, on inflation and employment. A change in  $M$  changes the inflation rate and employment level, and  $V$  summarizes the impact on societal well-being. Societal welfare may also depend on the distribution of income or the composition of output (particularly when that in turn might affect the rate of growth of the economy).<sup>12</sup>

If there is no cooperation (and no transfers), each would try to set the money supply to maximize its own utility:

$$V^E(M_E + M_W, 0, \theta^E) = 0, \quad (1a)$$

$$V^W(M_E + M_W, 0, \theta^W) = 0 \quad (1b)$$

But both countries cannot have their own way. Let  $M^{E*}$  be the solution of (1a);  $M^{W*}$  to (1b). If the West is facing a deficiency in demand, and the East is having a boom, one might expect  $M^{E*} < M^{W*}$ .

As the WestCB expands money supply beyond  $M^{E*}$ , the WestCB will seek to take the liquidity out of the system. The WestCB winds up with a very large portfolio of T-bills (TBs). The EastCB will continue to sell its holdings of TBs, so long as it can. (For much of the rest of the chapter, we will omit the dependence of each country's monetary policy on  $\theta$ , the state of nature.)

Each CB, in setting its monetary policy, focuses only on the effects in its own region, ignoring the spillovers. But there are important spillovers from the West to the East and vice-versa. If some of the firms in the West are national firms, they can use the greater availability of finance in the West to undertake projects in the booming East, or to speculate through a "carry trade." Some of the firms receiving money may in fact be financial intermediaries (arbitrageurs), taking advantage of the low interest rates in the West to finance (or to provide finance for) projects in the East. And higher growth in the West will increase demand for imports from the East. Through all three mechanisms, expansionary monetary policy in the West exacerbates inflationary pressures in the East. The East would prefer that the West be less expansionary, and the West might prefer that the East be more expansionary.

The intuition for what is happening in this case is clear: if the East Coast is experiencing a boom, it will want to contract the money supply, but if the West is in recession, it will want to expand the money supply. The money supply, in this model, is determined jointly; it is like a public

good, in that what matters is the total value of  $M$ , not how much is supplied by any particular CB. As in the case of any public good, there can be different views about the optimal supply of the public good; what is best for one group may not be for another.

Of course, within even a closed economy with a single monetary authority, the same issue arises: that is, policies which may be optimal for one group may not be for others. Our macro models typically slide over by assuming a representative agent. One of the criticisms of unrepresentative central banks—where the voices of workers are not heard, while that of the financial community is overrepresented—is that the collective decision represents more the interests and perspectives of the financial community. The problems would not be so bad if those who benefitted from the particular choice of a monetary policy could or would compensate the losers. The issue would not arise only if it could be shown that a particular monetary policy Pareto dominated all others, which is obviously not the case.<sup>13</sup>

Assume, on the other hand, that it is possible for the two regions to provide lump sum transfers to each other. Social welfare (or Pareto efficiency) is achieved by

$$\text{Max } V^E(M, T, \theta^E) + V^W(M, -T, \theta^W) \quad (2)$$

so

$$V_M^E + V_M^W = 0 \quad (3a)$$

$$V_T^E = V_T^W \quad (3b)$$

Equation (3a), which makes it clear that Pareto optimality requires that the sum of the marginal returns to an increase in the money supply should be zero, not each individually. Achieving this cooperative solution may not be possible in the absence of compensating payments.

The creation of an independent central bank, not part of a broader political process, exacerbates the problems, because it makes it more difficult to design Pareto improving compensations (i.e., to offset the distributional consequences of monetary policy). This cost has to be offset against any putative benefit associated with any improvement in monetary policy from independence associated with either a better ability to make time-consistent commitments or with less "politicization" of monetary policy.

### 1.1 Using other instruments

Matters are not quite as bad as I have just described, because monetary authorities may have access to a range of other instruments, the effects of which may have lower spillovers outside the particular region concerned. A long-standing criticism of the standard model is that it does not describe and analyze clearly the process of credit creation through the banking system and the ability of regulators to affect this credit creation. Much of the effect of monetary policy is mediated through the supply of bank lending – both the availability of credit and the terms on which it is available. Even in the absence of credit rationing, the terms at which credit is made available do not necessarily move in close tandem with T-bill rates. The spread (between lending rate(s) and the T-bill rate) is an endogenous variable, which has to be explained, and which can be affected by policy.<sup>14</sup>

For simplicity, we assume that there is a vector of policy variables,  $\alpha^i$  is under the control of each monetary authority, societal welfare is a function of  $M$ ,  $\alpha^w$ , and  $\alpha^E$ , and that each of the monetary authorities chooses  $\alpha$  to maximize its own welfare:

$$V_{\alpha^i}^i = 0$$

Again, a coordinated solution would be preferable:

$$V_{\alpha^i}^E + V_{\alpha^i}^W = 0$$

For instance, by lowering reserve requirements, the CB in the West can encourage more lending by its banks, which is needed, given its weak economy. Western banks have an informational advantage concerning Western firms; as a result the bulk of their lending is to Western firms, and the direct beneficiary of their lending is the economy of the West. Thus, if the Western region undertakes a regulatory policy the effect of which is to expand lending mostly to SMEs, the financial spillovers to the East will be smaller, and similarly, if the Eastern region undertakes policies aimed at contracting lending to the SMEs.

It should be emphasized that the use of any one instrument affects the optimal value of other instruments. If, for instance, the government were to require that a certain fraction of all lending be directed to SMEs, then the optimal interest rate (the interest rate required to restore the economy to full employment) might be markedly higher than it would be in the absence of such a constraint.



One of the criticisms of the Fed in the current crisis is that it seemingly failed to pay sufficient attention to these concerns. Its bailout strategy was focused on the larger international banks, which disproportionately lend to large multinational enterprises, not SMEs; indeed, large numbers of local, community, and regional banks that are central to SME lending remain weak.<sup>35</sup> As a result, the cross-border spillovers are larger than they otherwise would have been.

## 2 Variable exchange rate

In the simple model of a single country with a single currency, the conclusion that problems arise when there are multiple central banks might seem so obvious that it does not even need to be mentioned, let alone modeled. But in a globalized world, where there might be, for instance, multiple currencies that are strong enough to serve as reserve currencies, then the cross-elasticities of currencies – the extent to which they can serve as substitutes for each other – may be sufficiently large that the model just described provides a good approximation to what is happening. As the CB increases liquidity (money) in its country, there are large spillovers to other countries, through the financial and trade mechanisms described above. In the extreme case of the previous section, the money supply was jointly determined, and we observed an inconsistency in the value of  $M$  that each CB strove for.

Now each CB controls its own money supply, but of course each country is affected by what the other does, not least through the exchange rate – the relative price of the two currencies.

In this highly reduced form analysis, we do not need to model specifically how an increase in “ $M^i$ ” or  $\alpha^i$  affects the exchange rate. But if an increase in  $M^i$  leads to a lower exchange rate for country  $i$ , then its exports will increase, and other countries’ imports will increase (i.e., some of the gains to country  $i$  are at the expense of others).<sup>36</sup>

In the simplest case, we now write the utility of country  $i$  as a function of the vector of money supply:

$$V^i(M^1, M^2)$$

And the Nash Equilibrium is given by the solution to

$$V_1^1 = 0, V_2^2 = 0.$$

The two equations define two reaction functions, and the Nash equilibrium is at the intersection of the two.

Without cooperation, the Nash equilibrium will be Pareto inferior to what could have been achieved with cooperation, but full cooperation is hard to achieve without compensatory payments, and even more so, if the set of instruments that are focused on is excessively narrowed (which has been the case in discussions of the conduct of monetary policy in recent decades, where the focus has been on using interest rates).<sup>17</sup>

Notice that in this model, in setting its monetary policy, the country claims to be only pursuing its own domestic goals (e.g., restoring the country to full employment). But if the country is large, the policies it pursues have spillovers on others, for instance through the global liquidity supply and the exchange rate. The fact that the country claims that it is not doing this to improve its terms of trade or to change the global interest rate from what it otherwise would have been does not change the significance of the spillover.<sup>18</sup>

In the previous section, we noted that monetary authorities have a range of other instruments besides the money supply (or interest rate). They can change reserve requirements, liquidity requirements, capital requirements, etc. They can be more or less lax in enforcement of the requirements that they have adopted. We denoted these other instruments available to the monetary authority, besides the money supply, by  $\alpha^i$ .

We now introduce a new set of variables that monetary authorities can use, to reduce the extent of externalities that they impose on others or that are imposed on themselves. Such policies may, at the same time, have benefits or costs to the countries undertaking them. If there are costs to engaging in expansionary monetary policy (increasing money supply by a given amount), then if more of the "liquidity" is directed at the home country, and less elsewhere, the magnitude of the expansion of the monetary supply necessary to achieve a given expansion of domestic credit will be smaller. At the same time, such policies that limit the spillovers will mean that the country that is already experiencing a boom will not suffer from further expansion of its credit. Capital controls directed at flows into or out of a country are examples of policies of which the direct effect is on the spillovers into or out of a country.

We denote these externality-controlling actions by  $\beta$ . Country  $i$ 's (expected) utility is given by

$$V^i(M^i, M^j, \alpha^i, \alpha^j, \beta^i, \beta^j, T).$$

And it maximizes this by setting

$$V_{M^i}^i = V_{\alpha^i}^i = V_{\beta^i}^i = 0.$$

Again, cooperation could achieve Pareto superior outcomes, especially if cross-border lump sum transfers were allowed, but also even if they weren't. Cooperation would entail

$$V_{M^i}^1 + V_{M^i}^2 = 0$$

$$V_{\alpha^i}^1 + V_{\alpha^i}^2 = 0$$

$$V_{\beta^i}^1 + V_{\beta^i}^2 = 0.$$

In setting the value of each variable, the effect on both countries is taken into account. As before, optimal transfers require

$$V_T^1 = -V_T^2$$

And again, we can observe that restricting the policy set may make achieving cooperation more difficult.<sup>19</sup>

But this is what the international community has been doing for almost three decades, as they have erected prohibitions against barriers to the free flow of capital, barriers which could, if appropriately designed, mitigate some of the cross-border externalities.

Ironically, the presumptive reason for imposing constraints on such policies is that such policies exert an adverse effect on others, even if they exert a positive effect on the country imposing them. Efforts at financial market liberalization were influenced by the earlier efforts at trade liberalization, where there was a compelling argument behind reciprocity of mutual trade liberalization: if all countries removed their trade barriers, under certain conditions, all countries could be better off (though literature over the last quarter-century has shown the severe limitations under which that conclusion was valid).<sup>20</sup>

One could perhaps make a corresponding argument for allowing free mobility of *all* factors, but the factor market liberalization agenda has never gone in that direction – it has focused on eliminating all barriers to the movement of capital, while retaining extensive movements to the barriers of labor. In this world, there is no “exchange.”

If a country engages in trade liberalization, in the conventional static analysis, the country itself is better off, and so are the countries from which it imports. Mutual trade liberalization is therefore even more beneficial to all parties. But when we say the country is better off, what we mean is that the gains of the winners from trade liberalization are so great that the winners could compensate the losers. But such compensation is often not made, so trade liberalization does *not* result in a Pareto improvement, and there is, accordingly, resistance.<sup>21</sup>

Capital and financial market liberalization provide an opportunity of countries with high endowments of capital to earn a higher return on their abundant factor by investing it in other countries. There may be benefits that accrue to the recipient country, for example, expanded output, higher wages, etc. But if these benefits do exist, there would presumably be no reason that the recipient country would impose the barrier (i.e., there is a presumption that forcing countries to liberalize lowers their welfare at the expense of the country opening its markets).<sup>22</sup>

Indeed, recent years have produced a plethora of theoretical and empirical analyses explaining why full financial and capital market liberalization may be welfare-decreasing, going well beyond the concern that such liberalization undermines the ability to have "targeted" monetary policies with diminished spillovers to other countries and/or that it effectively expands the policy space.<sup>23</sup>

Full liberalization exposes countries to more shocks, and there is a high economic cost to the resulting volatility (which cannot be insured against),<sup>24</sup> including the actions that governments may take to mitigate the volatility, such as building up reserves.

In particular, as Jeanne and Korinek point out, in the absence of government intervention, those who have access to international capital (like, perhaps, large real estate projects) borrow excessively from abroad. Looking forward, they do not take into account the effect of higher borrowing on the future exchange rate (e.g., in the event of an adverse shock). Each borrower takes the probability distribution of exchange rates as given, but when they all borrow more in foreign denominated currency, in the event of an adverse shock, the exchange rate will fall more, with adverse effects on all those who owe money in foreign exchange.<sup>25</sup> Thus, imposing constraints on the free flow of capital leads to a more stable exchange rate, and the imposition of such constraints by one country can lead to a Pareto improvement within that country. At the same time, such constraints imposed by one country have affects

(possibly negative, possibly positive) on other countries, which the country won't take into account when it decides to impose them.

To return to our earlier, reduced form formulation: we showed that a coordinated equilibrium is better than an uncoordinated one. But assume full coordination is unachievable. Countries can only agree on whether an instrument should or should not be allowed. Would global welfare be higher if capital controls were banned as an instrument? Let  $\beta_i$  denote the level of capital controls. Let  $\beta_i^*$  be the value of  $\beta_i$  in the symmetric Nash equilibrium. Let  $\beta_i = 0$  denote the value of  $\beta_i$  under the "no capital control" regime. The question is, is  $\Sigma V^i(\dots, \beta_i^*, \dots) > \Sigma V^i(\dots, 0, \dots)$  (i.e., is welfare higher in the Nash equilibrium with controls or without?). It is straightforward to establish that so long as the direct benefits of increasing  $\beta_i$  exceed the indirect costs imposed on others, the regime with capital controls generates a higher level of global societal welfare.

We can use the envelope theorem to assess the magnitude of the effects of the change by any country in its policy on others. Consider a change in  $\beta_i$  (the analysis for changes in  $M$  or  $\alpha$  are similar.)

$$dV^i/d\beta_i^i = \partial V^i/\partial \beta_i^i + \{\Sigma (\partial V^j/\partial P^j)(\partial P^j/\partial \beta_i^i)\} = \partial V^i/\partial \beta_i^i,$$

where  $\partial P^j/\partial \beta_i^i$  is the change in policy  $\{M, \alpha, \beta\}$  undertaken by  $j$  in response to the change in  $\beta_i^i$ . The impact of the change in policy on welfare, taking into account all of the country's adjustments, is exactly the same as it would be if it did not make any adjustment (for a small perturbation).

In particular, if an increase in  $i$ 's money supply leads to a surge of inflows into country  $j$ , and that results in increased inflation there, the externality of  $i$  on  $j$  is just equal to the direct cost of the induced inflation. We do not have to ask the question of how the country should optimally respond to the inflation. We only need to ascertain the direct impact. If, as some have suggested is the case, the Fed's expansion actions had little effect on aggregate demand in the United States, but had much greater effects on the already booming emerging markets, then the impact on global social welfare may well be negative.<sup>26</sup>

### 3 Liberalization in a world of credit and other constraints

So far, we have conducted our analysis at a highly abstract level. We have related actions of monetary authorities to the level of well being

in each country. Because the countries are large, the action each takes has significant effects on others. There are important spillovers. (Later, we will discuss in more detail the circumstances in which spillovers are likely to be negative or positive or non-existent). The effects of monetary policy depend, of course, on the structure of the economy.

In standard neoclassical models, investment is determined by the real rate of interest; thus, controlling the real rate of interest provides the central channel for controlling the level of economic activity. It is also the case in standard models of utility maximization over an infinite lifetime, changes in interest rates also can, but need not, have a powerful effect on current consumption. There is, in fact, scant direct empirical evidence in support of either hypothesis; only in models in which there are strong prior constraints (where the effects of changes in nominal interest rates are, for example, constrained to be zero) can the effects of the real interest rate on investment be detected, and this is especially true both when the country is experiencing a real estate boom/bubble and when it is in deep recession. In the latter case, there is typically large excess capacity; one should not expect that, just because one can obtain capital at a lower interest rate, firms would be willing to invest in more excess capacity. Indeed, real interest rates are already negative, and yet investment in real estate (and consumption) remains constrained.<sup>27</sup> This is also the case in a real estate bubble. If markets (often irrationally) expect returns on real estate of, say, 25 percent per year, then raising interest rates from 4 percent to 6 percent won't dampen investment much.<sup>28</sup>

In the case of consumption, there are offsetting income and substitution effects, so it should not be a surprise that empirical results are ambiguous. For the large number of those who are saving for a target (retirement, funding a child's education, making a down payment on the purchase of a house), the interest elasticity of savings is negative.

Increasingly, economists are recognizing that monetary policy affects the economy not just through the T-bill rate, but through the availability of credit and the terms on which it is offered. Credit and collateral constraints matter. (In section 5, we return to this theme, explaining that in the absence of such constraints, monetary policy would have little or no effect, so the analysis of such constraints should be at the center of any analysis of monetary policy.<sup>29</sup>

For more than 30 years, there has been a well-established literature explaining why, in the presence of imperfect and asymmetric information, markets are often characterized by credit rationing. Central bank

doctrine in many countries at various times has focused on credit availability, though in the more recent dominance of neoclassical doctrines, such perspectives were put aside.

Consider a simple Greenwald-Stiglitz model [2003] where lending is mediated through the banking system, where the lending rate  $r^l$  is a function of the T-bill rate,  $r$ , where the monetary authority controls the T-bill rate, but where the monetary authority does not control the inflow of funds and thus the availability of credit. Assume lending,  $L$ , is constrained not by demand, but by the supply of funds (as it is in a world of credit rationing), that higher interest rates attract an inflow of foreign capital, which in turn leads to more lending, and a higher level of lending leads to a higher level of aggregate demand,  $Y^d$ . Raising interest rates thus has just the opposite effect that it has in a standard closed economy model.

For simplicity, we assume aggregate supply is fixed at  $Y^*$ , and that the optimal level of aggregate demand is  $Y^*$ , where aggregate demand equals aggregate supply. Thus, in this model national "welfare" is given by<sup>30</sup>

$$V(Y(L(r))),$$

with  $V' > \text{or} < 0$  as  $Y < \text{or} > Y^*$ ,

with the optimal value of  $r$  given by

$$V'Y'L' = 0,$$

that is, by the solution to

$$Y(L(r^*)) = Y^*.$$

What is driving monetary policy (defined here as setting the interest rate) is the impact on the flow of funds into the country, not the creation of domestic credit. (We will come to the more general case shortly.)

Consider now a perturbation to the economy that results in an exogenous increase in aggregate demand: that is,

$$Y^d = Y^d(L(r), \epsilon).$$

The increase in aggregate demand would lead to inflation, as  $Y^d$  at the old  $r$  exceeds  $Y^*$ , and in the standard "inflation targeting" remedy to the resulting inflation is to increase the interest rate. But under the assumptions given earlier,

$$L' > 0 \text{ and } Y' > 0.$$

Hence, increasing  $r$  leads to an inflow of capital, increasing lending and aggregate demand, and increasing inflation. A recipe based on the neoclassical model provides precisely the wrong advice for an economy confronting credit rationing. It is easy to show that the optimal response is to lower interest rates, not raise them.

Of course, governments have additional instruments, and these should be employed. Denote, as before, a regulatory instrument (reserve or capital requirements) by  $\alpha$ . Assume now, for simplicity, that  $\alpha$  and  $r$  also affect social welfare directly (e.g., as a result of distributional consequences or costs of implementing a regulation):

$$V(Y^d(L(r, \alpha)), \alpha, r).$$

Then optimal policy entails

$$V_Y Y' L_r + V_r = 0$$

$$V_Y Y' L_\alpha + V_\alpha = 0.$$

The first equation says that in setting the interest rate, we don't just target the level of aggregate supply: we also take into account the effect of a change in the interest rate on welfare. If higher interest rates, for instance, represent an adverse distribution from (on average poor) debtors to creditors, then we choose an interest rate that is lower than the rate that would entail aggregate demand equaling supply. The second equation says that we can improve upon the equilibrium so attained by adjusting other regulations. For instance, loosening capital or reserve requirements might lead to more lending at any given level of  $r$ , so even if there is some cost to such an adjustment, it would be optimal to do so.

### 3.1 Impacts on composition of output

The desirability of using regulatory instruments is even stronger when there is a concern about the composition of output. (One might be concerned about the composition of output if some sector, such as real estate, is systematically associated with instability, as a result of credit bubbles, or some other sector, such as high tech export sector, is systematically associated with learning spillovers,<sup>31</sup> or some sector, such as SMEs, is systematically more closely linked to job creation, and the country faces a severe and persistent problem of unemployment.)<sup>32</sup>



Consider a monetary authority trying to offset an increase in the inflow of capital going into one sector (e.g., the real estate sector), which is causing inflation and/or distorting the economy. Earlier, we suggested that the standard response – raising the interest rate – might be counter-productive. But raising interest rates might dampen the other sector, and if it does so enough, the net effect is deflationary. But fighting inflation in this manner comes at the expense of the SME sector, which may be the employment and technology-driving sector. Hence, while the increase in interest rates might dampen inflation arising from shortages in some sectors, it has an adverse effect on the composition of output – and on welfare. There is an alternative welfare enhancing policy: tightening the constraints on capital inflows (e.g., a tax on short-term capital inflows) might, by reducing the flow of funds to the real estate sector, decrease aggregate demands arising there. The perturbation to the economy arises from an increase in capital inflows. It may be desirable to target the response to the source of the perturbation.

More formally, assume a social welfare function of the form

$$V(Y^d(\beta L^1(r, \alpha), r), Y^d(L^2(r, \alpha), r), \alpha, \beta, r).$$

Social welfare is a function of the demand for (output of) goods of type 1 and 2, each of which is a function of the interest rate and/or credit availability. But the credit availability functions differ, and in particular, for good 1 (which we can think of as “unproductive” real estate) credit availability depends on foreign capital inflows, so  $L^1_r > 0$ , and a tightening of cross-border capital flows (reflected in a reduction in  $\beta$ ) reduces credit availability, while loan supply to sector 2 (which we can think of as local SMEs, information about which is not readily available to international investors, so they shun the sector) depends just on domestic sources, so  $L^2_r < 0$  (when returns on government bonds increase, banks find it less attractive to lend),<sup>33</sup> and lending does not depend on restrictions on cross-border flows.

This leads to the first order condition for  $r$

$$V_{Y_1} [Y^d_L \beta L^1_r + Y^d_r] + V_{Y_2} [Y^d_L L^2_r + Y^d_r] + V_r = 0.$$

In setting the interest rate, we pay attention to the direct distribution effects ( $V_r$ ), as well as to the effects on the composition of output. Assume that an increase in interest rates leads to an expansion of the “unproductive” sector 1 and a contraction of sector 2<sup>34</sup> (i.e.,  $Y^d_L \beta L^1_r + Y^d_r > 0$  while  $Y^d_L L^2_r + Y^d_r < 0$ ), then we will set the interest rate at a lower rate than we

would otherwise. For example, we might be more tolerant of moderate inflation, realizing that, at the margin, the cost of a slight increase in inflation is less than the cost of the "distortion" in the composition of output.

But if we can restrict capital inflows by lowering  $\beta$ , then the adverse compositional effects can be reduced.<sup>35</sup> We now have an additional first order condition

$$V_{Y_1} Y_L^{d1} L^1 \beta + V_\beta = 0.$$

With two additional regulatory instruments,  $\alpha$  and  $\beta$ , we can obtain still better outcomes. The additional first order condition is given by

$$V_{Y_1} Y_L^{d1} L_\alpha^1 + V_{Y_2} Y_L^{d2} L_\alpha^2 + V_\alpha = 0.$$

For instance, assume that inflationary pressures are related to the sum of demands for the two goods (in more realistic models, composition will matter as well). Then, we can choose  $\{\alpha, \beta, r\}$  such that

$$Y^{d1} + Y^{d2} = Y^*,$$

and then, among the non-inflationary policies, choose the one which maximizes welfare, taking into account compositional and distributional concerns. This result is hardly a surprise: in this simple model, we have three objectives – full employment, distribution, and the composition of output, and we can do better with three instruments than with one, or even two.<sup>36</sup>

In this model, without the use of regulatory constraints, even moderate changes in the interest rate may not be able to dampen demand significantly, when a country faces inflationary pressures, because of countervailing effects of increases in interest rates on  $Y^1$  and  $Y^2$ : higher interest rates may dampen sector 2, but lead to an expansion of sector 1 because of capital inflows. By the same token, if the country faces unemployment, and a shortage of aggregate demand, lowering interest rates may be ineffective, because while it may lead to an expansion of the second sector (if the financial system is working well), it may lead to a flow of funds abroad (or reduced inflows of funds), weakening the first sector.

But even if increasing interest rates worked in reducing overall demand, in an attempt to countervail a surge of capital from abroad that led to inflationary pressures, a policy of increasing the reserve requirements and lowering interest rates (or increasing them less

than they would otherwise be increased) may be preferable to just raising the interest rates. Assessing the impacts entails analyzing the differential effect on the availability of domestic credit to SMEs, and the terms on which it is made available. More generally, in comparing two policies that have analogous effects on inflation, one has to ascertain the differential compositional effects. These will depend on the supply elasticities of foreign capital and the response functions of banks (which in turn depends on their risk aversion, risk positions, and risk perceptions.) But the CB can "steer" credit toward the desired sector, either through hard constraints – a requirement that at least a certain fraction of lending go to SMEs – or softer constraints – differential reserve requirements or deposit insurance rates, depending on the composition of lending.

Even better outcomes can be obtained by employing such policies in combination with a policy of capital inflow constraints ( $\beta$ ) (with the interest rate set to hit the target levels of inflation), if it is feasible to impose such constraints. Both policies have the benefit of reducing excessive inflows of capital, the short run distortions that result (as the foreign capital inflows go disproportionately into one sector, one associated either with less positive externalities or more negative externalities than the other sector), and the long run instability associated with these "excessive" capital inflows.

Such policies, designed to offset the source of the perturbation to the economy, are, not surprisingly, superior to the employment of a single regulatory constraint, and that in turn is superior to the employment of no regulatory constraint, relying only on interest rates.

Obviously, the optimal mix of policies will depend on the economic environment (the state of the business cycle), both because what needs to be done will differ (e.g., whether the intent of monetary policy is to dampen excess demand or to stimulate demand, to offset what otherwise would be a deficiency in aggregate demand), and because the responses of both domestic and foreign agents will depend on the economic environment. In a recession, lowering interest rates may not, for instance, lead to a substantial increase in  $Y^2$ , but, because capital inflows are so limited, may not have much effect on capital inflows and therefore on  $Y^1$ . In a boom, especially one associated with a real estate bubble, the effect of raising interest rates on  $Y^1$ , in enhancing a flow of funds into the country, may be significant, far greater than the adverse effects on  $Y^2$ .

### 3.2 Micro-foundations and alternative channels and instruments

While the above discussion described policy using highly reduced form equations representing the welfare effects of changes in interest rates and regulations, it should be clear that there are well-developed micro-foundations underlying the analysis. While we do not fully articulate these micro-foundations here, it may be worth clarifying some of the channels/mechanisms through which the effects of monetary policies are felt.

For instance, there is a large literature, growing out of the work of Stiglitz and Weiss (1981, 1986), on credit rationing, where the amount that those in the SME sector can borrow depends on the value of their collateral (Kiyotaki-Moore, 1997). Greenwald-Stiglitz (1986) had shown that the effects of changes in prices (interest rates, wages) from competitive levels had a second order direct effect on utility, but a first order effect on selection, incentive compatibility, participation, credit rationing, or other constraints arising out of imperfect and asymmetric information and/or imperfect and incomplete risk markets. Accordingly, markets are essentially never (constrained) Pareto efficient, taking into account the costs of information and of creating markets; government interventions that are welfare-enhancing essentially always exist. This provides the fundamental critique of the neo-liberal position that begins with the presumption that one should not interfere with market allocations. This presumption simply has no basis in economic theory.<sup>37</sup>

Different instruments of the monetary authority affect different sectors differently. Raising interest rates, in the standard analysis, has a more significant impact on interest sensitive sectors. Relying on interest rate adjustments for offsetting perturbations to the economy distorts the economy, moving resources out of these sectors. But in the presence of collateral constraints, there can be further effects. Higher interest rates or the reduced availability of credit (in effect, an increase in the shadow price of capital) reduce the value of assets (like land) that are used for collateral. They therefore tighten credit constraints.

They therefore tighten credit constraints in the SME sector. In effect, the collateral constraint makes the SME sector more interest-sensitive than it otherwise would have been. There are other instruments that monetary authorities could employ to mitigate these effects: for example,

constraints on where funds are lent, so that even with an increase in the interest rate, an increased fraction of the funds are made available to the SME sector (and less to consumption).

#### 4 Negative and positive spillovers

In the heated debates surrounding the US policy of quantitative easing, one response to complaints by emerging markets that they were being adversely affected by US policy was that there wouldn't be these adverse effects if the country's had managed their economy well. China, for instance, could have easily undone any inflationary pressure simply by letting its exchange rate rise. The problem was not with QE, but with China's management of its exchange rate.

At the same time, as we noted in the introduction, critics of capital controls argued that there were negative spillovers to other countries of such controls, for if funds were restricted from entering one country, there would be increased pressure on other countries.<sup>38</sup>

These two perspectives are, of course, inconsistent: the former seems to suggest that a surge of funds coming into a country has adverse effects on the country only if that country is doing something wrong; while the latter, recognizing surges may have an effect, shifts the focus to the spillovers not of the original source of the liquidity, but to those attempting to divert the funds away from themselves.

In our earlier analysis, the actions of each (large) country – its choice of  $\{M, \alpha, \beta\}$  – does have effects on others, which it won't take into account in an uncoordinated equilibrium. The spillovers can be either positive or negative. For countries whose macro economy is correlated with the large country upon which we are focusing, the spillovers of demand creating policies (e.g., an increase in  $M$ ) is positive; for countries whose macro economy is negatively correlated, the externalities will be negative.

If the monetary authority in country  $i$  is expanding  $M$  to stimulate the economy, but much of the increased liquidity is being used to make investments in country  $j$ ,  $j$ 's imposition of capital controls may exert a positive externality on country  $i$ : more of the funds may actually go to where they were intended.<sup>39</sup>

In section 2, we analyzed the externality of country  $i$ 's monetary policy on country  $j$ , showing that the magnitude of the impact of welfare can be assessed simply by looking at the *direct* impact, assuming that there were

no adjustments in policy (assuming that in the initial situation, policies were optimally determined).

There is one special case that deserves attention. In a standard neoclassical model (no credit constraints, collateral constraints, etc.), if the impact of *i*'s policy on *j* is solely through the interest rate, then the effects are purely distributive. If country *j* is borrowing *B* dollars from country *i*, then country *j* is better off by the amount of the savings in interest payments, and those in country *i* are worse off by the same amount. The converse is true when there is an increase in the interest rate. In such a situation, one should not expect the borrower to complain about interest rate reductions.<sup>40</sup> But the United States, a large borrower on global capital markets, complained about the "savings glut" from China the effect of which was to lower the interest rate it paid.

But the analysis above highlighted the many channels through which monetary policy has its effects. An unexpected lowering of global interest rates as a result of US monetary policy hurts lenders and helps borrowers. There can be large real effects from these within country redistributions which more than outweigh the cross-country redistributions.<sup>41</sup> Thus, foreign countries can be hurt both by the lowering of global interest rates and by the subsequent increase. (Greenwald and Stiglitz, 1993).

There can be a host of other effects. For instance, assume that the *j*th government's policy is defined by the magnitude of the intervention in the exchange rate market. The exchange rate itself is endogenous. With a fixed intervention, the lowering of *i*'s interest rate leads to an increase in *j*'s exchange rate, *e*. Then

$$dV^j/dr^i = \partial V^j/\partial r^i + (\partial V^j/\partial e) (\partial e/\partial r^i).$$

The first term represents the direct effect (e.g., on the cost of borrowing from abroad), and the second term represents the impact on welfare from the change in the exchange rate. The second term can (and often seems to) dominate the first.

Alternatively, assume that the government's policy is defined as setting the exchange rate, but to do that, it must alter the level of intervention in the foreign exchange market, denoted by *I*, and there are real costs to doing so. The exchange rate itself was set so as equalize the marginal benefits of adjusting the exchange rate with the marginal costs.

Then

$$dV^j/dr^i = \partial V^j/\partial r^i + (\partial V^j/\partial I) (\partial I/\partial r^i),$$

where  $\partial I / \partial r^i$  is the changed level of intervention in the foreign exchange market required to maintain the exchange rate at a fixed level. Again, we've seen how  $i$ 's monetary policy can impose costs on country  $j$ .

So far, we have focused on the costs imposed by a particular *action* in country  $i$ . But there are costs associated with particular *policies*.<sup>42</sup> For instance, a monetary policy by the large country associated with larger variations in the interest rate will lead to the design of policy frameworks in other countries more capable of responding to these large changes. The country might, for instance, have larger reserves, so that it could better manage the resulting exchange rate volatility. But, of course, there is a large cost associated with holding larger reserves. (Rodrik, 2006, Korinek and Servén, 2011).

## 5 Why monetary policy has any effect: the centrality of constraints

This chapter is about how the actions of one monetary authority spill over into other countries. To assess that, as we have repeatedly said, one has to understand the channels through which monetary policy affects the economy. We have argued that it is not only through interest rates but also through credit availability and collateral constraints. It can affect the flow of capital into a country, as well as exchange rates. In the standard neoclassical model, the main effect, however, is through interest rates. In this section, we argue that if the neoclassical model were correct, monetary policy would have little or no effect, and therefore monetary authorities *must* focus on market imperfections, in particular on capital market imperfections. We also explain how these constraints may have played an important role in simultaneously limiting the effectiveness of QE in the United States and in enhancing the magnitude of the spillovers to other countries.

### 5.1 The Modigliani Miller theorem and the (almost) irrelevance of monetary policy

The starting point of any neoclassical analysis of monetary policy should be the most important theorem in finance: the Modigliani Miller (MM) theorem. Some years ago, I proved a generalization of the MM theorem for the public sector, which argued that, under the idealized conditions

under which the MM theorem held, public financial operations, such as a change in the maturity structure of government debt, should have no effect (Stiglitz, 1981, 1983). (The result could also be thought of as a generalization of the Barro-Ricardo theorem, suggesting that government debt itself had no effect.)<sup>43</sup>

The intuition, of course, is simple, and it is the same that underlies the Barro-Ricardo analysis. Putting aside any distributive effects, we owe money to ourselves, so government debt is simultaneously a liability and an asset. This fact provides the basis for an important critique to those excessively worried about government debt, at least when it is internally held. (It's another matter when the debt is held by foreigners, because then the debt amounts to a diminution in the country's "net worth.")

If the government borrows more now (instead of paying for current expenses by raising taxes), to be repaid at some later date, the effect can and will be precisely offset by the representative consumer saving more, and using the funds to repay the government debt later. But in the general equilibrium formulation, there can be multiple heterogeneous individuals, and the result holds, assuming, of course, that those who would have paid the taxes now pay the "equivalent" amount later (i.e., that there are no distributive consequences to the postponement of the taxes). And the same holds if the government decides to raise more funds by a sequence of short-term borrowings, rather than by long-term debt.

The empirical evidence is overwhelming that the Barro-Ricardo theorem – and my generalization of it – do not describe the world in which we live.<sup>44</sup> The question is not the validity of the analytic proposition, but why it fails. And what insights does this provide us into capital markets and the workings of monetary policy?

## 5.2 Distributive effects, capital constraints, and seeing through the public veil

It should be obvious, from the start, that it is hard to avoid distributive effects, the absence of which are essential to the validity of the Barro-Ricardo result. With finitely lived individuals, the decision to postpone financing for current expenditures through taxes has potentially important intergenerational effects. To be sure, there may be partially offset through changes in intergenerational transfers, but the fact is that most individuals do not leave any significant bequests to their children,<sup>45</sup> in which case there can't, and won't, be such offsetting bequests.



A variety of capital market imperfections provide the basis of the strongest theoretical critique. If individuals would, for instance, want to have borrowed more, but are constrained from doing so, the existence of an incremental future liability will not induce them to start saving. The borrowing constraint will simply be less binding than it was before. By the same token, were the government to decide to tax more and borrow less, the individual facing a borrowing constraint won't be able to offset the effect through increased borrowing.

In reality, most individuals do not fully incorporate future tax liabilities into their budget constraints – and they incorporate the “risk pattern” even less. Thus, as a result of a change in the maturity structure of debt (or a shift from unindexed debt to indexed debt), changes in the risk pattern are not offset by corresponding changes in their portfolios.

### 5.3 Institutional constraints, Credit availability, profit maximizing risk-averse firms, and the liquidity trap

It is clear that the idealized world of Modigliani-Miller provides an inadequate description of the economy.<sup>46</sup> There is a widespread assumption that monetary policy – even quantitative easing – has some effects.

And it is easy to understand why it would have at least some effects in a world in which there are not only distributive consequences to monetary policy but deep capital market imperfections, both those arising from imperfections of information and from institutional rigidities. For instance, an increase in deposits held by the banking system in the Federal Reserve (“base money”) as a result of an open markets operation, can, through the credit multiplier, lead to increased lending. I say *can*, not necessarily *will*, for banks are (for the most part) profit-maximizing, risk-averse firms,<sup>47</sup> and they may decide the best way to allocate their portfolios is not to issue new loans to, for instance, SMEs, but to buy government bonds from the household sector or from abroad, or simply to hold the excess liquidity at the Fed. This can give rise to a liquidity trap, though one that is distinctly different from that discussed by Keynes and some more recent commentators, which focuses on the zero lower bound on the interest rate.

The distinction is important: Keynes was confronting a situation where prices were falling at 10 percent a year; real interest rates remained in excess of 10 percent, so it was plausible that the inability to lower real interest rates represented a constraint on the ability of monetary

authorities to ignite the economy. Today, however, there is moderate inflation of less than 2 percent, so real (T-bill) interest rates are negative. To be sure, at a sufficiently negative real interest rate, individuals might be spurred to consume more and firms to invest more. But within reasonable ranges, changes that further lower (expected) real interest rates to -4 percent – even were they feasible – are unlikely to spur much further investment or consumption.

For many smaller businesses, the real constraint is the lack of availability of credit (a problem that simply cannot be analyzed in a model with perfect capital markets). Providing more liquidity to banks does not necessarily lead either to more lending or to lower lending rates (Greenwald-Stiglitz, 2003).

#### 5.4 The ineffectiveness of temporary interventions

To understand whether, and how, monetary policy affects the economy, one must thus go beyond the neoclassical model, to an analysis of the role of banks, credit rationing, and capital market imperfections more broadly.

This is especially important when we consider the impact of what are proposed as short-term, temporary interventions. There is an understanding, for instance, that at some time quantity easing will be reversed. But in the standard neoclassical analysis, all market participants are forward-looking. They know that it will be reversed, and they take that into account in their decisions today. This presents a puzzle as to how behavior can be affected, except through the relatively small changes in intertemporal substitution that occur over the period of the intervention.

Consider, for instance, a temporary intervention – buying long-term bonds now, under the presumption that the economy will recover in a couple of years, in which case the action will be reversed. Apart from slight changes in endowments (increases in the levels of state variables like human and financial capital) that might have been induced by the temporary intervention, at  $t + 2$ , asset prices will be the same as they would have been before the intervention. Knowing this, it is hard to see why there should be large changes in asset prices (share prices) at  $t$  and  $t + 1$ . With lifetime budget constraints essentially unchanged, it is hard to see why there should be any significant changes in consumption at  $t$  and  $t + 1$ , even if there should be some changes in asset prices.

There is even an argument for why consumption might be depressed. As the Fed bought long-term bonds, there was the obvious risk that when it reverses the purchases as the economy recovers, there would be a capital loss. The expectation of such a capital loss, with full integration of the public and private budget constraints, should have contracted consumption, offsetting the intended effect of expanding consumption. The Fed suggested it might hold the bonds to maturity, using other ways of tightening credit, for example, by paying interest on deposits at the Federal Reserve, in effect enabling it never to realize the capital losses. But these actions only mask the reality that (the present discounted value of) government revenues are less than they otherwise would have been; they don't change the predicted adverse effect on consumption, assuming full integration and rationality.<sup>48</sup>

Of course, in models with less than perfect rationality, market imperfections and high degrees of risk aversion, such temporary interventions can have effects. One of the arguments of the advocates of QE is that it leads to higher stock market prices, and higher stock market prices lead to more consumption. There are two questions: why should one expect a *temporary* intervention to lead to higher stock market prices (today), and why should higher stock market prices today lead to more consumption. Individuals focusing on cash flows that had much of their wealth in bonds that roll over see cash reductions in cash flows. As the financial press continually describes the response to low interest rates, it leads to a "search for yield." There is, of course, no general theory that would suggest that as yields go down, individuals act in a less risk-averse manner; quite the contrary, the adverse wealth effects might more plausibly lead to more risk-averse behavior. But if individuals do behave in this way, it in turn leads to an increase in the price of stocks – even if those individuals "rationally" realize that the forces leading to this increase (above what the prices would otherwise be) are just temporary.

But even if this policy did lead to higher stock prices, it does not necessarily imply that the policy leads to significantly increased consumption. If the reason for the increase in stock prices is the "search for yield," then it reflects a worsening of the lifetime budget constraint as a result of lower interest rates, and net that should have ambiguous effects on consumption, with wealth and substitution effects operating in opposite directions.

But there is another set of effects that may be operating. The standard model ignores the intergenerational distributive effects of monetary

beneficiaries are the banks, especially the large banks that control the lion's share of the mortgage market. If that is the case, the short-run benefit to the economy, at least through this channel, will be limited.

Another market imperfection may have reduced the benefits derived from QEIII even more. Mortgages that could easily be refinanced already have been; borrowers who have not refinanced either have insufficient income or are "underwater." The mortgage could be refinanced only if there were a principal write-down. In a standard model with rationality, it would pay both lenders and borrowers to engage in debt restructuring. Foreclosures are expensive for everyone involved, including the communities in which they occur. There is enormous dead weight loss. But principal write-downs entail recognition of losses faster than would otherwise be the case, especially since the 2009 change in accounting regulations that allowed even impaired mortgages *not* to be written down. That would make the *seeming* profits in the short run lower, even if it would make long-run profits higher.

Agency problems pervade the banking system, and bank management has incentives to focus on the short run. Moreover, some banks may face high costs in raising funds (a natural capital market constraint, arising from the high level of non-transparency of the banks.) Were they to engage in extensive write-downs of principal, they would have to raise more capital.<sup>53</sup> In short, the level of refinancing may be far smaller than would be the case if financial markets were perfect, but analyzing the extent to which there will be refinancing, and the impact on banks and aggregate demand, entails a complex analysis of institutional constraints and imperfections.<sup>54</sup> Monetary policy ignores these at its peril.

These concerns are important in understanding the nature and extent of spillovers arising from the conduct of monetary policy by one country on others. Thus, if America's financial system had been less clogged, more of the liquidity created by the Fed would have gone to stimulating the American economy – the intent of the policy – and the effects on others would have been reduced.

## 5.7 Liquidity versus solvency

Not only is this kind of institutional analysis important for understanding monetary policy, it is essential for understanding central banks' conduct in performing one of their central roles: lender of last resort. Much is made of the distinction between lack of liquidity and insolvency, and while this

distinction is central to central banks' decisions about which banks to support, and which to let die, the distinction itself is questionable, and illustrates prevalent inadequacies in the analysis of market imperfections.

Typically, if everyone agreed that a bank is solvent, it would have access to funds; it would be liquid. The problem arises because bankers – those who have borrowed too much and put too much of their money into risky assets – believe that the asset prices will recover, and that their “fundamentals” are strong. The fact that other market participants don't agree should give government pause. But the bankers worked hard to convince the government that – in this particular instance – the market is wrong. But when the market was irrationally exuberant, they fought equally hard to ensure that the government took at face value asset prices; it would have been viewed as unacceptable to question the market, to take 20 or 30 percent off market prices, in assessing bank balance sheets, on the grounds that prices were inflated by a bubble.

Even in their conduct in the role of lenders of last resort, central banks need to be mindful of spillovers. Large banks in large economies engage in global lending, and (as became evident in the crisis of 2008), the failure of a large multinational bank will have global consequences. While the citizens of the country engaged in the bailout bear the costs, some of the benefits of the bailout are reaped abroad. This suggests that, without global coordination, there might be an undersupply of bailouts.<sup>55</sup>

## 6 Concluding comments

There are five essential insights of the Greenwald-Stiglitz [2003] approach to monetary theory and policy:

- 1 One of the main channels through which monetary policy affects the economy is through impacts on credit availability.
- 2 If that is the case, then the analysis of credit availability should be front and center in monetary policy.
- 3 In most countries, banks play a dominant role in the provision of credit, and for good reason,<sup>56</sup> and if that is the case, then the analysis of bank behavior should be front and center in monetary policy.
- 4 The interest rate that matters for much economic activity is the firm borrowing rate, and the spread between that rate and the T-bill rate is an endogenous variable.

- 5 One cannot and should not separate out regulatory instruments from the conventional instruments of macroeconomic policy (e.g., open market operations), and monetary authorities should employ a full panoply of instruments.

The Greenwald-Stiglitz analysis is based on a critique of traditional models in which the effects of monetary policy are mediated just through interest rates, and the only interest rate that mattered was the T-bill rate.<sup>57</sup> In these models, there is no credit rationing, and prices (including real interest rates) are set to ensure demand equals supply. In the Greenwald-Stiglitz models, monetary policy is largely mediated through the banking system. The lowering of interest rates may (or may not) be reflected in a commensurate lowering of lending rates or a commensurate increase in credit availability. Indeed, there is a new version of a liquidity trap – not caused (as Keynes suggested) by a high elasticity of the demand for money, but by a low responsiveness of banking sector lending, even as the central bank provides the banking sector with more liquidity. This is precisely what has been happening in the United States and Europe, and the theory developed by Greenwald and Stiglitz anticipated and predicted this kind of liquidity trap well before it became evident in the aftermath of this crisis.

This chapter has focused on a “global” model of monetary policy and credit creation, where the actions of monetary policies in one jurisdiction can and do have effects on the level of macroeconomic activity in other jurisdictions.

The analysis has shown that (a) cooperation is desired among monetary authorities; (b) cooperation can be achieved more easily if there are a multiplicity of instruments, because it is easier to achieve outcomes that Pareto dominate the Nash equilibrium; (c) there are instruments (like restrictions on cross-border capital flows) that reduce externalities and increase the effectiveness of monetary policy on the domestic economy; it was wrong for these policies to be eschewed for so long; (d) there are good reasons for monetary authorities to be concerned about the structure of the economy and the distribution of income, and if they are, it is important for them to make use of a multitude of instruments; (e) in particular, seemingly unconventional policies, like responding to an influx of capital by simultaneously lowering interest rates, raising reserve requirements, and restricting capital inflows may be highly desirable.

Some central banks have shown a predilection for using only one instrument – the interest rate (typically adjusted through open market operations). This is predicated on the belief that price instruments are superior to other forms of intervention, based on some variant of a neo-classical model. But underlying such analyses is a fundamental cognitive dissonance: government control of a fundamental price is a massive intervention in the market, only justifiable because of major (macroeconomic) market failures. There is no theorem that says, in general, that when there are such market failures, optimal interventions should be through a single instrument, or that that instrument should be a price instrument (the interest rate), or that the adjustment in that instrument should be simply related to a single signal of market disequilibrium, the inflation rate (the Taylor rule), regardless of the source of the perturbation to the economy, though there may be highly idealized circumstances in which that may be true.<sup>58</sup> In general, given the pervasiveness of market imperfections and the multitude of disturbances that can throw an economy off kilter (disturbances on the demand and supply side, disturbances originating within the domestic economy or from abroad, and if from abroad, from trade or from finance), it is desirable to have at one's disposal a panoply of instruments. Monetary authorities do have multiple instruments. Not using this full panoply has resulted in self-inflicted wounds.<sup>59</sup>

Neoliberal policy doctrines are flawed, not only in constraining unnecessarily the set of instruments, but also in not identifying the full range of market failures. We have argued that the government needs to be concerned about the distribution of income and the composition of output, both of which are affected greatly by monetary policy and the choice of instruments utilized by monetary authorities. Relying on interest rate adjustments imposes greater costs of adjustment for macroeconomic disturbances in sectors and firms that are more interest sensitive, and even more so, when credit availability is mediated through the banking system (as it typically is), in those sectors and firms that are more reliant on bank finance (such as the SME sector) and/or more constrained by collateral. If firms are risk (volatility) averse – a hypothesis for which there are both strong theoretical and empirical foundations (Greenwald-Stiglitz, 1990, 1993) – then the economic structure is distorted away from such sectors. So, too, a broad set of welfare costs and benefits are associated with policies that expose a country to greater or less exchange rate variability.

In section IV, we explained that the pecuniary externalities associated with interest rate and exchange rate adjustments have real welfare consequences. This chapter has delineated the important macroeconomic spillovers on others that arise from the monetary policy of a large country. Achieving global (Pareto) efficiency requires global coordination. Expanding the set of instruments makes it easier to achieve Pareto improvements over the Nash equilibrium that otherwise would have occurred. But in the absence of global coordination, we have shown how governments, by using a wider range of instruments, including capital controls, can reduce the impact of such actions on their economy. While a coordinated use of such instruments is preferable to their uncoordinated use, there is a presumption that some use of such instruments, even in an uncoordinated way, is better than no use. The attempt by the United States to unduly restrict the use of these instruments (including through trade agreements now under negotiation) is, from the perspective of global welfare, a mistake.

We have argued that to understand the impacts of various instruments and the cross-border externalities that they exert, one must go beyond neo-classical models, in which the effects of many of the key policies are at most limited, and others simply impose distortions. Not only credit and collateral constraints need to be taken into account, but also market "irrationalities." And this is especially so in the case of temporary interventions, where the presumption is that rational forward looking markets would take into account the consequences of the future reversal of the policy, limiting the effectiveness of such policies. Should asset prices be affected, the effect of these changes in asset prices on consumption or collateral constraints should be limited.<sup>60</sup>

While the analysis of this chapter has focused on equilibrium models, market responses to perturbations, especially in models with credit rationing and unemployment, may be unstable: unemployment may, for instance, lead to a lower share of wages, lowering aggregate demand, and increasing unemployment still further. Standard policy prescriptions may make matters worse: a supply side shock, part of which gets passed on in the form of higher prices, under inflation targeting will lead to higher interest rates, exacerbating the adverse effects of the supply shock on the macroeconomy. To these instabilities, we have now added a third: with long and variable effects of actions, especially as the effects are felt on distant shores, in the absence of cooperation among monetary authorities, the global economy may not converge quickly or smoothly even to the (inefficient) equilibrium. But this is a topic for a later chapter.



## Notes

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- 1 See, for example, papers by McCallum and Nelson (2000) and Smets and Wouters (2002).
- 2 A similar analysis applies to a large economy with a large competitive fringe that responds in a similar way to any action by the large economy, except in that case, it is more natural to describe the equilibrium as a Stackleberg equilibrium than as a (symmetric) Nash equilibrium.
- 3 It makes little sense to analyze the role of monetary policy in the context of models in which markets on their own are efficient, and there would, accordingly, be no need for monetary policy.
- 4 Krishnamurthy and Vissing-Jorgensen (2011) found the most sizeable impacts and argue, using an event study method, for a “significant drop in nominal interest rates on long-term safe assets,” but a much smaller impact on less safe assets such as corporate Baa rates. They also find expected inflation impacts, implying lower real rates. However in contrast, Chen et al. (2011) find more “moderate” effects: GDP growth of less than a third percentage point and a “very small” effect on inflation. Other related papers adding to this point: Wright (2011) finds that “stimulative monetary policy shocks lower Treasury and corporate bond yields, but the effects die off fairly fast, with an estimated half-life of about two months.” Kiley (2013) examines the impact of the unconventional monetary on private yields and finds the effectiveness is attenuated in recent years at the zero lower bound compared to prior 2008.
- 5 The Cleveland Fed has found that lending to small and medium businesses is likely still more than 20 percent below its pre-crisis levels. “In the fourth quarter of 2012, the value of commercial and industrial loans of less than \$1 million – a common proxy for small business loans – was 78.4 percent of its second-quarter 2007 level, when measured in inflation-adjusted terms” (Federal Reserve Bank of Cleveland, 2013). Large enterprises are sitting on large amounts of cash. It is not the availability of finance that is constraining investment, and it is unlikely that reductions in interest rates will likely lead to more investment. The effects on consumption are taken up more directly below.
- 6 See Ostry et al. 2012

- 7 Korinek (2013) has provided a deep analysis of the circumstances under which coordination in the imposition of such controls might be desirable.
- 8 This has, of course, been a longstanding argument of advocates of capital account management. See, for instance, Stiglitz et al. 2006 and the references cited there.
- 9 Too extensive to provide adequate referencing.
- 10 Thus, several of the results noted above (that monetary policy in an open economy is markedly different from that in a closed economy; that the imposition of capital controls increases the policy space available to a country; that policy coordination is desirable, and that there can be benefits from the use of additional instruments) have been noted in each of the separate literatures referred to earlier.
- 11 The utility functions can be the same (i.e., the only difference can be the economic circumstances, reflected in  $\theta^E$  and  $\theta^W$ ).
- 12 As recently suggested by the work of Greenwald and Stiglitz (2006, 2014), where some sectors of the economy are more amenable to learning and have larger spillovers to other sectors, so that changes in the composition of output affect the growth rate.
- 13 For a broader discussion of these issues, see Stiglitz (1998b, 2012, chapter 9).
- 14 For a further elaboration of the ideas presented here, see Greenwald and Stiglitz, 2003.
- 15 The number of insured institutions on the FDIC's "Problem List" was 772 during the first quarter of 2012. 140 banks failed in 2009, 157 in 2010 and 92 in 2011 (FDIC Failed Bank List, 22 October 2012).
- 16 An increase in  $M^i$  can have other externalities on country  $j$ , (e.g., as a result of the expansion of income in country  $i$ , which increases imports).
- 17 For a broader critique of the excessive reliance on interest rates by central banks, see Greenwald and Stiglitz, 2003 and 2013, and Stiglitz et al., 2008.
- 18 There is a long-standing literature (Persson and Tabellini 1995) showing the benefits of coordination if countries have incentives to employ monetary policies to exert monopoly power over international prices, and that capital controls (to be discussed shortly) can have such effects (MacDougall, 1960, Kemp, 1962, Hamada, 1966, Jones, 1967, and Obstfeld and Rogoff, 1996). But in a world with large countries, there will always be such effects.
- 19 Cooperation requires that both parties are better off than in the Nash equilibrium. Even without transfer payments, by bargaining over  $\alpha_i$ ,  $\beta_i$ , and  $M^i$ , a Pareto improvement can be achieved.
- 20 See, for example, Newbery and Stiglitz (1984), where trade liberalization lowers welfare as a result of the increased uncertainty. Moreover, even in the conventional trade story, there are distributional effects of trade liberalization. Redistributions are not costless, and taking this into account, it is not necessarily the case that social welfare is increased.

- 21 As we noted in the previous footnote, in the presence of risk, without good risk markets, trade liberalization may in fact be Pareto inferior. Moreover, in more dynamic contexts, where there is learning, trade liberalization may have adverse effects on growth and long-term well being. See Greenwald and Stiglitz (2006, 2014).
- 22 The same argument goes for “forcing” labor market liberalization. Allowing free mobility of labor has greater efficiency benefits than allowing the free mobility of capital, given the larger disparities in wages than in returns to capital. But even given the seeming benefits to labor immigration, that parallel those associated with capital inflows, most countries impose restrictions, partly because of the significant distributive consequences that cannot easily be offset.
- 23 For a survey and discussion of the debate over capital market liberalization, see Stiglitz and Ocampo (2008) and Stiglitz (2000 and 2002). For an analysis explaining why capital market liberalization can lead to more volatility, see Stiglitz, 2003. For a discussion of why financial market integration can lead to poorer global economic performance as a result of contagion, see Stiglitz (2010b and 2010c.) For a discussion and empirical evidence of why financial market liberalization may lead to lower growth and more instability, see Rashid (2011).
- 24 There is, in this sense, an underlying market failure: the absence of a full set of risk markets.
- 25 This kind of argument – that in a world with incomplete risk markets, each investor takes the price distribution as given, but when they all invest more in, say, the risky asset, the price distribution changes – was first developed in Stiglitz (1982). More recently, it has been used to explore a wide variety of macroeconomic failures (e.g., associated with fire sales). See, for example, Korinek (2010, 2011) and Jeanne and Korinek (2011). See also Korinek, Roitman, and Vegh, 2010 and Diamond and Rajan, 2011.
- 26 The equivalent dollar value of these changes in utility can be similarly analyzed, using the expenditure function.
- 27 That is why the focus by some monetary economists on the zero lower bound to interest rates is misplaced, and why the analogy sometimes given to the Keynesian liquidity trap is also misconceived. See the discussion below.
- 28 Between 30 June 2004 and 29 June 2006, the Federal Funds rate was raised from 1 percent to 5.25 percent, but this did fairly little to curb the real estate bubble.
- 29 There are a large number of other theoretical and empirical arguments explaining why a standard neoclassical model provides an adequate description of the economy, and, in particular, does not provide the basis for the analysis of the impacts of monetary policy. For instance, in a standard

neoclassical model, prices convey all the relevant information; information about “quantities,” such as the exposure of a country to short-term foreign denominated debt, would be irrelevant. Yet, at least since the East Asia crisis, international policy makers have emphasized the importance of such information. For a fuller discussion of these issues, see Greenwald and Stiglitz (2003).

- 30 In a more general version of this model, government might be concerned with the distribution of income, for example, between banks, firms, and consumers, which is affected directly by  $r$  and  $r^1$ . We can then write  $V(Y, r, r^1(r))$ . An increase in the T-bill rate may affect not only the level of aggregate demand (through the level of lending activity) but also affect welfare through impacts on the distribution of income.
- 31 See, for example, Greenwald Stiglitz (2006 and 2014) and Stiglitz (2012).
- 32 Note that the persistence of unemployment is, itself, evidence that the standard neoclassical model provides an inadequate description of the economy.
- 33 For an analysis of the theory of loan supply, see Greenwald and Stiglitz (2003).
- 34 While the higher cost of capital might by itself lead to the contraction of the sector, the effect is more than offset by the greater availability of credit.
- 35 Though the optimal interest rate may still be lower than it would have been without the capital inflow, since inflationary pressures emanating from sector 1 would have been reduced.
- 36 In general, if there is an imperfect set of risk markets, then we will want to use as many instruments as we have available. See Stiglitz (2014).
- 37 We also showed that whenever risk markets are incomplete (as they always are), markets are not constrained Pareto efficient. See also Geanakoplos and Polemarchakis, 1986.
- 38 Forbes et al. (2011) and Lambert et al. (2011) attempt to identify the magnitude of the spillovers arising out of Brazil’s imposition of capital controls.
- 39 Alternatively, though, they could go to countries with lower yielding returns, implying an adverse effect on the investors in country  $i$  that have had access to the funds.
- 40 Korinek (2013) has identified the set of circumstances – in particular, if the controls are designed to correct for domestic externalities – in which the imposition of currency controls by one country imposes no externalities on others, so that global coordination is not necessary.
- 41 The within-country redistributions are complex. A lower (than expected) interest rate may help corporate borrowers and hurt lenders. In a world in which there are credit constraints, the adverse effect on lenders may be particularly harmful. In a world in which many borrowers are fragile, the positive effect on borrowers may be particularly beneficial.

- 42 We can think of a policy as a rule that maps a realization of  $\theta$  into a set of monetary actions  $\{M, \alpha, \beta\}$ .
- 43 That work itself was based on my generalization of the MM theorem (Stiglitz, 1969, 1974), work which itself, together with Stiglitz (1982b), explained the limitations of the theorem.
- 44 See for example, Johnson, Parker and Souleles (2006). Anecdotally, when Bush cut taxes dramatically in 2001 and 2003, the average savings rate fell to near zero – it did not increase, as the Barro-Ricardo analysis would have suggested. Of course, there were many other things going on, and defenders of the theory might argue that were it not for the tax cut, savings would have been even lower (i.e., minus 2 or 3 percent of GDP). But with credit constraints already binding for so many individuals – and with the bottom 80 percent of America already consuming 110 percent of their income – it is hard to believe that in the absence of the tax cuts, the savings rate would have been that low.
- 45 In fact, large fractions of the population have little wealth – and hence no bequests of significance. According to the US Census Bureau, in 2010, almost 20 percent of American households had zero or negative wealth, and almost 50 percent of those with at most a high school diploma had zero or negative wealth. The median holdings of financial assets by the 20 percent of families with lowest income was only \$1100, and for the next quintile, it was only \$5200, according to the 2010 (down from \$1800 and \$7300, respectively, in 2007) Federal Reserve Board Survey (Bricker, J., Kennickell, A. B., Moore, K. B., and Sabelhaus, J. (2012) “Changes in US Family Finances from 2007 to 2010: Evidence from the Survey of Consumer Finances.” *Federal Reserve Bulletin*, June, 98(2)). Wolff and Gittleman (2011) find that between 1989 to 2007, only “21 percent of American households at a given point of time received a wealth transfer and these accounted for 23 percent of their net worth” (32). They also find that wealth transfers as a proportion of current net worth fell sharply over this period, from 29 to 19 percent. For earlier periods, Paul Menchik and Martin David (1983), using probate records of men who died in Wisconsin between 1947 and 1978, estimated that the average intergenerational bequest amounted to less than one-fifth of average household wealth in 1967 and about 10 percent of the average household wealth of families headed by those ages 65 or over. Michael Hurd and Gabriella Mundaca (1989) found from the 1984 “Survey on the Economic Behavior of the Affluent” data that only 12 percent of households in the top 10 percent of the income distribution reported that more than half their wealth came from gifts or inheritances, and only 9 percent in the 1983 “Survey of Consumer Finances.”
- 46 My own earlier work on asymmetric information and stressing the importance of bankruptcy provided part of the critique. Higher debt

ratios may entail higher (expected) losses from bankruptcy and may have signaling/screening effects. (Stiglitz, 1969, 1982). But these "limitations" are not relevant, at least for countries like the United States, where there is essentially no risk of default.

- 47 I should be more cautious: given the agency issues that were revealed so vividly in the crisis, they might be better described as managerial enterprises, maximizing the well being of the managers, subject to certain constraints on the access to credit. In either case, we have to describe the *behavioral* responses to a change in, say, base money or T-bill interest rates.
- 48 The irony is that government insists that banks use mark to market accounting, but the central bank doesn't do so itself.
- 49 They can, but typically only through substitution effects (a temporary investment tax credit or VAT tax), or through redistributive effects (e.g., the recapitalizations of the banking system, transferring, often in a non-transparent way, resources to the banks at the expense of others).
- 50 But even this effect might be limited: lenders, realizing that the monetary policy was temporary, might base lending not on the value of collateral today, but on its expected future value, which might be diminished with the end of the low interest rate regime. Still, there is considerable evidence that there are institutional rigidities, so that the collateral requirements do *not* adjust as they might in a world with rational expectations.
- 51 It should be noted, however, that some of the holders of mortgages (the lenders) are elderly, with a high level of marginal propensity to consume.
- 52 William C. Dudley, president of the Federal Reserve Bank of New York, noted in a recent speech, "Federal Reserve MBS purchases have succeeded in driving down mortgage rates to historically low levels. But these purchases would have had still more effect on the economy if pass-through rates from the secondary market to the primary market had been higher ... The incomplete pass-through from agency MBS yields into primary mortgage rates is due to several factors – including a concentration of mortgage origination volumes at a few key financial institutions and mortgage rep and warranty requirements that discourage lending for home purchases and make financial institutions reluctant to refinance mortgages that have been originated elsewhere." (2012, "The Recovery and Monetary Policy." Remarks at the National Association for Business Economics Annual Meeting, New York City, 15 October. <http://www.newyorkfed.org/newsevents/speeches/2012/dud121015.html>).
- 53 Alternatively, they could reduce lending, which would be counterproductive, exacerbating the economic downturn.
- 54 The list of imperfections in the mortgage market is not meant to be exhaustive. Institutional arrangements, for instance, make it difficult for lender A to refinance a mortgage held by lender B, and lender A often has

little incentive to refinance the mortgage – it will simply lower his revenues. More broadly, the mortgage servicers have little incentive to facilitate mortgage restructurings. In the last few years, Congress has attempted to grapple with these issues, with limited success. Perverse incentives of service providers have impaired bank restructurings, as have the conflicts of interest among holders of first and second mortgages.

- 55 Or that would be the case, if monetary authorities were not unduly influenced by the financial sector. See Stiglitz, 2010a.
- 56 This is beyond the scope of this chapter, except to note that they relate to problems of imperfect and asymmetric information. Securitization undermines incentives to select good mortgages and monitor; it creates enormous moral hazard problems, and credit rating agencies – the purported “solution” is inherently inadequate. Securitization makes information (about the quality of, say, the mortgages included in the securitization package) a public good, and there is no efficient and effective way by which that information can be provided privately. (The problem is similar to that discussed by Grossman-Stiglitz, 1980). The performance of securities markets in the years before and after the crisis illustrates all of these points.
- 57 They also provide a critique of the standard explanation of the determination of the interest rate as the intersection of the demand and supply for money. They point out that, with most “money” being interest bearing, the traditional view that the interest rate is the opportunity cost of holding money is wrong; furthermore, most transactions are not income generating, but rather than exchange of assets, so if money were required for transactions, there would be no simple and stable relationship between money and the level of economic activity (since the ratio of asset transactions to income can be highly variable). Further, most transactions do not require money; credit is typically an effective substitute, and when it is not, one needs to explain why not. (Cash-in-advance models simply assume that it is not an effective substitute.)

In the 1930’s there was an active debate between two approaches to the determination of the interest rate: the Keynesian, based on the demand for money used for transactions purposes, and that of Robertson’s (1951), which centered on the demand and supply of loanable funds. In some ways, our approach represents a further development of the work of Robertson, with two important changes. First, in his model, the supply of loanable funds was based just on savings. In ours, there is a critical role for banks, which make assessments of the credit worthiness of potential borrowers. Imperfect and asymmetric information is central. Such information tends to be local and specialized; foreign lenders (suppliers) of funds have different information than domestic lenders, so that their allocation of funds is markedly different.

Second, in both Keynes and Robertson, demand always equals supply; yet in models with imperfect and asymmetric information, there can exist rationing equilibrium. Indeed, such equilibria are pervasive.

Moreover, traditional models (of both the Keynesian and Robertsonian version) have little to say about the determination of the spread – the difference between the T-bill rate and the lending rate. If there is a difference, it only reflects a difference in (objectively determined) risk. With risk-neutral lenders and identical expectations, the expected payments are the same. If borrowers' economic activity depended only on their expected payments, and if there were no bankruptcy costs, then the spread would, in fact, be largely irrelevant. But bankruptcy costs are significant, expectations do differ, and firms are risk averse (See Greenwald and Stiglitz 1990, 1993 and Stiglitz 1972).

- 58 In the context of taxation, that was the major insight of Frank Ramsey. See also Stiglitz et al. (2008, 2014).
- 59 Such self-imposed constraints arise out of incomplete and sometimes incoherent views about market failures and the role and scope for government intervention. It also arises from the excessive influence of Tinbergen's "targets and instruments" approach, which was based on a highly oversimplified model of the economy.
- 60 That is, lenders, knowing that the impact on collateral values from the temporary intervention is temporary, would adjust the collateral required for any long-term lending in an offsetting way.

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