Where to draw lines: stability versus efficiency

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Abstract

What kinds of assets should financial intermediaries be permitted to hold? What kinds of liabilities should they be allowed to issue? Should a government or a central bank offer explicit deposit insurance or implicit deposit insurance by acting as a lender of last resort? This paper reviews how tensions involving stability versus efficiency and regulation versus laissez faire have for centuries run through macroeconomic analysis of these questions.

1   Introduction

The appropriateness of governmental responsibility for the monetary system has of course been long and widely recognized. ...
This habitual and by now almost unthinking acceptance of governmental responsibility makes thorough understanding of the

1

grounds for such responsibility all the more necessary, since it
enhances the danger that the scope of government intervention
will spread from activities that are to those that are not appro-
priate in a free society, from providing a monetary framework to
determining the allocation of resources among individuals.
Milton Friedman (1960, p. 8)

This essay is about wise and timely things that macroeconomic theory
has to say about where to draw lines between (1) markets for money and
credit, and (2) monetary and fiscal policies. Historically, it has been difficult
for American statesmen to agree about how to draw those lines. By shedding
light on the tensions and trade-offs involved in drawing those lines, macroeco-
nomic theory helps explain why. The issues are so formidable that the most
brilliant economic minds have swerved, or been tempted to swerve, from one
extreme position to another. Ambiguities and uncertainties about the path
forward arise partly because the choices are difficult and involve conflicts of
interest that thrust us beyond macroeconomics into politics. Nevertheless,
macroeconomic theory helps by characterizing how choices affect aggregate
risk and how that risk is allocated among citizens and foreigners.

A companion paper (Sargent (2010)) uses U.S. historical examples to il-
lustrate processes that have created, temporarily resolved, and then often
reopened monetary and fiscal policy ambiguities. That paper describes his-
tories of political struggles about four aspects of U.S. monetary and fiscal
arrangements: (i) whether to allow an inconvertible paper currency to be a
legal tender for public and private debts; (ii) whether the U.S. federal gov-
ernment should redeem impaired debts of state governments; (iii) whether
and how the U.S. government should implement a gold standard; and (iv)
whether to have a national central bank and, if so, what responsibilities
to assign to it. Debates over these issues were fought long and hard and
resolutions of them were temporary. Statesmen who argued one side when
young advocated the opposite side of an issue when older (James Madison

2

and Henry Clay on a U.S. Bank and Salmon Chase on legal tender), possibly to revert again to one's youthful position when even older (Salmon Chase on legal tender). I offer these examples to illustrate statesmen's struggles with what we now call time-consistency problems; their mixed success in using constitutional clauses to improve outcomes by tying their successors' hands; and the ways that a coherent fiscal and monetary policy occasionally emerged from intentions to implement grand principles, but more often from a haphazard sequence of improvisations and compromises made under the shadow of the government's intertemporal budget constraint.

This paper tries to shed light on these historical struggles by acknowledging ambiguities brought to us by a collection of economic models designed to inform us about the consequences of assembling monetary and fiscal policies in different feasible ways. I focus on models that bear mainly on historical controversy (iv) above, namely, the proper role of a central bank, but that also shed light on aspects of the other three topics. Versions of these models are quite old because the policy issues that inspired them are even older. I mainly refer to rational expectations models, formalized in the 1970s and 1980s, themselves descendants of older models that were constructed to understand what central banks should do, and where, if anywhere, lines should be drawn to separate credit from money markets. The rational expectations hypothesis sharpens these models by highlighting how agents' expectations of future government actions affect outcomes today and shape the changing predicaments into which government officials are cast. I play by the rule that it takes a model to beat a model.

Recurrent outbursts of a long battle over the appropriateness and scope of the 'real bills' doctrine run through the history of our topic. I interpret the real bills doctrine either as advocating free banking or as recommending that a central bank stand ready to purchase sound evidences of commercial indebtedness at an interest rate set with an eye to promoting prosperity. Authored by Adam Smith, the real bills doctrine has both been attacked as

a dangerous fallacy and defended as the backbone of sound monetary policy. The real bills doctrine is alive and well today, and it provides justification or consolation for the massive holdings of private securities on central bank balance sheets.

By rationalizing positions taken both by advocates of the 'real bills doctrine' and their opponents, our formal models frame what seem to be difficult policy choices. Studying these models makes it easier to appreciate why great American statesmen such as Madison and Clay changed their minds. In the same vein, Milton Friedman was also tempted to change his mind about whether to recommend financial laissez faire or strict regulations designed to put impermeable barriers between markets for money and credit.

An enduring issue that is especially pertinent today is exactly how to *define* a real bill. Can banks manufacture 'real bills' by packaging risky securities? It has been claimed that financial intermediaries promote economic efficiency by facilitating loan maturity transformation, liquidity provision, and risk-sharing; that these activities also make the financial system fragile by exposing it to runs; and that arresting runs requires central banks to act as lenders of last resort and government to supply deposit insurance. After describing two models that offer opposite perspectives on lenders of last resort and deposit insurance, I shall cite work that argues that a well designed regulatory system has to manage time consistency issues that resemble those observed in our historical examples.

2   Efficiency versus stability

The shifting opinions of politicians and voters mentioned in the introduction and documented in Sargent (2010) become more understandable when we recognize that 'model uncertainty' about what a central bank should do has prevailed among leading economists (and sometimes even within the mind of a single economist). For hundreds of years, a tension between economic

efficiency and financial stability has run through economists' thinking about banks and central banks. The names of the liabilities (bank notes and bills of exchange in the 18th century, bank notes and deposits in the 19th and 20th centuries, claims on money market mutual funds and maybe even credit default derivatives in the 21st century), and the names of the assets (self-liquidating commercial loans in the 18th and 19th centuries, sovereign debt in the 20th, and mortgage backed securities in the 21st century) have changed, but the underlying theoretical issues endure. What kinds of assets should financial intermediaries be permitted to hold, and what kinds of liabilities should they issue? Regulating banks' portfolios can foster a stable price level and stable monetary (narrow) aggregates, but at the cost of creating rate-of-return wedges (i.e., situations in which different people face different rates of return on assets carrying the same risks). These rate-of-return wedges open incentives for evasion and impose costs in terms of economic efficiency. Later, I shall use writings of Milton Friedman to illustrate a tension between stability and efficiency and the conflicting policy recommendations to which they can give rise.[1]

I shall organize my discussion around a centuries old contest pitting a free banking or real bills policy against a narrow banking policy that was rationalized by the quantity theory of money and that was embodied in both Peel's Bank Act of 1844 and the original Chicago plan for banking reform.

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[1]A presumption that it is good for the relative prices of some assets (interest rates on assets not called money) but not others (an asset called money) to fluctuate over time and across contingencies pervades the literature on these issues. Often, a preference for price stability cannot be represented for reasons internal to the models being used to study how to attain stability. That there are poorly understood forces for prices to be sticky comes through clearly in the striking evidence about the consequences of pure changes in monetary units of account in the early 18th century. See Velde (2009).

3 The real bills doctrine

The real bills doctrine emphasizes the efficiency gains associated with financial competition. It prescribes disarming legal barriers that separate money and credit markets. Legal barriers to competition can either be torn down directly to allow unrestricted financial intermediation, or else circumvented, by having a central bank issue notes that it uses to purchase enough private loans to eradicate the rate of return wedges that the legal barriers were designed to sustain.[2]

The author of the real bills doctrine, Adam Smith (1806, bk. II, ch. II), conducted what today we call a small-country analysis when he took as given the price of gold in terms of consumption goods. Starting from a system in which gold coins alone served as money, Smith argued that a country could improve the allocation of resources by allowing banks to issue notes backed by assets that take the form of safe short-term evidences of private indebtedness (which he called 'real bills').[3] It is feasible for the bank notes to be convertible on demand into gold because the short term loans backing them are risk-free. This policy would prompt private agents to rearrange their cash holdings in a way that would induce a country as a whole to export the gold coins displaced by the more convenient-to-hold but 'good-as-gold' bank notes and to use the proceeds to finance imports of goods to be consumed or invested. Smith said that this operation would have no impact on the domestic price level but

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[2]See Sargent and Wallace (1982) for an account of how central bank open market operations can circumvent legal restrictions on denominations that intermediaries are permitted to issue.

[3]In saying that " ... a bank discounts to a merchant a real bill of exchange drawn by a real creditor upon a real debtor and which as soon as it becomes due is really paid by that debtor," Smith (1806, p. 44) indicates that he is thinking about low risk IOUs.

that it would make the country better off.[4,5]

3.1 Criticism of real bills doctrine

Smith's analysis, which presumed a commodity standard, later came to be understood as promising that the money supply could be trusted to regulate itself if a central bank were freely to rediscount banks' holdings of safe private securities at an interest rate set "with a view of accommodating commerce and business."[6] That prescription came in for widespread criticism especially after the price level anchor that Smith had assumed disappeared when fiat money replaced gold. With promises to convert bank notes into gold no longer anchoring the price level, some monetary economists asserted that a limit on the *quantity* of fiat currency had to be imposed, and this, or so it was claimed, the real bills rule could not do. Critics asserted that discounting short term private evidences of indebtedness at a fixed interest rate would unhinge both the quantity of fiat money and the price level. The real bills

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[4]Smith's argument for using bank notes that are intermediated evidences of safe private indebtedness to economize on gold was adopted and carried forward by Ricardo and Keynes. Antecedents for Smith's idea are to be found in the writings of John Law, a writer and public financier whose reputation had suffered so badly after the collapse of the Mississippi bubble that Smith chose not to mention his works. Antoin E. Murphy found and published John Law's long-lost manuscript Law (1994), originally written in about 1705. See Murphy (1997) for a fascinating account of Law's life and ideas.

[5]Why did Smith choose to include extensive passages on money in a book remembered today for attacking mercantilism and advocating free trade? Smith's advocacy of financial deregulation to economize on the stocks of gold and silver tied up as money was an important component of his criticism of mercantilism. Smith described mercantilism as a set of restrictions on trade designed to protect a country's commodity money from disturbances to supplies and demands for goods emanating at home and abroad. See Smith (1806, bk. III, ch. I). Smith did not attack a straw man. His is one of the most coherent and persuasive accounts of mercantilism that I have read. See Sargent and Smith (1997) and Durdu et al. (2009) for formal models that cast a version of Smith's policy proposal against forms of over saving that are associated with mercantilist policies. I view Smith's proposal for a form of free banking as being an important part of his comprehensive package of policy proposals to dismantle mercantilist restrictions on trade without having adverse effects on a domestic monetary system.

[6]The words in quotes are from section 14 of the Federal Reserve Act of 1913.

'doctrine' became known as the real bills 'fallacy'.[7]

3.2 Indeterminacy under real bills?

This criticism of the real bills doctrine has been cast in terms of Wicksellian price level and money supply indeterminacy under a policy that pegs an interest rate. The reasoning uses a Keynes-Hicks portfolio balance or LM curve $\frac{M}{p} = L(r, Y)$, where r is the nominal interest rate, Y real output, M the money supply, and p the price level, in the following way. When Y is pinned down by a full-employment or 'natural rate of output' condition and when the government or central bank puts loans on tap by offering freely to exchange money for bonds or capital at a set interest rate, the portfolio balance equation determines real balances $\frac{M}{p}$. But it determines neither the numerator M nor the denominator p separately. Versions of such an analysis are presented by Sargent and Wallace (1975) and Sargent (1987b, pp. 96-99), both of which cast indeterminacy results in terms of 1960s vintage models. These models depended sensitively on special assumptions about private actors' preferences over portfolios that were embedded in the function $L(r, Y)$. These assumptions represent what Leontief (1947) called 'implicit theorizing' because they were not derived explicitly from preferences defined over properties of asset returns. In particular, those models adopted what Tobin (1961) interpreted as Keynes's assumption that government bonds are perfect substitutes with private bonds and equity, but imperfect substitutes with government issued money. Obtaining a determinate price level and money supply in these 1960's vintage models requires pegging the money supply, not an interest rate.[8]

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[7]For example, Ahamed (2009) mentions the real bills doctrine often, but always as a mischievous and discredited misconception.

[8]Policy rules that set an interest rate schedule as a function of the price level could also be used to restore determinacy in some formulations. However, such rules seem difficult to interpret in terms of an instruction to the bank's trading desk to put loans on tap.

3.3 Real bills partly rehabilitated by Tobin

Tobin (1961, 1963) enriched the asset menu and the assumptions about private actors' portfolio preferences beyond those elementary Keynesian ones. He then focused attention on how outcomes of open market operations depend not only on the liabilities emitted by the central bank, but on the assets that 'back' those liabilities. For example, Tobin (1961) interpreted Keynes as assuming that government bonds and capital are perfect substitutes and focusing his theory of liquidity preference on the margin between money versus a bonds-capital aggregate. Tobin said that if one had to work with only two aggregates of assets, it was better to make government bonds perfect substitutes with money and to focus on a money-bonds versus private capital margin.[9],[10]

Tobin typically used models with a sticky wage that diverted attention away from how to sustain a nominal anchor (a sticky wage or a sticky price *is* a nominal anchor). But his work had very much of a 'real bills' flavor because it asserted that you can not judge a monetary policy by looking only at the liability side of banks' balance sheets.[11],[12] For Tobin, it was important to distinguish 'outside' (unbacked) from 'inside' (backed by private assets) money. Tobin advocated a research program that would apply portfolio theory to analyze central bank open market operations.

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[9]Tobin's preferences over asset aggregation schemes come from observing the correlations of returns on the component assets.

[10]John Stuart Mill asserted "The issues of a *Government* paper, even when not permanent, will raise prices; because Governments usually issue their paper in purchases for consumption. If issued to pay off a portion of the national debt, we believe they would have no effect." Mill (1844, p. 589), as quoted by Friedman and Schwartz (1982, p. 30), who cite this passage as an example of faulty doctrine.

[11]Tobin's work had very much an anti-naive-quantity theory flavor because he recommended not focusing exclusively on aggregates of banks' liabilities.

[12]For example, Tobin (1955) sets up a model so that central banks' open market exchanges of money for government bonds have no effect, but exchanges of money for capital do.

3.4 Real bills rehabilitated in general equilibrium

To complete Tobin's research agenda required working with general equilibrium models whose all-cards-on-the-table nature makes them immune from the Leontief (1947) 'implicit theorizing' barb. This was accomplished when Wallace (1981), Chamley and Polemarchakis (1984), and their followers brought key insights of Modigliani and Miller to bear on analysis of monetary and fiscal policies. Modigliani and Miller (1958) and Stiglitz (1969) described conditions that rendered an enterprise's liability structure irrelevant, given the structure of its assets. Wallace, Chamley and Polemarchakis, and others fashioned appropriate notions of government assets and liabilities that would allow them to apply the Modigliani and Miller and Stiglitz insights to identify circumstances under which open market operations and other related government liability-management policies are relevant.

I interpret papers cast in the mold of Wallace (1981) and Chamley and Polemarchakis (1984) as 'back-solving' exercises.[13] These back-solving exercises consist of the following steps: For a given monetary-fiscal policy, first determine an equilibrium price system and allocation. Then freeze the allocation and price system and attempt to solve the model's equilibrium conditions for a *class* of monetary-fiscal policies that support the same equilibrium. By doing this, Wallace (1981), Chamley and Polemarchakis (1984), and their followers constructed nontrivial equivalence classes of policies that support the same allocation and price system. Selections from within such an equivalence class of policies can be said to be 'irrelevant'. These irrelevance classes bear out many of the real bills hunches present in Tobin's work.

General equilibrium models like those of Wallace (1981) and Chamley and Polemarchakis (1984) are also very good vehicles for describing the tensions that pit the gains in stability against the losses of efficiency brought by

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[13]'Back solving' means exchanging the mathematical roles of what we usually think are endogenous (prices and allocations) and exogenous (endowments and monetary and fiscal policies) variables.

financial regulation.[14]

3.5 Real bills versus the quantity theory, or efficiency versus stability

To analyze claims made for and against the real bills doctrine, Sargent and Wallace (1982) and Smith (1988) adopted versions of the overlapping generations model of Samuelson (1958). The overlapping generations model is a natural vehicle for this purpose because it can be rigged so that objects that resemble both inside and outside money are traded in equilibria with aggregate fluctuations.[15] The structure of endowments and preferences can be arranged to make an unbacked fiat money issued by a government be valued within a competitive equilibrium. This government issued liability pays zero nominal interest and plays the role of outside money. Sargent and Wallace (1982) and Smith (1988) used within-generation heterogeneity of endowments and preferences to motivate private borrowing and lending. Private IOUs available in zero net supply are safe assets that can be used to back inside money, i.e., they are Adam Smith's 'real bills'.

3.5.1 Fluctuations ignited by fundamentals

To inject aggregate volatility that impacts the credit market and the money market, Sargent and Wallace (1982) assume a strictly periodic inter-generational pattern in the endowments of the people who are natural borrowers, a class of rich agents who are relatively well endowed later in their lives. These rich borrowers issue safe interest-bearing IOUs that are purchased by rich lenders (rich agents who are well endowed early in life). Poor lenders might also hold

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[14]Wallace (1989) offers a characterization of potential irrelevance of open market operations in terms of an absence of apparent arbitrage opportunities in an equilibrium price system.

[15]Many of the ideas can also be represented in the context of models in the style of Bewley (1980, 1983), but versions of these models with aggregate fluctuations are more difficult to work with than are overlapping generations models with short-lived agents.

some of them too, but only if there is adequate financial intermediation. The rich lenders are naturally holders of large denomination 'bonds' while the poor lenders are naturally holders of small denomination 'money'. The poor lenders can hold claims on the large denomination loans issued by rich private borrowers only indirectly, that is, only if banks purchase private IOUs and use them to back small denomination notes or deposits that the poor lenders can afford. The endowment patterns of rich and poor lenders are constant across generations, so the demand for credit from the rich borrowers is the only source of instability in money and credit markets.

The Sargent and Wallace (1982) model environment is constructed to represent the quantity theory case for imposing legal restrictions that separate markets for credit and for money, and to raise questions about it. When legal restrictions in the form of a minimal denomination for liabilities that banks can issue are in place, poor lenders are confined to holding outside money while rich lenders will choose to hold the IOUs issued by the rich borrowers.[16] The legal restriction preventing production of inside money props up the demand for outside money and leads to rate-of-return wedges that indicate that credit and money markets have been decoupled.[17] Rich lenders get higher rates of return than do poor lenders holding assets with identical risk. With money and credit markets thus separated, an equilibrium exists with a constant price level; poor lenders hold outside money while rich lenders hold private securities that yield a positive but fluctuating nominal rate of

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[16]This restriction is designed to mimic Peel's Bank Act of 1844.

[17]A legal restrictions theory can also be used to rationalize the cash-in-advance restrictions in the models of Lucas and Stokey (1983), Lucas (1986), and Sargent (1987a, ch. 5). Furthermore, paying interest on government-issued fiat currency emerges as a necessary condition for solving a Ramsey problem (see Lucas and Stokey (1983) and Lucas (1986)). The optimal policy eradicates the rate-of-return wedges opened up by the legal restrictions protecting the money market from competition with the credit market. Another way to implement the optimal policy is to permit free entry of intermediaries offering risk-less liabilities backed by risk-less assets purchased in the credit market. Arbitrage profits tempt entry into this intermediary business in any equilibrium having a positive nominal interest rate.

return. Fluctuations in the rate of return on private loans are driven by the demand for credit emanating from the periodically varying endowments of rich borrowers. Those fluctuations do not affect the money market, which is protected by the legal limits on producing inside money. Here the quantity-theory-inspired legal restrictions stabilize the price level by separating the markets for credit and money. For the quantity theory of money to fit the data in this regime, 'money' should be defined as outside money.[18]

Evidently, the restrictions that separate money and credit markets achieve price level stability at a cost in terms of economic efficiency. Because different agents face different rates of return on assets with identical risks, the equilibrium allocation of resources is not Pareto optimal. A Pareto optimal allocation can be attained by implementing a real bills policy that creates a sufficiently large quantity of inside money backed by private IOUs. This can be done in superficially different but economically equivalent ways. One way is to instruct a central bank to circumvent the legal restriction on note size by purchasing private IOUs and using them to back inside money in the form of small denomination notes that the poor lenders can hold. This can lead to one of two possible outcomes, depending on whether or not endowments and preferences of the overlapping generations imply a low or high interest rate equilibrium without fiat money.[19] In the low-interest-rate case, in which the economy is naturally short of borrowers, there exists an equilibrium in which fiat money continues to be valued and interest rates on inside and outside money are equated. In this equilibrium, the nominal rate of interest is zero, but now the price level fluctuates because fluctuations in the demand for credit affect the supply of inside money. A quantity theory equation linking the price level and a money supply will still fit the data, but now it is necessary to define money as the sum of outside and inside money. This real bills equilibrium is Pareto optimal, but not Pareto superior to the quantity theory

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[18]This conforms with a Chicago tradition in the 1950s and 1960s that one should define 'money' by choosing among monetary aggregates that explain the price level best.

[19]See Samuelson (1958) for an analysis of these cases.

equilibrium that separates the money and credit markets. Moving from one equilibrium to another produces winners and losers.

Using a central bank open market strategy is not the only possible way to eliminate barriers between credit and money markets. Another way to implement the same Pareto optimal allocation is simply to remove the legal restriction and to permit unfettered financial intermediation, also known as free banking. This will lead to the same equilibrium price level as well as the same allocation.

Thus, in the case in which the economy is naturally short of borrowers, removing barriers between money and credit markets creates instability in the price level and the money supply but leaves fiat money valued. But in the high interest rate case in which the economy has enough borrowers, removing barriers between money and credit markets causes fiat money to become worthless as the economy switches to a commodity standard. Here, legal restrictions protect the value of fiat money. However, in this case it is also true that an equilibrium without valued fiat money is Pareto optimal.

3.5.2   Fluctuations coming from sunspots

In the Sargent and Wallace (1982) model, with or without restrictions that separate money and credit markets, fluctuations in the price level, interest rates, and allocations emanate from fluctuations in fundamentals. Smith (1988) observes that historically concerns about adverse effects of waves of optimism and pessimism not linked to fundamental sources of fluctuations seem to have motivated some proposals to separate money and credit markets. To represent and evaluate those concerns, Smith constructs an overlapping generations structure in which regulations to separate credit and money markets succeed in eradicating equilibria that depend on sunspots. Smith describes restrictions that move the economy from an equilibrium with excessive fluctuations driven by sunspots to one without sunspots. Removing those restrictions produces winners and losers, so equilibria with and without

14

legal restrictions that draw lines between money and credit are not Pareto comparable. As with the Sargent and Wallace (1982) model, the welfare comparisons that Smith performs sharply expose some of the ambiguities that necessarily confront a policy maker pondering whether he or she should want rates of return on some assets to be stable while accepting that other rates of return on other assets are not.

4 The Chicago plan for 100% reserves and Milton Friedman's improvements

Sargent and Wallace (1982) and Smith (1988) designed their quantity theory regime legal restrictions to emulate the Chicago plan for 100% reserve requirements that Friedman (1960, p. 65) credited to Henry Simons and Lloyd Mints. Friedman modified the original Chicago plan to correct defects that he said were associated with the inefficiencies and incentives for avoidance brought by the legal restrictions that prevent people from exploiting the arbitrage opportunities presented by the rate of return discrepancies that prevail in equilibrium under the original Chicago plan. Friedman (1960, ch. 3) suggested two ways to overcome these difficulties. The first is to pay interest on reserves, to be financed either through taxation or through earnings on the central bank's portfolio.[20] The second is to 'move in the opposite direction' advocated by Gary Becker (1956) by abandoning restrictions on intermediation and permitting free banking (Friedman (1960, ftnt. 10, p. 108)).[21]

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[20]Notice that this is an early version of the 'Friedman rule' later proposed in Friedman (1969). That financing details form essential parts of the plan is a good example of how monetary and fiscal policies are inextricably linked.

[21]The tensions between efficiency and stability run through the vast literature critically evaluated by Friedman and Schwartz (1986).

4.1 General equilibrium analysis of Friedman's improvements

Subsequent researchers aimed to clarify the sense in which these two proposals are really opposites. As we shall see, when interest payments are financed from earnings on the central bank's portfolio, they are not opposites. Sargent and Wallace (1985) and Sargent (1987a, pp. 177-182) study versions of Friedman's proposal in the context of two different general equilibrium models with potentially valued fiat money, an overlapping generations model in Sargent and Wallace (1985), and a cash-in-advance model in Sargent (1987a, pp. 177-182).[22] Both models reveal that while Friedman's proposal to pay interest on reserves eliminates the inefficiencies and incentives for avoidance that concerned Friedman, they have side effects that come from erasing the lines between money and credit markets imposed by the original Chicago plan.

When interest payments are financed by earnings on the government portfolio, either no equilibrium with valued fiat money exists, or there is an equilibrium with a zero nominal interest rate and an allocation equivalent to one that would emerge under free banking. Thus, a proposal to pay interest on reserves financed by earnings on the central bank's portfolio is equivalent in its economic effects on relative prices and quantities to the 'move in the opposite direction' advocated by Gary Becker.

When payments of interest on reserves are financed by taxes, both models reveal that while Friedman's proposal to pay interest on reserves eliminates the inefficiencies and incentives for avoidance that concerned Friedman, it does so by making the price level either indeterminate or infinite because it eradicates the barriers between the money and credit markets. These outcomes emerge because paying a market rate of interest on reserves makes reserves into as good an investment for banks as are the alternative assets

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[22]Both models assume lump sum taxes.

16

that earn that market rate, rendering the demand for reserves indeterminate. When the demand for reserves becomes indeterminate, so do the taxes that have to be raised to pay interest on reserves. In the overlapping generations model, the market interest rate itself as well as tax rates and total tax collections are indeterminate. Similar results prevail under a cash-in-advance model, but here the interest rate becomes determinate under tax financing even though the price level and taxes are indeterminate.[23],[24]

4.2 Indeterminacy theme

A specter of indeterminacy runs through the literatures that convey economists' thoughts about real bills doctrine, the quantity theory of money, and proposals to supply an 'optimal quantity of money' by paying interest on reserves. Avoiding the Wicksellian indeterminacy of the price level and money supply alleged to be endemic to a real bills policy motivated restrictions to separate markets for money and credit. Those restrictions worked, but they produced collateral damage in the form of equilibrium rate-of-return wedges that indicate inefficiencies and avoidance vulnerabilities. Implementing interest-on-reserves proposals to correct those rate-of-return discrepancies reignite indeterminacies.

4.3 Paying interest on reserves subverts independence of the central bank and the fiscal authority

From Friedman (1960) onward, analyses of schemes to pay interest on reserves financed by taxes have highlighted the fiscal ramifications of such a

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[23]See Sargent (1987a, pp. 177-182). Lucas (1986, p. 124) proposes a closely related scheme with interest payments on currency to be financed by government earnings from private IOUs that it purchases in period 0. Lucas does not emphasize the indeterminacy lurking in his scheme, but I believe it is there nonetheless.

[24]Things are somewhat different in interesting ways in Bewley models and extensions of Townsend turnpike models. See Ljungqvist and Sargent (2004, pp. 594–597) and Manuelli and Sargent (2010).

policy. The interdependence of monetary and fiscal policies inherent in such policies is one more illustration of how the sequence of government budget constraints make the 'independence of the Fed' a fiction. That it is perhaps a *useful* fiction comes from comparing what seem to be diametrically opposed proposals for coordinating monetary and fiscal policy made by Milton Friedman. Friedman (1953) proposed a debt management policy in which the Fed purchases 100% of all debt issued by the Treasury and thus automatically and immediately finances 100% of all government deficits. Later, Friedman (1960) proposed that the Fed increase the monetary base at k percent per year, thereby telling the Treasury that it will finance at most a small part of any large deficit. In hesitating between such apparently opposite proposals, Friedman was struggling to find a way for a determined monetary authority to get the upper hand over the fiscal authorities in what can become a game of chicken presented by the unpleasant arithmetic of the government budget constraint.[25]

4.4   Take away points

In summary

- Proposals to separate money and credit markets introduce inefficiencies. Proposals to construct *optimal* policies in the fashion of Friedman (1960) strive to reduce or eliminate those inefficiencies. But those proposals all end up reintegrating the credit and money markets.[26]

- Proposals to pay interest on reserves financed by earnings on the central bank's portfolio are economically equivalent to implementing a real

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[25]See Sargent and Wallace (1981) and Sargent (1993, ch. 2).

[26]This is brought out forcefully in the analysis of Lucas and Stokey (1983), who analyze a setting in which the 'Friedman rule' that aims to eliminate a rate-of-return wedge between money and short-term risk-free bonds emerges as part of an optimal policy rule. The Friedman rule or something closely approximating it has emerged as optimal policy in a variety of environments.

bills or free banking regime. They therefore undo the stabilizing effects sought by the original Chicago plan for separating markets for money and credit.

- Proposals to pay interest on reserves financed by taxes also subvert restrictions designed to separate markets for money and credit. In addition, they further confuse the line between fiscal and monetary policy and raise substantial issues about central bank independence.

- There are winners and losers in moving from a regime that separates money and credit markets to one that unfetters intermediaries.

5 Another line: fighting bank runs versus discouraging excess risk-taking

I have described how Milton Friedman and other economists have struggled with tensions between stability and efficiency in deciding where to draw the line between money and credit markets. I now discuss closely related issues that at heart shape alternative visions of the proper roles of lenders of last resort and deposit insurance. Because of how they alter incentives of banks' owners, depositors, and other creditors, government lender of last resort and deposit insurance activities raise questions about the same fundamental public policy issue that I have been discussing throughout this paper, namely, "what assets and liabilities should banks be allowed to hold and to issue?"

5.1 Deposit insurance is good

In the Diamond and Dybvig (1983) model, 'banks' enable risk-sharing and maturity transformation that can improve the allocation of resources by al-

lowing society to exploit investment opportunities efficiently.[27] But with first-come, first-serve deposit contracts, there are multiple equilibria, and some of these are not good. In a no-run equilibrium, outcomes are good. Maturity transformation facilitates risk-sharing and the appropriate financing of long-lived projects (the allocation is Pareto optimal). In an equilibrium with a 'run', risk-sharing and maturity transformation break down and the allocation of resources is Pareto inferior.

In this environment, government supplied deposit insurance works like a charm by knocking out bad equilibria. The government removes equilibria with runs by promising payoffs that will be made only off the desirable and unique no-run equilibrium. This means that in equilibrium, deposit insurance ends up being costless.

How would someone armed only with the Diamond and Dybvig model approach the events of fall 2008? The model asserts that explicit deposit insurance immunizes banks from runs. That means that FDIC insured banks should be protected from runs. But the model interprets a 'bank' to be any intermediary that conducts maturity transformation by issuing shorter term liabilities to fund longer-term assets. In 2008, that meant not just institutions that called themselves banks, but also money market mutual funds, special purpose vehicles known as shadow banks, insurance companies, and even parts of companies manufacturing durable goods like automobiles. Because they were not insured by the FDIC, such intermediaries were vulnerable to runs. It was natural to apply the Diamond and Dybvig model to argue

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[27]Also see the closely related earlier paper Bryant (1980) and the enlightening comparison of the models of Bryant and Diamond and Dybvig by Allen and Gale (2007, ch. 3). Allen and Gale (2007, Sec. 3.7) emphasize that the Diamond-Dybvig model relies on sunspots to ignite runs while the Bryant model and Allen and Gale (1998) rely on depositors' views about the prospects for economic fundamentals. Allen and Gale (2007) cite empirical evidence favoring fundamentals over sunspots as causing bank runs in practice. Green et al. (2009) interpret the model of Atkeson and Lucas (1992) as an infinite-horizon version of a model like Diamond and Dybvig's and by extending it to include capital discuss how liquidity provision interacts with business cycles. Atkeson and Lucas (1992) extend a model of Green (1987).

that the contagion that rapidly gathered steam in the fall of 2008 could be arrested by extending deposit insurance to all such Diamond and Dybvig 'banks' (institutions whose maturity mismatches made them vulnerable to a run); that by doing so aggressively, the contagion would be arrested; that the ultimate cost of doing so would be small because adverse events that pass high costs to the government would occur only if the run failed to be arrested, an outcome that the government's extension of deposit insurance had eliminated.

In this way, the Diamond and Dybvig model justifies the aggressive extension of 'deposit insurance' to previously uninsured creditors of non-bank financial intermediaries. It also inspires hope that a more serious breakdown has been avoided by using a policy that will not impose substantial costs on tax payers.

While this application of the Diamond and Dybvig paper offers grounds for optimism, cautionary words in the concluding section Diamond and Dybvig (1983) should cause us to think again. There the authors noted that by studying deposit insurance within a model that rigorously excludes moral hazard, they had purposefully excluded a countervailing force that had been analyzed by Kareken and Wallace (1978) in a paper that offers a very different perspective on deposit insurance.

5.2 Deposit insurance is bad

In the Diamond and Dybvig model, deposit insurance is unambiguously good. In the model of Kareken and Wallace (1978), deposit insurance is unambiguously bad when unaccompanied by a set of portfolio regulations that prevent banks from taking the excessive risks that deposit insurance tempts them to accept.

Kareken and Wallace studied an economy with complete markets that provide individuals ample opportunities to take or avoid risk. Like Diamond and Dybvig, Kareken and Wallace assumed rational expectations, so deposi-

tors 'see through' intermediaries and view themselves as holding shares of a bank's portfolio. Kareken and Wallace compared two scenarios that might conceivably confront banks and their depositors. In the first scenario, a bank can attract depositors who want to hold risk-free assets if and only if it holds a risk-free portfolio.[28] In this scenario, banks are safe in equilibrium because withdrawing depositors would immediately punish banks that do not hold safe portfolios.

In Kareken and Wallace's second scenario, a government guarantees deposits, so depositors have no reason to be concerned about the riskiness of a bank's portfolio. Nevertheless, a bank's shareholders do because shareholders' value is maximized when a bank becomes *as large* and *as risky* as possible. The deposit insurance allows shareholders to gamble on favorable terms with other peoples' money (the tax payers'), and shareholders want to do this as much as possible. The bank is bound to fail sooner or later, and then the government will have to pay the depositors. Note that the moral hazard problem is not solved by having the *share holders* take losses when adverse events occur. The Kareken and Wallace model assumes that share holders *do* take losses when a bank fails, a risk that they accept. The problem occurs when the bank's *creditors* expect not to take losses, enabling the bank's shareholders to gamble at the tax payers' expense.

In this way, Kareken and Wallace isolated the moral hazard problem created by improperly priced government-supplied deposit insurance. Kareken (1983) used the Kareken and Wallace analysis to argue that financial deregulation without accompanying reform of deposit insurance would be putting 'the cart before the horse'.

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[28]This situation approximates the 'natural' competitive banking system of Bagehot (1920, p. 68) wherein banks experience a 'preservative apprehension' (Bagehot (1920, p. 106)).

5.3 Aligning political incentives

> In framing a government which is to be administered by men over men, the great difficulty lies in this: you must first enable the government to control the governed; and in the next place oblige it to control itself.   James Madison, *Federalist Papers*, number 51.

The Diamond and Dybvig and the Kareken and Wallace models take government policy as exogenous. Appreciating the problem of banking regulation requires making government policy endogenous in ways that recognize the incentives that confront government policy makers as time and chance unfold.

The good and bad aspects of deposit insurance isolated by the Diamond and Dybvig and Kareken and Wallace models, respectively, present a tension about how the government should administer deposit insurance and lender of last resort functions. At least informally, the dilemma has long been recognized. Bagehot said that in normal times the Bank of England should act in a way that convinces other banks *not* to expect to be bailed out when they experience adverse portfolio shocks; but nevertheless that when banks are threatened by a run, the Bank of England should lend freely to other banks, albeit while charging a high rate of interest and requiring good collateral. Bagehot warned that this policy might not work. Indeed, under rational expectations it cannot work because it is not coherent intertemporally.

At the time that Northern Rock failed in 2007, Lawrence Summers chided Governor Mervyn King of the Bank of England with the advice that 'now is not the time to bring out the moral hazard police'. Summers's advice is both correct, according to a pure Diamond and Dybvig view, and incorrect, according to a pure Kareken and Wallace view that would make you ask 'if not now, when?' When a run threatens, government authorities face incentives that will make them choose to follow through on the painful policies needed to confirm the 'preservative apprehensions' on the part of banks' creditors

that would stop banks from taking on too much risk. Such intertemporal *conflicts* among the things preferred by a benevolent government are called time-consistency problems.[29]

5.4 A model with good and bad aspects of bank bailouts

Keister (2010) extends the Diamond and Dybvig model to characterize a time-inconsistency problem inherent in sustaining government policies that alter the vulnerability of the economy to runs while also changing banks' choices about liquidity.[30] He does this by augmenting the model to include a government that uses taxes to finance a public good and occasionally to bail out depositors.[31] The model is set up so that bailouts are part of an efficient government policy both *ex ante* and *ex post*, though the generosity and distribution of the bailouts differ across those two timing protocols. The *ex ante* efficient policy (designed at time 0 before people realize whether they want to consume early or late and see a sunspot variable that may trigger runs) involves a level and distribution rule for government bailouts together

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[29]That prospective actions that *ex ante* seem desirable to government functionaries also seem suboptimal *ex post* is at the heart of the predicament of designing deposit insurance and lender of last resort policies. Bagehot (1920, pp. 100-101) identified the problem: "A panic, in a word, is a species of neuralgia, and according to the rules of science you must not starve it. The holders of the cash reserve must be ready not only to keep it for their own liabilities, but to advance it most freely for the liabilities of others. They must lend to merchants, to minor bankers, to "this man and that man" whenever the security is good. In wild periods of alarm, one failure makes many, and the best way to prevent the derivative failures is to arrest the primary failure which causes them." But "If the banks are bad, they will certainly continue bad and will probably become worse if the Government sustains and encourages them. The cardinal maxim is that any aid to a present bad bank is the surest mode of preventing the establishment of a future good bank. Bagehot (1920, pp. 51-52).

[30]See Allen and Gale (2007, ch. 7) for a welfare analysis of alternative proposals for regulating bank portfolios.

[31]At time 0, the government taxes private agents, carries the proceeds over without depreciation into period 1, which it then uses either to purchase a public good or bail out depositors facing losses. The public good is valued by both early and late consumers. There is a sunspot variable s taking on two values s_1, s_2 with known positive probabilities that potentially induces late consumers to withdraw early when $s = s_2$.

with illiquid bank portfolios. (Here the degree of illiquidity is defined as the ratio of short term liabilities to short term assets. The bank is illiquid when this ratio exceeds 1.) An *ex post* efficient government policy (designed at time 1 after people realize their types and observe the sunspot variable) involves *larger* bailouts as well as a distribution of bailouts across banks and depositors that distorts *ex ante* incentives. The basic problem is that if they were to *anticipate* that the government would carry out the *ex post* optimal rule for distributing bailouts to depositors, intermediaries would choose portfolios that are more illiquid than the *ex ante* efficient ones, an adverse outcome that Keister uses to frame the time inconsistency problem confronting policy makers in this environment. It is important to note that Keister's analysis does not rationalize a no-bailout policy. He shows that relative to the *ex ante* efficient policy, an arbitrary *ex ante* policy of *no bailouts* expands the region of the parameter space for which the economy is vulnerable to runs that are associated with inefficient outcomes. Keister (2010) uses this finding to capture the adverse destabilizing effects of a no-bailout policy. Keister constructs a tax on banks' illiquidity that together with the *ex post* optimal bailout policy implements the *ex ante* optimum.

5.5 Related approaches

Stern and Feldman (2004) explore other ways of characterizing and coping with the incentive problem confronting government agents that is provoked by the tension between *ex post* good (arresting contagion) and *ex ante* bad (provoking excess risk-taking) aspects of deposit insurance and other lender-of-last resort activities. These writings take us into the realms of political economy and sustainable government plans.

The analysis of Stern and Feldman addresses the time-consistency problem by focusing attention on ways to rearrange the interests and choice menus available to voters and government policy makers that can make it in *their* interests to follow through with policies designed to ameliorate the excessive

risk-taking that government creditor insurance policies promote. Their perspective is that what has thus far impeded protecting ourselves against both contagion and efficient risk-taking is a set of incentive problems confronting not just banks and their creditors but also the elected officials and other government officers with the authority to insure creditors and act as lenders of last resort. Stern and Feldman were inspired to apply lessons we have learned in coping with the time inconsistency problem created by temporarily exploitable trade-offs between inflation and unemployment. Accordingly, they seek government programs and appointment procedures that will give government agents the incentives to execute policies that will attenuate excessive risk-taking at tax payer expense.

6   Concluding remarks: what is a real bill?

This paper has cited formal models that interpret Adam Smith's 'real bills' as safe evidences of private indebtedness and the wedges that the real bills doctrine aims to eradicate as being wedges between risk-free rates of return faced by different people. We have seen that analogous efficiency-versus-stability issues arise when we ask whether financial intermediaries should be allowed to transform maturities and risks to help complete missing insurance and lending markets. Rate of return wedges and the associated inefficiencies are tell-tale signs of equilibria in models with incomplete markets. Expanded intermediation can reduce those wedges. Should banks and other intermediaries be allowed to improve efficiency by offering products that rely on statistical averaging and censoring to transform bundles of risky assets of various durations into less risky assets that can back short-term risk-free deposits? Whether financial institutions should be allowed to purchase or to create such wedge reducing, efficiency improving assets and use them to back putatively risk-free liabilities raises questions about proper policies toward public lenders of last resort and suppliers of deposit insurance.

I began by quoting words from Milton Friedman that asserted the importance of properly regulating monetary arrangements. I conclude by quoting troubling words that express a fear that in the U.S. we have not yet figured out where to draw lines properly.

> . . . some central structural issues have not yet been satisfactorily addressed.
>
> A large concern is the residue of moral hazard from the extensive and successful efforts of central banks and governments to rescue large failing and potentially failing financial institutions. The long-established safety net undergirding the stability of commercial banks deposit insurance and lender of last resort facilities has been both reinforced and extended in a series of ad hoc decisions to support investment banks, mortgage providers and the worlds largest insurance company. In the process, managements, creditors and to some extent stockholders of these non-banks have been protected.
>
> The phrase too big to fail has entered into our everyday vocabulary. It carries the implication that really large, complex and highly interconnected financial institutions can count on public support at critical times. . . . Beyond the emotion, the result is to provide those institutions with a competitive advantage in their financing, in their size and in their ability to take and absorb risks.
>
> As things stand, the consequence will be to enhance incentives to risk-taking and leverage, with the implication of an even more fragile financial system. We need to find more effective fail-safe arrangements.   Paul Volcker (2010)

A Bagehot: ideal versus practical banking regimes

Walter Bagehot (1920) described the features of the mid 19th century British money market that rendered it vulnerable to recurrent panics and that virtually forced the Bank of England to be the lender of last resort. Bagehot made it clear that he did not like the existing British banking system and the advantages and responsibilities that the Bank of England had acquired as owner of a preponderance of England's reserves and through its special relationships with the government. Bagehot said that what he called a 'natural' competitive banking system without a 'central' bank would be better. Bagehot (1920, p. 98):

> Nothing can be truer in theory than the economical principle that banking is a trade, and only a trade; and nothing can be more surely established by a larger experience than that a Government which interferes with any trade injures that trade. The best thing undeniably that a Government can do with the Money Market is to let it take care of itself.

Bagehot (1920, p. 103) thought that a system of competitive banks would ordinarily be immune to breakdowns and would not need a lender of last resort.

> Under a good system of banking a great collapse, except from rebellion or invasion, would probably not happen. A large number of banks each feeling that its credit was at stake in keeping a good reserve probably would keep one; if any one did not, it would be criticised constantly, and would soon lose its standing, and in the end disappear.

But Bagehot said that this ideal system was not practical for late 19th century Britain. He described Britain as having evolved through a long process

of political and economic improvisations to reach a system of banking arrangements that a good theorist could criticize but that a pragmatist must acknowledge was invulnerable to proposals for reform.[32] "Thus our one reserve system of banking was not deliberately founded upon definite reasons; it was the gradual consequence of many singular events and of an accumulation of legal privileges on a single bank which has now been altered and which no one would now defend." Bagehot (1920, p. 97) Centralizing the entire banking system's reserves with the bank of England made the system more unstable than the 'natural' competitive system that Bagehot preferred. "And this system has plain and grave evils. 1st. Because being created by State aid it is more likely than a natural system to require State help." Bagehot (1920, p. 105) "The English Government not only created this singular system but it proceeded to impair it and demoralise all the public opinion respecting it." This happened when by *requiring* the Bank of England to suspend convertibility of its notes into specie, "[Mr. Pitt] removed the *preservative apprehension* which is the best security of all banks." Bagehot (1920, p. 106) (italics added)

B Real Bills in the Federal Reserve Act

The real bills doctrine was written into the Federal Reserve Act of 1913 and taken seriously by early Federal Reserve Boards. Thus,

> . . . any Federal reserve bank may discount notes, drafts, and bills
> of exchange arising out of actual commercial transactions; that
> is, notes, drafts, and bills of exchange issued or drawn for agricul-

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[32] "Credit is a power which may grow but cannot be constructed. Those who live under a great and firm system of credit must consider that if they break up that one they will never see another, for it will take years upon years to make a successor to it. On this account I do not suggest that we should return to a natural or many reserve system of banking. I should only incur useless ridicule if I did suggest it." (Bagehot (1920, p. 68)) So much for mechanism design.

tural, industrial, or commercial purposes . . . Nothing in this Act contained shall be construed to prohibit such notes, drafts, and bills of exchange, secured by staple agricultural products or other goods, wares, or merchandise from being eligible for such discount; but such definition shall not include notes, drafts, or bills covering merely investments or issued or drawn for the purpose of carrying or trading in stocks, bonds, or other investment securities, except bonds and notes of the Government of the United States. Notes, drafts, and bills admitted to discount under the terms of this paragraph must have a maturity at the time of discount of not more than ninety days . . .

Federal Reserve Act, 1913. section 13, paragraph 2

From the Annual Report of the Federal Reserve Board in 1923 we have:

[T]here will be little danger that the credit created and contributed by the Federal reserve banks will be in excessive volume if restricted to productive uses. Board of Governors (1923, p. 34)

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