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Robust Political Economy and the Lender of Last Resort

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Abstract Of the leading versions of lender of last resort policy, which is to be preferred in a world of realistic incentive and information imperfections? The three most prominent versions of lender of last resort policy are: the Classical system of central bank lending on good collateral at a penalty rate, the Richmond Federal Reserve system of open market operations to prevent liquidity drains, and the New York Federal Reserve system of commitment to taking any and all action necessary to prevent the spread of financial contagion. We compare these policies to the mechanisms that developed in free banking systems. Free banking systems had no formal lender of last resort, but instead developed institutions that lessened the possibility of systemic panic in the first place. We find that free banking weakly dominates the Classical system. Free banking also outperforms the New York Fed and Richmond Fed systems on the incentive margin, but is weaker on the information margin. In addition, the paper discusses how the New York Fed doctrine is the only stable activist policy, since the limited responses necessitated by the Classical and Richmond Fed policies are not credible.

Keywords Bagehot · Free banking · Incentives · Information · Monetary institutions · New York Fed · Private clearinghouses · Richmond Fed · Robust political economy

JEL Classification E52 · E58 · P16

> "Any system which gives so much power and so much discretion to a few men that mistakes—excusable or not—can have such far-reaching effects is a bad system. … Mistakes, excusable or not, cannot be avoided in a system which disperses responsibility yet gives a few men great power, and which thereby makes important policy actions highly dependent on accidents of personality."—Milton Friedman (2002 [1962]: 50)

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1 Introduction

A growing body of literature critically assesses the performance of U.S. central banking in light of the 2007–9 financial crisis.[1] One theme arising from this literature is that policy failure on the part of the Federal Reserve was the proximate cause of the recession that followed the crisis.[2] While some argue that the Federal Reserve was partly responsible for the unsustainable run-up in asset prices that preceded the bust (e.g. Beckworth 2012; Horwitz and Luther 2010; Taylor 2007, 2009; White 2012a), others contend that it failed only to offset the severe monetary contraction following the bust (e.g. Hetzel 2012; Sumner 2011, 2012),[3] .[4] These accounts of the crisis and its aftermath call for a reconsideration of the proper form and function of monetary institutions. This paper contributes to that effort by reexamining historical interpretations of the lender of last resort policy first elaborated by Thorton (1939 [1802]) and popularized by Bagehot (1896 [1873]). In particular, this paper will consider the three chief versions of that policy—the Classical system of central bank lending on good collateral at a penalty rate, the Richmond Federal Reserve system of open market operations to prevent liquidity drains, and the New York Federal Reserve system of commitment to taking any and all action necessary to prevent the spread of financial contagion—and, comparing them to free banking systems' ability to stem off financial panic, determine which systems are robust to agent imperfections in the form of information and incentive frictions.

The literature on the lender of last resort most relevant to this work takes two forms. The first can be described as exercises combining comparative economics with the history of economic thought. Scholars writing on past interpretations of lender of last resort doctrine provided a framework for deriving policy implications from this doctrine (e.g. Bordo 1990; Humphrey 1989; Selgin 1989, 2012). More recent works are characterized by formal models that examine whether asymmetric information, the idiosyncrasies of interbank loan markets (with special focus on collateral and repo markets), and moral hazard allow an unambiguous interpretation of lender of last resort doctrine (e.g. Freixas et al. 2004; Li et al. 2013; see also Goodhart and Huang 2005 and Rochet and Vives 2004). While these latter efforts seriously consider information and incentive frictions in their attempts to determine optimal lender of last resort policy, they unfortunately limit these frictions to private agents.[5] They seem to assume that the lender of last resort, provided with the optimal policy from the models' reduced-form solutions, can unerringly implement that policy in real time and will have the right incentives to do so. In order to appreciate the desirability of any particular lender of last

[1] See for example Ahrend (2010); Beckworth (2012); Benes and Kumhof (2012); Boettke and Smith (2013a, b, c); Diamond and Rajan (2009); Dowd and Hutchinson (2010); Espinosa (2012); Hetzel (2012); Horwitz and Luther (2010); Jarocinski and Smets (2008); Leamer (2007); Mehrling (2010); O'Driscoll (2012); Kling (2010); Kotlikoff (2010); Roberts (2010); Selgin et al. (2012); Sumner (2011, 2012); Taylor (2007, 2009); White (2008, 2009, 2012); Woodford (2012); Woolsey (2012).

[2] This is not the only explanation of the financial crisis put forth. For a sample of opinions on the causes of the financial crisis see *Critical Review* Vol. 21, No. 2–3.

[3] The former explanation draws on the Austrian theory of the trade cycle (Garrison 2000; Horwitz 2000) whereas draws on the Monetarist story of Friedman and Schwartz (1963). These theories are not irreconcilable, and may in fact be complementary (Boettke and Luther 2009).

[4] Moral hazard explanations also feature prominently in these works. See especially Espinosa (2012), Roberts (2010), and White (2012a, b).

[5] The lender of last resort in these models is assumed to be an actor of a different kind from the profit-seeking bankers.

resort policy, this assumption must be relaxed. In doing so this paper follows the structure of the comparative-economics literature.[6]

This paper also contributes to the literature on alternative monetary institutions that considers possible arrangements to replace central banking. Popular alternatives include unrestricted note issue on the part of individual banks, known as free banking (Sechrest 2008; Selgin 1988, 1994; Selgin and White 1994a; Smith 1990 [1936]; White 1989, 1995), a separation of the money and credit functions in banking, known as limited purpose banking (Kotlikoff 2010; Kotlikoff and Leamer 2009), and an enforced 100 % reserve requirement, known as full-reserve banking (Huerta de Soto 2012; Jarocinski and Smets 2008; Rothbard 2008, 2009). These are for the most part overarching works of system, whereas the scope of this paper is more narrow, focusing only on the lender of last resort function. However, the findings of this paper may have implications for the debate as to which of these alternative arrangements, if any, is superior to modern central banking.

In the following section, we outline the framework of robust political economy. In Section 3 we explore the theoretical desirability of a last-resort lender and explore how market-based institutions and practices filled this role before the rise of modern central banks. We will judge the various interpretations of lender of last resort doctrine—Bagehot's rules, the Richmond Fed doctrine, and the New York Fed doctrine—using standards derived from the robust political economy literature in Sections 4, 5, and 6. In Section 7 we conduct a comparative analysis of the four lender of last resort conceptions. In Section 8 we offer closing thoughts on the implications of the findings for public policy and future research.

2 Robust political economy: the positive framework

2.1 The meaning of robustness

In the abstract, robustness designates a system's ability to perform well under stress. In the context of political economy, robustness "examines deviations from ideal conditions with respect to (but need not be limited to) actor motivation and information" (Leeson and Subrick 2006: 108). Robust political economy focuses on the ability of the political-economic system to achieve beneficial outcomes when actors are limited in knowledge or information-processing ability, or may engage in opportunistic behavior. The question robust political economy tries to answer is, "Which institutions perform best when people have limited knowledge *and* are prone to self-interested behavior" (Pennington 2011: 3, emphasis in original)?

Robust political economy has its roots in two separate strands of analysis. This interplay is summarized in Figure 1. The "epistemic" side (the columns of Figure 1) focuses on what has come to be known as the knowledge problem. Relaxing the "strong" informational assumptions of perfect information and perfect rationality (unerring discernment of the correct means to attain given ends) requires us to consider individuals who are boundedly rational at best and may be subject to sheer ignorance—they may not know what they do not know (O'Driscoll and Rizzo 2014). Robustness requires functioning well under the inevitable ignorance that

[6] An approach similar to the one advocated here can be found in Calomiris (2013). While concerned with banking panics rather than last-resort lending per se, Calomiris considers similar historical cases and reaches similar conclusions to those to be discussed later in the paper.

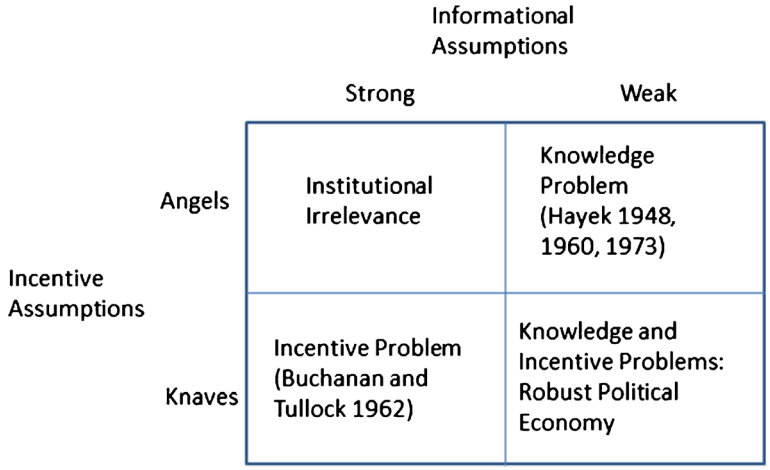

Fig. 1 Incentive-information matrix

results from scarce information and limited ability to process new information (Hayek 1948). The informational process can either be facilitated or hampered by the underlying institutional framework (Hayek 1960, 1973). Complete and perfect information and perfect agent rationality, while useful assumptions in formal modeling, often poorly characterize actors in the real world (Leeson and Subrik 2006: 107), especially in non-market settings. The incentive side (the rows of Figure 1) distinguishes two archetypes of human behavior: Actors can be "angels," meaning their actions are harmonious with social welfare, or "knaves," meaning they may act opportunistically where their own payoff comes at the expense of their organization's interest or the public good. The potential for opportunism in non-market actors follows from the behavioral symmetry of individuals as self-interested agents in scenarios of private and public choice (Buchanan and Tullock 1962). Thus concern for robustness requires that institutions "be judged on their capacity to channel potentially self-interested motivations in a way that generates beneficial outcomes at the societal level" (Pennington 2011: 3).[7]

As Boettke and Leeson (2004: 100) note, command-and-control solutions to political-economic problems can look more efficient than market solutions when we assume complete information and angelic behavior on the part of planners. When we relax these assumptions to consider possibilities of imperfect information and knavery among planners parallel to what we assume for market actors, we arrive at more balanced criteria for the analysis of real-world institutions. In a perfect world, social outcomes are invariant to the institutional framework. Either the institutions exist and are superfluous, or the problems that institutions are created to overcome never arise.

[7] While the range of human behavior is perhaps better captured by a continuum rather than the discrete categories presented above, these categories highlight the essential feature of robust political economy: comparing best-case to worst-case scenarios. Robust political economy is fundamentally a search for those institutions that function well even in these worst-case scenarios. As Boettke and Leeson (2004: 100) recognize, "Many systems can stand up tothe test of the easy case, but very few remain standing when confronted with the hard case."

2.2 Robust political economy applied to monetary institutions

Monetary institutions have been examined from the perspective of robust political economy by Boettke and Smith (2013a, b, c). Their arguments focus mostly on incentive frictions, although they are clearly aware of information frictions. Boettke and Smith argue that the Federal Reserve, though nominally independent, does not operate in a political vacuum, and thus political considerations ought to occupy a much more prominent place in our theories of how monetary policy operates. They note that F. A. Hayek, James Buchanan, and Milton Friedman all recognized the problem of misaligned central bank incentives and made efforts to solve it (Boettke and Smith 2013c; see also Friedman 2007; Buchanan 2012, and Hayek 1978).[8]

The above discussion suggests three dimensions along which to judge institutional arrangements for the lender of last resort function:

1) Information—does the lender of last resort arrangement rest on reasonable assumptions about the information possessed and processed by the agents acting within the system?
2) Incentives—does the arrangement rest on reasonable assumptions about the incentives agents face when called upon to act as the doctrine requires?
3) Stability—given the answers to 1) and 2) can we expect the last-resort lender arrangement to persist in its proposed form in future stress situations?[9]

A robust arrangement will receive affirmative answers to the above questions. Assessment would be difficult were we looking for some cardinal measure of performance. But our concern here is comparative institutional efficacy, which requires a ranking of alternative versions of the lender of last resort.

Two points about the following comparisons need to be made more explicit. First, it is assumed that each of the last resort lending policies to be discussed has the same end: stabilizing the financial system as a whole.[10] The evaluations of information compatibility, incentive compatibility, and stability fall entirely within this context.[11] Second, it is important to emphasize that the evaluations are not claims about superiority in every single circumstance. If one lender of last resort policy is found to be more robust than another, this does not mean it is impossible for the policy which is "dominated" to yield a desirable outcome. Rather, it means that there is a strong *tendency* for the dominated policy to produce inferior outcomes (e.g. Hayek 1967).

Having made explicit the criteria by which we will judge the four alternative conceptions of the lender of last resort, we now proceed to spell out those conceptions. It will be useful to

[8] In a slightly different vein, Anna Schwartz (1987) examined the efficacy of the lender of last resort under different economic and regulatory conditions. This can be considered a proto-exercise in robust political economy analysis of monetary institutions.

[9] Stability is important for robustness because ambiguity with respect to the lender of last resort arrangement the monetary authority uses is costly. In particular, market actors will be forced to invest greater resources in understanding the "true" last-resort lending rule, will err in decisions predicated on a given last-resort lending rule when another is effect, or some combination of both. Recent research (e.g. Baker et al. 2013) has highlighted how uncertainty can negatively impact economic outcomes; uncertainty with respect to the underlying monetary rule during times of financial turbulence raises similar problems, and ought be avoided wherever possible.

[10] More specifically, this means preventing the spread of contagion by ensuring the continued viability of illiquid, but still solvent, organizations.

[11] Of course, the different versions of last resort lending doctrine will propose different means by which the end of financial stability is best achieved.

begin with a brief summary of the conditions under which a lender of last resort is desirable, and to discuss briefly the practices that emerged to mitigate financial turbulence before the rise of modern central banks.

3 Last-resort lending and market mitigation of financial turbulence

3.1 Banking, banking panics, and the lender of last resort

At its most general level, commercial banking consists of issuing small retail liabilities that are used to finance portfolios of loans and other assets. Commercial banks make profits to the extent they can exploit an interest rate spread between their liabilities, such as savings and demand deposits, and their assets, such as mortgages or commercial paper. Commonly their liabilities are shorter in duration than their assets. These banks, realizing that depositors are extraordinarily unlikely to present their claims for redemption *en masse*, are able to hold reserves that are only a fraction of their demandable deposits. The rest are used to finance their investment portfolio. The resulting arrangement is acceptable to both bank customers—even uninsured depositors—and the banks themselves: Bank customers can expect to earn interest on their savings deposits (and sometimes on their demand deposits as well), and to enjoy unpriced transaction services, which compensates them for the risk that they will not be able to withdraw their funds in certain scenarios. The bank thereby enjoys higher profits.

Banks with different investment strategies are likely to keep different (fractional) reserve levels. Conservative banks will retain higher reserves and invest in lower yield/lower risk assets. Banks with higher risk tolerance will keep a lower reserve ratio and pursue higher yield/higher risk assets. Customers' compensation for this risk with their (uninsured) deposits will take the form of varying interest on deposits, as determined by market conditions and the terms of agreement between the individual banks and their customers. When the banking *system* is functioning well, customers are not concerned about the security of their deposits. The liabilities backing the banks' abilities to finance their portfolios—consumer deposits—are *information insensitive*. In other words, it is not profitable for private speculators to invest in acquiring private information about the soundness of these securities (Gorton 2010: 20). Unsound management by any one bank that leads depositors to doubt that bank's ability to redeem claims will undoubtedly harm the bank in question. Such behavior may lead depositors to transfer their funds to another bank in a "flight to quality" that disciplines the risk-taking propensities of each individual bank (Kaufman 1988). But these events do not constitute a reason to question the integrity of the banking system as a whole (Bordo 1990: 19).

However, the situation is very different when events call into question the soundness of the entire system. Examples include the inability of the banking system to supply a currency sufficiently elastic to suit the needs of trade, as in the Panic of 1907 (Smith 1990), and the bursting of the bubble in collateralized mortgage debt leading to widespread uncertainty in the "shadow" banking system during the most recent financial crisis (Gorton 2010). In situations such as these, bank liabilities become *information sensitive*—there is a payoff from acquiring private information concerning the soundness of the banks' securities. When bank depositors become aware that there is a possible solvency problem, because this information is costly to acquire and is asymmetrically distributed, each depositor has an incentive to withdraw their funds as quickly as possible (Gorton 1988). This desire is rational since bank deposits are convertible on demand (Bordo 1990: 19). When depositors do try to redeem their claims *en*

masse, the result constitutes a bank run. Bank runs spell doom for insolvent banks (banks whose total liabilities exceed their total assets), but because the flight to liquidity forces asset sales at fire sale prices, which necessitates depressed asset prices for *all* banks, the run can turn solvent banks into insolvent banks

The lender of last resort is supposed to prevent the spread of financial contagion by meeting the public's demand for liquidity. The job of the lender of last resort is to stop the panic by intervening at the point when the liquidity of solvent but illiquid banks is threatened (Bordo 1990). Historically, "isolated runs…were not contagious when a dependable lender of last resort existed" (Schwartz 1987: 9). This impels the question of what a "dependable" lender of last resort looks like. What particular form ought the lender of last resort take to best insure that it plays its desired role? By analyzing from the perspective of robust political economy the theory and history of the systems of private clearinghouses, public Bagehotian authorities, and the interpretations of the Richmond and New York Federal Reserve, we will make significant progress towards answering this important question.

3.2 The baseline scenario: free banking[12]

Free banking systems, such as the one that developed in Scotland (White 1995), predate the formal development of lender of last resort doctrine by Thorton and Bagehot. As such, there is no formal (i.e. public) authority providing last-resort lending services. Nevertheless, banks in these systems developed, in the course of conducting ordinary business, practices that (unintentionally) lessened the chance that a panic would cripple the system. The practices to be discussed reduced the chance that bank runs evolved into systemic panics. This obviated the need for a concerted lender of last resort policy. Three features in particular—the interbank clearinghouse, the distinction between inside and outside money, and temporary suspensions of note redemption—deserve special attention.

3.2.1 The interbank clearinghouse

The interbank clearinghouse is perhaps the most important mechanism that allowed decentralized banks of issue (banks that issued their own notes as liabilities) to cope with financial turbulence. Theoretically, private clearinghouses can be viewed as the evolved outcome of decentralized banks' profit-maximizing strategies in absence of a central coordinator, such as a modern central bank (Fink 2011; Selgin 1988; Selgin and White 1994a; White 1995). Because banks of issue profit from maintaining high note circulation (the greater the public's holding of its notes, the greater a bank's float), these banks have an incentive to make mutual agreements to accept each other's notes. The accumulation of each other's notes leads in turn to the need for an efficient interbank clearing process. The clearing and settlement process evolved from bilateral into multilateral to economize on transaction and reserve-holding costs. Once formed, the clearinghouse can perform other useful functions. One such function is information collection and sharing, which helps to mitigate information asymmetries. Another is an enforcer of quality standards, which prevents an individual irresponsible bank from free-riding on the institutional- and brand-name capital of responsible banks who use the clearinghouse. Lastly, by pooling resources, they serve as transaction-cost

[12] The following is a condensed summary of the process described by white (1999: chapter 1), which the interested reader should consult for a more in-depth discussion.

reducers in situations where banks of issue unexpectedly find themselves in need of short-run liquidity or must divest themselves of toxic assets in a short period. The importance of this last feature, in particular, in mitigating a potentially crisis-inducing event (such as the failure of a large and interconnected financial institution) by containing financial "contagion," is particularly important.

The historical record of free banking periods shows actual clearinghouses did in fact perform these theoretically useful functions. It seems there were significant economies of scale in the formation of clearinghouses, as exhibited by the tendency for a single clearinghouse to service all banks of issue in a political-economic entity. As White (1989: 231) attests, "Eventually all the banks within an economy will be connected through one or a small number of clearinghouses…[t]he histories of the best-known early clearinghouses, in London, Edinburgh, and New York, all conform to this general pattern." In some cases the clearinghouse would become a "banks' bank," with each bank keeping deposits at the clearinghouse for the purpose of settling balances. With respect to maintenance of quality standards, clearinghouses—through the voluntary agreement of its members—established capital requirements and bank examinations as a way of disciplining member banks (Gorton and Mullineaux 1987: 457), and shared information among themselves as to which banks were sound and which were suspect. Lastly, they provided a source of liquidity-sharing and even liquidity creation during times of crisis. When bank runs broke out, clearinghouses facilitated liquidity transfers between member banks, creating a short-term credit market analogous to the federal funds market in which banks in the U.S. participate today (White 1989: 233).[13]

The interbank coordination achieved through the private clearinghouses helped to prevent individual bank failures from evolving into a system-wise crisis in the first place. A good example is how the Scottish free banking system coped with the failure of the Ayr Bank. The Scottish free banking system and accompanying interbank clearinghouses were well developed by 1769, when the Ayr Bank opened its doors. Within 3 years of operation it was obvious the Ayr Bank had overissued its notes, had made too many bad loans, and had become insolvent. The effectiveness of the interbank clearing mechanism quickly saw the return of the Ayr Bank's liabilities, which it was unable to redeem. The bank was forced to close its doors, and the spillover effects were large enough to bring down 13 more small private bankers in Edinburg and one small provincial bank near Perth. For comparison, there were 32 total banks, in Scotland just before the Ayr failure (White 1995: 27). Notably, despite the size of the Ayr Bank, the failure of the Ayr Bank did not cause a systemic event. The clearinghouse mechanism allowed the other largest Scottish banks to divest themselves of the Ayr Bank's liabilities before the crash, preventing the Ayr failure from threatening the integrity of the system. The largest note-issuing institutions were able to continue business, with the spike in public demand for liquidity lasting merely one business day (White 1995: 29).

[13] Clearinghouses in the U.S. during the National Banking Era provided a unique way to ameliorate a crisis. Member banks of a single clearinghouse would suspend individual operation, suppress information concerning the solvency of individual banks, and issue certificates redeemable by the clearinghouse as a whole. This was an important source of emergency liquidity in a system constrained by regulations that prohibited branch banking and, due to collateral requirements, rendered the conversion of currency to deposits artificially inelastic (Smith 1990). This had the benefit of substituting the solvency of the system as a whole for the solvency of individual member banks during a panic. However, the uniqueness of the U.S. case makes it inappropriate for drawing general inferences, so it will not be treated in detail here. Interested readers should consult Gorton (1985, 2010), Gorton and Mullineaux (1987), and Timberlake (1984).

3.2.2 Inside vs. outside money[14]

The distinction between inside money (liabilities issued by individual banks) and outside money (the money-commodity, such as gold or silver, which emerged from barter as a medium of exchange prior to the rise of the banking system) that prevailed during free banking periods had important, though unintended, consequences for systemic stability. In a mature free banking system, claims to outside money, rather than outside money itself in the form of commodity coins, serve as the day-to-day medium of exchange. These liabilities were accepted because they could be redeemed for the underlying money-commodity, and because they were less costly to store and transport. The unintended consequence of the inside money-outside money distinction was that it made it profitable for banks to accommodate changes in the public's money demand, as well as changes in the public's compositional preference for notes vs. deposits (Selgin 1988; Selgin and White 1994a, b).[15] For example, if the public's money demand suddenly and unexpectedly rose, a representative bank of issue would notice this through a piling up of gold reserves in their vaults, as fewer members of the public presented their notes for redemption during a given time period. The bank rationally responds by issuing more notes, which it uses to purchase additional assets. Purchasing these assets injects the new notes into public hands, satisfying their demand for higher cash balances. This prevents the otherwise-costly necessity for many price adjustments across the economy, which would otherwise result in a downturn in economic activity. A currency stock elastic to the requirements of trade, as prevailed in historical episodes of free banking, is important for preventing the collapse in liquidity that Friedman and Schwartz (1963) showed is hazardous for system-wide stability.

3.2.3 Temporary suspension of redemption

The final stability-enhancing feature of free banking discussed here is the temporary suspension by banks of deposit redemption during times of turbulence. Diamond and Dybvig (1983) rightly note that suspension can burden consumers with welfare costs by obstructing consumers' ability to engage in planned consumption. However, this must be balanced against the potential welfare gains achieved by the prevention of bank runs afforded by suspension. In addition, suspension clauses serve as an alternative to deposit insurance as a means of countering runs. Importantly, "[b]ecause suspension contracts are incentive compatible, they can avoid the moral hazard problem associated with insurance" (Selgin 1993: 360).

Historically, banks often included clauses in deposit contracts giving banks the option of temporarily not honoring the public's demand for redemption if such demands might result in liquidity problems for the bank. Banks could invoke this clause for a pre-defined period, and in return the public was granted a special interest payment on their held liabilities for the duration of the suspension. (Selgin 1993; Selgin and White 1994a, b: 1729). While governments have

[14] Because the inside money-outside money distinction is intrinsic to the operation of all free banking systems, it is impractical to discuss any specific historical case in this subsection as is done in others. Readers interested in specific historical details should consult the free banking literature cited above.

[15] Evidence of this stability can be seen by comparing Canada's laissez-faire approach with that of the U.S. during the National Banking Era. While in the U.S. there were little seasonal variations in note circulation and large fluctuations in interest rates come the harvest season, in Canada note circulation was around 20 % higher in the autumn relative to its own mid-winter seasonal lows and there were no noticeable seasonal interest rate fluctuations (Schuler 1992: 88; Selgin and White 1994b).

not always been favorable to the inclusion of such provisions in deposit contracts, they were permitted in Scotland from 1730 to 1765, Sweden from 1864 to 1903, and Canada during the majority of the 19th century (Selgin 1993: 356; Dowd 1991: 12–14).

The Canadian banking system in the first half of the 19th century shows the effectiveness of redemptions suspension in preventing bank runs from growing into banking panics. In 1837, a financial panic that began in Britain began to affect the Canadian banking system. In response, banks suspended payments to noteholders and depositors. While technically illegal, it was tolerated by government officials on the assumption that forcing payments would lead to a system-wide collapse. [16] The suspension of payment allowed the banks time to liquidate their assets without having to resort to fire-sales (Schuler 1992: 83).[17] Temporary suspension of redemption thus blunted the impact of financial contagion that began overseas.

3.3 Assessing the robustness of free banking

We can now consider the question of free banking's robustness. Information-wise, free banking systems were equipped with effective mechanisms, namely the clearinghouse, for coping with the informational asymmetries inherent in banking. In non-crisis times, the clearinghouse served an informational role by facilitating cooperation among member banks. In times of crisis, when bank liabilities have become information-sensitive, the clearinghouse provided a node of coordination for the system as a whole. In lowering the transaction costs for interbank cooperation, they also lowered the transaction costs (especially collateral evaluation costs) of a potentially troubled bank securing emergency liquidity from one whose financial position was more sound. The private clearinghouse system did not require any heroic assumptions about the agents operating within its framework.

The incentive issue also appears favorable. Bank customers, both depositors and borrowers, were disciplined by normal market forces. Importantly, the separation between inside money and outside money, which allowed banks to adjust the money supply and its composition (notes or deposits) to the needs of trade, did not also afford banks an incentive to over-issue liabilities. Any bank that printed up more notes than the public was willing to hold would find those notes presented back to it for redemption (Selgin 1988: Ch. 3). In addition, suspension of redemption, when not forbidden by law (and, as the Canada example shows, even sometimes when it was), provided a way to stem a potential bank panic. The use of these clauses as an incentive-compatible alternative to modern-day deposit insurance further strengthens the case that free banking systems, as a matter of day-to-day business, took steps to prevent bank runs before they occurred. Finally, due to the presence of a hard budget constraint among banks, the potential for moral hazard problems seems low under free banking.

Stability seems more difficult to assess. On the one hand, free banking persisted in Canada and Scotland for over a century in each case. Sweden had a similarly long-lived experience with free banking. The persistence in substantively unchanged form of free banking during these periods suggests they were stable arrangements. On the other hand, today these systems have almost completely been replaced by central banks as the lender of last resort. Historical

[16] In Upper Canada, the governor threatened to shut down banks that suspended payments. As a result banks suffered reserve drains and were forced to contract their loans more than banks in other provinces. The crisis in Upper Canada was said to be worse "than anywhere else in North America" (Schuler 1992: 83).

[17] This historical example suggests clearinghouses also had a way of dealing with problem posed by Diamond and Dybvig (1983). This suggests that under panic condition the suspension of payments, contrary to Diamond and Dybvig, was welfare-enhancing (Selgin 1993).

and theoretical analysis suggests that free banking systems were replaced not as the result of market forces but political forces (Smith 1990). If the possibility of political influence from outside the system is sufficient to render a system unstable, it is not clear how any system could ever be judged stable. It makes more sense to consider a system is stable if that system itself does not itself generate the behaviors that lead to its unraveling. In other words, *given current monetary institutions*, do we expect the current lender of last resort mechanism to persist? In this sense we may say that free banking is stable.

In summary, mechanisms that prevent the problem that last-resort lending policies are intended to solve arise endogenously in free banking systems. These mechanisms make it less likely that a run will evolve into a panic, with the accompanying threat to solvent but illiquid banks, which is the source of the desirability of a lender of last resort. The operation of these mechanisms rests on reasonable assumptions about the information and incentives of real-world agents. Lastly, the system appears internally stable over time. This result is not definitive, however. We need to compare the robustness of free banking mechanisms to the robustness of last-resort lending rules practiced by modern central banks before we can make any comparative statements of efficacy.

4 The classical system: central bank lending on good collateral

The legacy of Bagehot's *Lombard Street* is its blueprint for stopping bank panics. The book was motivated by the series of panics in England from 1847 to 1866. The Bank of England at this time responded to troubles by "curtailing credit to conserve the Bank's own liquidity" in the face of an internal drain of specie reserves (Selgin 2012: 303), thereby exacerbating the crises and contributing to their evolution into full-scale panics. Bagehot provided a formal framework to analyze how the Bank of England responded to the 1867 Overend-Gurney panic in particular. His principles caught on, and the Bank of England assumed the responsibility, accompanying its monopoly issue of legal tender banknotes, of acting as the lender of last resort to the English financial system.[18] According to Meltzer (2003: 52), the bank's assumption of this role was instrumental to the prevention of future crises escalating into panics, including the infamous 1890 Baring crisis.

Bagehot (1896: 58–59) succinctly summarized his policy prescription for the lender of last resort: "[V]ery large loans at very high rates are the best remedy for the worst malady of the Money Market…" Meltzer (1986: 83) elaborates on this criterion:

- "To prevent illiquid banks from closing, the central bank should lend on any collateral that is marketable in the ordinary course of business when there is a panic…"
- "Central bank loans, or advances, should be made in large amounts, on demand, at a rate of interest above the market rate."
- "The above…principles of central bank behavior should be stated in advance and followed in a crisis."

[18] Interestingly, Bagehot himself preferred free banking, what he called "the natural system—that which would have sprung up if Government had let banking alone" (Bagehot 1896[1873]), to central banking. He advocated his now-orthodox rules for last-resort lending because he believed the *political* constraints prevented a transition to the kind of banking system that existed in Scotland.

The first principle, lending abundantly on good collateral, is derived from the nature of a banking panic. Liquidity should be provided abundantly by the monetary authority because it is in the unique position to prevent en masse redemption sparked by the transition to information sensitivity of bank debt. Banks with good collateral to offer would be able to pay back once normal times return. Bagehot needed to persuade the privately-held Bank of England that following his recommendations would not reduce the Bank's profits.

The second principle, lending at a penalty rate, addresses the possibility of moral hazard. Bank of England officials had objected to lending reserves to banks with liquidity problems on the grounds that easy liquidity in times of turbulence would, at the margin, induce agents in the financial sector to make riskier investments in times of tranquility. Banks able to count on liquidity rescue would hold smaller reserves of their own and become dependent on the Bank of England's reserve. The provision of emergency liquidity at penalty (higher than market) rates is an active attempt to check this sort of behavior by making banks regret being in need of a last-resort loan.

The third principle, announcing the policy in advance, is a mechanism for anchoring market expectations. By announcing the central banks' commitment to stemming banking panics, the central bank can preemptively reassure the public that the crucial threshold from crisis to panic will not be crossed, which should stop the public from running the banks in the first place. It also serves as a warning to those in the banking sector: "In times of turbulence, if you are solvent but illiquid, you will pay a penalty. If you are insolvent, you will fail. Construct your portfolio accordingly."

At first glance, the Bagehotian system seems like a simple and effective mechanism for preventing the evolution of crises into panics, which explains its enduring presence in explaining modern central bank practice (e.g. Mehrling 2010) and in prescribing institutional improvements (e.g. Selgin 2012). In order to verify its effectiveness, we must now consider its robustness. Of special importance will be examining whether the central banks' pledge to restrict lending to banks whose position is fundamentally sound is credible.

Central banks from 1870 to 1970 seem to have taken Bagehot's prescriptions seriously (see e.g. Bordo 1990; Goodfriend 2012; Goodhart 1985; Schwartz 1986).[19] As mentioned above, the Bank of England acted as a lender of last resort to prevent the Baring Crisis of 1890 from evolving into a panic. It accomplished this by working jointly with the Bank of France and prominent clearinghouse institutions. The cooperation of these organizations, which agreed to cover the Bank of England's losses in its attempt to meet the public demand for liquidity, formed a kind of joint lender of last resort (Schwartz 1986: 19).[20] In 1901, the German Reichsbank stemmed a panic by purchasing prime bills on the open market and expanding its note issue, but in accordance with Bagehotian doctrine did not stop the failure of the Leipziger and other insolvent banks (Goodhart 1985: 96). The Bank of France followed a similar course in the crises of 1882 and 1889 (Bordo 1990: 24).

However, the experience post-1970 has been a different story. For example, the Bank of England rescued banks of questionable solvency in 1974 and 1982. In 1985 the Bank of Canada "arranged for the major chartered banks to purchase the assets of two small insolvent Alberta banks and fully compensate all depositors" (Bordo 1990: 26). The actions of the U.S. Federal Reserve in the most recent financial crisis, starting with the $29 billion bailout of Bear

[19] The exception is the United States, which will be discussed further below.

[20] Goodfriend (2012) argues that the Bank of England's adherence to Bagehot's rules was due to the incentives provided by shareholder residual claimancy.

Stearns creditors in March 2008, are an even more salient case.[21] Interventions such as these suggest the impact of Bagehot's message, while still receiving academic attention, have fallen out of favor with monetary policymakers.

Unlike its European counterparts, the U.S. Federal Reserve (assisted by Congressionally-created regulatory organizations) has never taken Bagehot's advice. The banking acts of 1933 and 1935 created the institution of deposit insurance. At the time, the creation of deposit insurance was opposed by a number of bank presidents and congressmen, as well as President Roosevelt, due to concerns over moral hazard (Hetzel 2012: 151). Moral hazard had been implicated in the failure of many state governments' deposit insurance schemes in the nineteenth and early twentieth centuries. Numerous provisions in the banking acts were explicitly constructed to curb the perceived moral hazard problems. In addition, further elaboration on the rules of deposit insurance in the 1950s attempted to signal credibly that FDIC would only bail out insured depositors, with no intention to extend these benefits to uninsured depositors or other debt holders. By restricting entry into banking, and placing ceilings on interest rates payable on savings accounts, the regulations simultaneously assured high net worth to banks. These rents thereby made a bank charter a valuable asset; the desire to protect franchise value was supposed to be the force counteracting moral hazard, a kind of efficiency-wage model for banks (Hetzel 2012: 152–153; Gorton 2010; see also Schwartz 1987: 3–8).

However, the above only works if those in the banking sector perceive a limited response as credible. If banks expect to be bailed out, the benefit from treating a bank charter as a valuable capital asset is severely curtailed. The Fed's (along with the FDIC) bailing out of the Franklin National Bank in October 1974, was the first of several incidents suggesting regulators and central bank authorities would be unwilling to tolerate losses by uninsured depositors even at moderately-sized banks. Fed officials allowed Franklin National, once the nation's 20th largest bank with total deposits of $1.45 billion (Sinkey 1977: 780), access to the discount window, but did not charge a penalty rate (Bordo 1990: 26), despite the fact that Federal Reserve System officials concluded in June of the same year that the bank would fail anyway. It was this bailout that "set the standard for TBTF [Too Big to Fail]" (Hetzel 2012: 154). This process was largely repeated with the 1980 bailout of First Pennsylvania Bank. The implicit policy of TBTF continued with the debt crises in Argentina, Mexico, and Chile in the early 1980's. These countries' defaulting on their debts led to a significant number of large U.S. banks becoming insolvent (Hetzel 2008: ch. 14). "Regulator unwillingness to close large, insolvent banks became publicly apparent in 1984 with the bailout of the debt holders and uninsured depositors of Continental Illinois and of its bank holding company" (Hetzel 2012: 156). In each of these cases banks had used uninsured short-term funding to create portfolios of risky long-term assets; the response of regulators and the Federal Reserve strongly suggested that the commitment made during the period from the 1930s to the 1950s to refrain from rescuing uninsured depositors was not, in fact, credible.

TBTF policies were also extended to nonbank financial institutions. "The Fed's intervention in May 1982 into the bankruptcy of Drysdale Securities, a small dealer in government securities, is significant in that it established the precedent of not allowing creditors of nonbank financial institutions to incur losses" (Hetzel 2012: 158). The Fed's later involvement in Long-Term Capital Management further suggests the public-sector financial safety net, though not

[21] The response of the Federal Reserve to the recent crisis will be explored more fully in the section covering the development of the New York Fed doctrine.

officially stated, is the rule rather than the norm (Hetzel 2008: ch. 17). In testifying before Congress, Federal Reserve Chairman Alan Greenspan claimed the Long-Term Capital Management intervention was necessary due to the heightened fragility of financial markets, which itself was a function of previous extensions of the unofficial safety net's severe curtailing of market discipline (Hetzel 2012: 159). A policy of seeking financial stability through bailouts undermines itself by fostering the moral hazard (Goodfriend and Lacker 1999).

This brief overview calls into question the robustness of Classical doctrine on the incentive side. Bagehot's rules crucially depend on the lender of last resort restraining its activities to assist only those banks that are illiquid but not insolvent. But when faced with the failure of a bank that could possibly trigger a systemic event, the agents charged with carrying out Bagehot's recommendations have an incentive to go beyond those recommendations and bail out the bank. No central banker wants to be remembered as having allowed a financial crisis due to insufficient action. The historical record shows that lender of last resort policy was mixed at best with respect to Bagehot's rules, and the successful instances occurred mostly in the latter part of the 19th century. In more recent times, bailouts seem to be the norm, rather than the exception.[22]

Robustness with respect to the information side is a bit more complicated. First, there is the issue of deciding upon an acceptable penalty rate for discount-window lending. It is important the penalty rate is above the rate that banks would charge each other on similar loans during times of tranquility.[23] The monetary authority has little choice but to use historical data as a proxy. Another issue is whether market agents and agents performing the lender of last resort function can distinguish clearly between sound and unsound collateral, or have some other reliable indicator of the solvency of the borrowing bank.

Goodhart (1985, 1987) argues that the informational burden associated with collateral evaluation is significant. Because there is no clear line between sound and unsound collateral, the line between illiquid and insolvent is blurry, if not entirely unperceivable.[24] While not trivial, Goodhart's concerns are relevant only at the margin. Agents may be unable to define precisely the line between sound and unsound collateral, but this does not imply that this uncertainty applies to all collateral. In addition, since market agents are aware that the lender of last resort will only lend on good and familiar collateral, they presumably internalize the risk of taking on exotic assets to their balance sheets.[25] Note that free banking systems were able to maintain industry-wide capital requirements and other safety standards through the clearinghouse. This was possible due to the clearinghouse's lowering of monitoring costs, as mentioned above. Collateral evaluation under free banking requires that the agents operating within

[22] It is also important to note that Bagehot's recommendations do not specify any punishment mechanism for central bankers who overstep their bounds, and none of the historical cases where Bagehot's rules were expected to be followed exhibited institutional fixes to rectify this oversight.

[23] Obviously, the penalty rate also must be below whatever rate prevails on the market during times of trouble, or else nobody would borrow using the discount window. This has not been a concern historically since during panics liquidity dries up, and banks can hardly afford to be making loans when they need liquidity to solidify their own short-term position. This makes loans between banks an exceedingly risky proposition even at high interest rates.

[24] Congdon (2009), along these lines, argues the Bank of England should be privatized so that it will lend *more* freely during times of turbulence.

[25] This is, of course, conditional upon market agents perceiving the limited response as credible, which we have seen is not the case. Nevertheless, exploring the information issues is important for the purposes of theoretical exposition.

that system had some reliable way, based on the accounting standards of the day, of assessing collateral quality. In addition, we can be confident that public authorities could surmount the difficulties of collateral assessment, since several European central banks (and the Bank of England especially) were successful in implementing Bagehotian solutions in the latter part of the 19th century. The main weakness of Classical doctrine is on the incentive side, not the information side.[26]

Our assessment of the stability criterion must take into account two divergent observations: Bagehotian responses characterized European lender of last resort responses from (roughly) 1870 to 1970, but the Fed has never put Bagehotian remedies into practice.[27] The effectiveness of Bagehotian doctrine in Europe during the time period in question may explain its relative longevity, although as Bordo (1990:24–25) explains, some of the blame must rest with the U.S.'s weaker banking system, which resulted from branching restrictions. However, the observation of numerous instances of deviations from Bagehot's rules in modern times prevents us from classifying the Bagehotian interpretation as truly stable.

In summary, the Classical system, while appearing sensible at first, is not without its difficulties. Using the case of free banking as a "baseline" with which we can determine comparative institutional efficacy, we can say the informational difficulties of Bagehotian doctrine are comparable. Agents in free banking systems had to evaluate collateral as a matter of daily business; agents following Bagehot's rules had to evaluate collateral during times of crisis, with the explicit end of deciding whether the collateral would be an acceptable base for the extension of emergency liquidity. Despite this, it seems appropriate to take a conservative position on the question of whether private or public agents are the low-cost evaluators of collateral. We (tentatively) conclude that on the information margin, free banking and the Classical doctrine are evenly matched.

However, we need to consider the Achilles' heel of Classical doctrine, which lies on the incentive side. Conditional upon a central bank holding to Bagehot's rules, as many central banks did for approximately 100 years, private actors have an incentive to refrain from constructing portfolios that may push them, in times of financial turbulence, from illiquidity to insolvency. But this incentive-compatibility breaks down if private actors believe the limited response necessitated by Bagehot's rules will not be followed. Given the record of actual central bank behavior, and the Fed's behavior especially, post-1970 suggests the limited and targeted response necessitated by Bagehot's rules is not incentive-compatible. Instead, we observe discretionary bailouts that result in moral hazard.[28] Based on the criteria that determine robustness, free banking "weakly dominates" Bagehot's rules. Thus Classical doctrine is less robust than free banking as a foundation for the prevention of financial panic. The benefits of a formal lender of last resort, relative to free banking, are uncertain; the costs are all too apparent.

[26] The interaction between incentive and information effects yields insight as to why banks load up on exotic, high-risk, high-return assets: The informational point is moot, since the lender of last resort will likely bail them out in the event of trouble anyway.

[27] Bordo (1986, 1990) provides evidence, in the form of the number of panics, that European central banks acting as Bagehotian lender of last resorts outperformed contemporaneous U.S. system. Also, Bordo (1990: 24) compares further the unique U.S. system to the Bank of England. In each of the crisis years common to both countries, the negative deviation from trend real output was greater in the U.S. than in Britain, and in three out of six cases from 1873 to 1932 the crisis evolved into a full panic in the U.S., whereas none of the crises evolved into panics in Britain.

[28] Again, this is due in part to the differing monetary-institutional environment between the modern Fed and European central banks in the late 19th century. Residual claimancy is especially important (Goodfriend 2012).

5 The Richmond federal reserve system: open market operations only

The Richmond Fed system, also called the Goodfriend-King view due to those authors' endorsement of the policy in an influential paper (Goodfriend and King 1988), offers a different interpretation of how liquidity should be allocated among individual firms in the event of a panic. It says that the monetary authority—here understood to be a central bank—ought never lend to individual banks.[29] Instead the monetary authority should rely on providing high-powered money to the financial system, as in the course of ordinary monetary policy. Sterilized discount window lending, which Bordo (1990: 21) calls banking policy, is unnecessary since this lending can be handled by private suppliers of credit: Both bank lending and private line-of-credit services require monitoring, but it is unclear that a central bank can provide these services at a lower cost than private organizations. Lending to the market allows individual intermediary firms to handle the insolvent-illiquid issue, as long as a sufficient quantity of high-powered money is provided to prevent a collapse of the money supply. In addition, as Flannery (1996: 805) notes, refraining from lending to individual banks prevents the monetary authority from giving in to the temptation of lending to insolvent banks and undermining market discipline.

The main difficulty in assessing the robustness of the Richmond Fed view is that no monetary authority during a panic has restricted itself to preventing a collapse in the money supply by providing high-powered money to the market. Unlike free banking, which performed well in Scotland, Canada, and Sweden, and Bagehot's rules, which were used successfully for a period of time in Europe, there is no historical experience that can be used to shed light on robustness criteria. In particular, it is not obvious that preventing a collapse in the money supply, which is a demand-stabilization policy, is sufficient to prevent a panic. If supply-side factors, such as "capital" built up in the relationship between banker and borrower (Goodhart 1985, 1987) or intermediation services (Bernanke 1981, 1983), are also significant, the effects of the panic may be only partially stemmed.[30, 31]

Our robustness analysis is necessarily more speculative than that of the other cases. We begin with the information side. The guarantee of the monetary authority to limit its actions to providing however much high-powered money the market demands places the burden for evaluating the liquidity of bank assets, and thus the line between illiquidity and insolvency, on private actors. This includes relegating the pricing of emergency loans to market forces, freeing the monetary authority from concerns over what rate of interest is an appropriate penalty rate. Because the monetary authority is only called upon to conduct ordinary open market operations and leaves the emergency pricing of liquidity to private actors, the Richmond Fed doctrine ranks ahead of Bagehot's rules and the private clearinghouses on the information margin.

[29] This view is endorsed also by Friedman (1960), Kaufman (1991), and Schwartz (1992).

[30] Supply-side factors will be an important part of the New York Fed doctrine, which will be explored in the next subsection. Remember also the private clearinghouse response in the U.S. avoided potential supply-side problems by grouping under a single organization for the duration of the crisis; Bagehot's rules avoided them by committing to intervene on a bank-by-bank basis.

[31] Why wouldn't these supply-side factors also be a problem for adherents to Bagehot's rules? After all, the end result—illiquid banks stay open at a cost, insolvent banks close—is the same. The answer lies in the monetary authority's lack of a hard budget constraint. This frees the monetary authority from the worries that private agents must confront in times of trouble, such as evaluating the soundness of other agents' underwriting standards (Flannery 1996).

The incentive side is more interesting. In theory, the monetary authority's limited response suggests that illiquid banks will be able to secure emergency funds, but insolvent banks will be forced to close. The difference from the Classical case is that the sorting process has become decentralized. This means that individual banks should not expect to be bailed out in the event that their excessively risky portfolio strategy comes back to plague them, and cannot appeal to the central bank to rescue them. But is a limited central bank response credible? The lack of historical evidence means the answer to this question is more speculative than answers given to other questions in this paper, but the experience of monetary authorities with Bagehot's rules does shed some light on the issue.

The Richmond Fed doctrine, from the perspective of the monetary authority, limits its response even more than do Bagehot's rules. We have seen that there are serious incentive-compatibility issues with Bagehot's rules. The incentive problems with Bagehot's rules strongly suggest similar problems for the Richmond Fed doctrine. While the Richmond Fed doctrine, were it ever put into practice, may persist for a while, the fact that following Bagehot's rules indefinitely was not incentive-compatible for central banks renders a perpetual adherence to the Richmond Fed doctrine unlikely.

What about incentive-compatibility for private actors? As with Bagehot's rules, whether the Richmond Fed doctrine is incentive-compatible for banks depends on their perception of the monetary authority's commitment to the limited response necessitated by the doctrine. If private actors believe they are dealing with a responsible monetary authority, they will behave themselves, in the sense that they will refrain from systematically constructing portfolios that make it likely they will become insolvent, rather than merely illiquid. If private actors believe the opposite, they will take on excessive risk, making it more likely they will become insolvent, believing the monetary authority will step in to cover their losses if necessary.

The above casts serious doubts as to whether the Richmond Fed doctrine, if it were ever officially adopted, would be stable. Our analysis suggests, relative to Classical doctrine and free banking, a somewhat more favorable informational environment, but no accompanying improvement of an already incentive-incompatible position. Incentive concerns over the action of the monetary authority especially suggest the Richmond Fed doctrine, if it were ever adopted, is not a stable equilibrium.

All things considered, we have strong reason to suspect the Richmond Fed doctrine is less robust than free banking on the incentive margin, but is more robust on the informational margin due to its eschewing of concerns related to the soundness of collateral. Since the Richmond Fed doctrine is in a more secure position than Bagehot's rules on the information margin, in theory it is more robust. But without historical examples comparable to the private clearinghouses' response and central banks' experiences with Bagehot's rules, we cannot (1) be sure that the Richmond Fed doctrine is sufficient to contain panics[32] or (2) make robustness claims as strong as that of Bagehot's rules vis-à-vis free banking.

6 The New York federal reserve system: prevent the spread of contagion

The final interpretation under consideration is that of the New York Federal Reserve, which holds that the proper function of the lender of last resort is a commitment to preventing the

[32] Remember Bernanke's (1983) theoretical explanation for why a banking panic may occur even without a collapse in the monetary aggregates, although we have yet to observe such an event.

spread of financial contagion. The landmark work supporting this view is Bernanke (1983). Attempting to explain the severity of the Great Depression, Bernanke's credit channel hypothesis offers an explanation of non-monetary shocks to aggregate demand rooted in banks' provision of intermediation services: "The basic premise is that…[t]he disruptions of 1930–33 reduced the effectiveness of the financial sector as a whole" (Bernanke 1983: 257). This thesis is actually an interesting mix of demand- and supply-side factors suggesting that attempts to stem off a panic by supplying high-powered money to the market will be insufficient. Further scholarly support for this view includes Goodhart (1985, 1987), who affirms the importance of relationships between lenders and borrowers, and Solow (1982), who believes the Fed is responsible for maintaining the integrity of the financial system. The associated policy implication is that interventions on an individual-bank basis are not only justified, but necessary.

The New York Fed doctrine explains the Fed's response to the most recent financial crisis.[33] In conducting monetary policy via open-market operations, the Fed relies on a group of private organizations to serve as intermediaries through which the Fed supplies reserves to the banking system and thereby to the market. These intermediaries are known as the "primary dealers."[34] In conducting expansionary open market operations, the Fed buys Treasuries from the primary dealers, who deposit the proceeds, expanding aggregate bank reserves. In addition, the Fed relies on private organizations known as the "clearing banks"—currently J.P. Morgan Chase and the Bank of New York Mellon—to buy and sell repo contracts (Selgin 2012: 306).[35] Normally, this system allows the Fed to implement its policies without interfering very much at all in credit markets, and "[b]ecause it relies on the private market to price and direct funds, the system avoids any risk of credit being provided at subsidized rates, and so heeds Bagehot's classical prescription" (Selgin 2012: 308).

However, this operating method is problematic in times of turbulence. If the private organizations with which the Fed deals become illiquid or insolvent, their effectiveness as monetary policy channels is thrown into doubt. The role of expectations complicates things further: Worries about the financial health of the primary dealers makes other private organizations reluctant to transact with them, throwing a wrench in the policy transmission mechanism. This results in a situation where illiquid but solvent firms cannot acquire short-term liquidity. The market "freezes up." This transmission mechanism collapse is a kind of nonmonetary concern described by Bernanke (1983). Thus the Fed may "be compelled to bail out a monetary policy agent" (Selgin 2012: 304) in order to preserve the integrity of the primary dealers and clearing banks out of fear that their failure could lead to a cascading collapse of the financial system as a whole. In other words, following Goodhart (1985, 1987), the New York Fed doctrine implicitly affirms that the lender of last resort is responsible for bailing out systemically important institutions.

As Gorton (2010) has shown, the financial crisis was essentially a banking panic, albeit an unconventional one, centered as it was around non-commercial-bank intermediaries or "shadow banks." The Federal Reserve's response can be viewed as a lender of last resort effort to

[33] Though rarely discussed, the legality of these actions is somewhat ambiguous. See Todd (2002) for a lawyer's perspective on the legality of lender of last resort activities.

[34] The list of current primary dealers can be found at http://www.newyorkfed.org/markets/pridealers_current.html

[35] The Fed relies on repo contracts mainly as a way to conduct temporary monetary policy, e.g. meeting seasonal demands for currency during the holidays. See Selgin (2012: 303–308) for an overview and Tuckman (2010) for a detailed explanation in the context of the financial crisis.

minimize the nonmonetary transmission mechanisms of the crisis. On the eve of the financial crisis, it was discovered that many of the primary dealers had portfolios characterized by a prevalence of toxic assets. In addition to making other agents hesitant to continue transacting with the primary dealers,[36] the primary dealers, facing falling asset values, attempted to rebuild liquidity by refraining from lending. The primary dealer system thus resulted in a systemic drying up of liquidity, the exact opposite of its intended purpose. The Fed "felt obliged to rescue several primary dealers, and to do so at the expense of solvent banks" (Selgin 2012: 310)." The rescue was achieved through the creation of "special facilities to provide loans of cash and Treasury securities to primary dealers, the securities broker-dealers that have a trading relationship with the Federal Reserve Bank of New York" (Federal Reserve 2010a). These included the Primary Dealer Credit Facility (PDCF), which provided overnight loans, and the Term Securities Lending Facility (TSLF), which loaned Treasuries to primary dealers for one moth against appropriate collateral, both begun in March 2008 following the failure of Bear Stearns.[37] In addition, as part of the first round of its "quantitative easing" program, the Fed purchased $600 billion of mortgage-backed securities (Federal Reserve 2008) and $250 billion of commercial paper and toxic assets from Bear Stearns and AIG (Selgin 2012: 311).

It is important to note that these interventions did not aim to prevent a collapse in monetary velocity. The Fed's response did not take the form of liquidity injections to the market. Instead, these were largely "sterilized" policies—asset swaps, rather than the expansion of high-powered money —of the kind discouraged by adherents of the Richmond Fed doctrine. These policies were intended to allow the primary dealers to replace risky assets temporarily with Treasuries. Sterilized lending expanded when the Fed gained the power to pay interest on reserves in May 2008. This policy did result in an unprecedented increase in the monetary base—from $850 billion to $1.7 trillion in a span of 4 months—but was not a traditional liquidity injection since the Fed used interest on reserves to sterilize the effect on M1 and M2. In Hummel's words, the Fed "made itself the preferred destination for a lot of bank lending… [The Fed] in effect created money and then borrowed it back from the banks by paying them interest" (Hummel 2012: 193, 195). [38] This fits the view of the Fed emphasizing decisive action in nonmonetary channels as essential for combating contagion.

We now proceed with robustness analysis of the New York Fed doctrine, beginning with the information margin. As before, during times of tranquility, there is no difficulty for either private or public agents. During times of turbulence, private agents must cope with reduced credit availability due to uncertainty about asset values. Under New York Fed doctrine, primary dealers and clearing bank organizations are in a favored position because they can sell toxic assets to the Fed, a buyer who is committed to preserving these agents' solvency and is not limited by a hard budget constraint. Even if the Fed buys toxic assets only from primary dealers and clearing banks, as it did with the PDCF, other holders of toxic assets benefit from the Fed's support for toxic asset prices. The process is correspondingly simple for the Fed: Because it no longer has to distinguish between good and bad collateral and is committed to

[36] For example, JPMorgan Chase refused to process Lehman's payments, freezing $17 billion of its assets on the eve of its collapse (Duffie 2009: 39).

[37] The PDCF was basically a "new and improved" discount window for primary dealers. By the time the Fed closed the PDCF in February 2010, total accumulated lending through the program was approximately $9 trillion; Merrill Lynch, Citigroup, and Morgan Stanly each received approximately $2 trillion (Sheridan 2011: 14).

[38] These are not the only steps the Fed took to prevent the spread of financial contagion; we limit the discussion to the mechanisms above because they are the most relevant to this paper. For a more detailed account see Hummel (2012) and Stewart (2009).

supporting the primary dealers and clearing banks, informational concerns associated with asset quality are virtually nonexistent. For example, between January 2009 and March 2010, the Fed directed the FOMC to purchase $1.25 trillion of mortgage-backed securities "to provide support to mortgage and housing markets and to foster improved conditions in financial markets more generally" (Federal Reserve 2010b). Even after financial markets have largely stabilized, as part of its third round of quantitative easing, the Fed has committed to purchasing an additional $40 billion per month of mortgage-backed securities (MBS) "[t]o support a stronger economic recovery and to help ensure that inflation, over time, is at the rate most consistent with its dual mandate" (Federal Reserve 2012). Indiscriminate buying of MBS means that informational concerns for both private and public agents are probably *least* severe under this interpretation! This suggests the New York Fed doctrine is more information-compatible than free banking, Classical doctrine, and even the Richmond Fed doctrine. This is so because the New York Fed doctrine frees the monetary authority from even the minimal task of deciding which assets may be traded in the conduct of ordinary monetary policy.[39]

The incentive margin is a different story. Interestingly, the New York Fed doctrine is incentive-compatible for central bankers, since it gives them the widest license to do whatever they feel is necessary to stabilize the financial system. But of all the lender of last resort doctrines consider so far, the New York Fed approach most distorts the incentives of private agents. This is because potential borrowers have little incentive to worry over the insolvency-illiquid boundary. The usual moral hazard arguments still apply, but the narrative changes slightly: The primary dealers and clearing banks, aware that they are unlikely to bear the full costs of their decisions concerning portfolio structure if bearing those costs contributes to the possibility of a systemic event, have less an incentive to worry about the risk side of the risk-return tradeoff. This is evidenced by the high leverage (and thus great sensitivity to price decreases in the underlying assets) prevalent among Wall Street banks and financial firms on the eve of the crisis.[40] Thus these organizations have a significantly weakened incentive to avoid exotic assets, being fairly confident that the Fed stands ready to cushion their downside losses. Also, unlike Classical doctrine, there is no clearly-defined notion of a penalty that, at least in theory, would prevent private agents from taking on excessive risk. Public agents no doubt wish private agents would not engage in the sort of behavior that, from their perspective, necessitates last-resort lending or bailouts, but it is unclear what mechanism, if any, the New York Fed doctrine offers to offset the moral hazard it creates.

The result is the lowest incentive-compatibility of the last-resort lending doctrines. At least with central banking under Bagehot's rules or the Richmond Fed doctrine, there is the possibility of monetary policymakers adhering to the limited response necessitated by the rule, as central banks did with Bagehot's rules for approximately a century. This means private banks will be incentivized to behave prudently as well. In the case of free banking, where there is no public actor, market mechanisms adequately align banks' incentives with financial stability. But under the New York Fed doctrine, there is no incentive for private actors to refrain from playing privately beneficial but socially costly strategies, and no incentive for

[39] While quantitative easing is usually considered a tool of monetary policy (albeit an unconventional one) rather than a lender of last resort activity, the Fed's targeting of MBS points to systemic concerns as well.

[40] This process is described in detail by Gorton (2010). The only "anomaly" with the above story is the failure of Lehman Brothers, which was on the list of primary dealers in 2007. Hummel (2012: 189–190) suggest the limited *initial* response of the Fed can be explained by worries over inflation, since commodity (and especially oil) prices were rising in 2007–08, just as the crisis was unfolding.

monetary policymakers to refrain from protecting private actors from the full consequences of their actions.

Finally, we consider stability: Once public authorities have adopted a New York Fed-style lender of last resort policy, is it likely to persist? This is more difficult to pin down, given that the Fed's extraordinary response to the most recent crisis is the only example of its kind from which we can draw inferences.[41] Intuitively, it does seem that this version of lender of last resort doctrine results in a kind of perverse equilibrium: The monetary authority focuses heavily (even if not exclusively) on nonmonetary channels, which requires interventions at the level of individual banks (and other financial organizations conducting quasi-banking activities). Their solvency must be preserved to prevent the nonmonetary effects from crippling the system. The banks and other financial organizations, aware of this, shift towards "heads I win big, tails I get rescued" strategies at the margin, precisely the sort of risk-taking behavior that leads to intervention in the first place. The crucial aspect here is the commitment of the lender of last resort to weighting strongly nonmonetary channels, combined with a lack of a budget constraint. In contrast, incentives were aligned under the free banking because the budget constraints of individual banks were binding. Since this allowed the banking system to ride out the storm, it also had the side-effect of preserving the nonmonetary channels crucial for financial stability, i.e. the intermediation services specified by Bernanke (1983).

The other lender of last resort mechanisms examined that relied on the support of a public authority—Bagehot's rules and the Richmond Fed doctrine—can be viewed as alternative versions of the New York Fed doctrine, with differing weights placed on monetary and nonmonetary channels. The Richmond Fed doctrine puts a zero weight on nonmonetary channels; Bagehot's rule, with its insistence on intervening on the behalf of individual banks conditional upon solvency and penalty rates secured by marketable collateral, weights non-monetary channels somewhere between that of the Richmond Fed and New York Fed responses. With increased weight on nonmonetary channels comes increased discretionary action. While it is perhaps not inevitable that a system that institutionalizes a more limited lender of last resort function will necessarily drift to a more expansive doctrine (remember Europe's relatively long-lived adherence to Bagehot's rules) it does appear unlikely that a transition to a limited-response equilibrium will occur through either market or political pathways. Former Federal Reserve Chairman Paul Volcker seemed to affirm this unsettling insight, remarking during the crises that by "transcending certain long-embedded central banking principles and practices," the Fed seemed to be approaching "the point of no return" (Volcker 2008: 2, in Selgin 2012: 311).

In summary, because it is the least discriminate, the New York Fed doctrine has low informational requirements. On this margin, the New York Fed doctrine, given its stated goals, is stronger than all the other interpretations. This strength, however, is a double-edged sword. It results in the New York Fed doctrine being weaker than all other interpretations on the incentive margin—the stronger the Fed's commitment to stemming contagion by discretionary action through nonmonetary channels, the greater the incentive for key banks and other financial organizations to adopt portfolio strategies that necessitate a lender of last resort response. Lastly, the New York Fed doctrine is the most stable (self-reinforcing) of the three doctrines that place responsibility for lender of last resort activities in the hands of a public authority. A direct comparison with free banking is more difficult, given the vast differences in the underlying political-economic system, but it is probably at least as difficult to push the

[41] Although the passage of Dodd-Frank does seem to ratify TBTF in the U.S. See e.g. Wilmarth (2011).

system away from an equilibrium characterized by a New York Fed-type solution as those that prevailed under free banking, suggesting the former is at least as stable.

7 Implications

Table 1 summarizes the results. The robustness criteria of each of the interpretations are listed in descending order. Consistent with the analysis, free banking (no lender of last resort) "weakly dominates" the Classical system since free banking is superior on incentive and stability margins, and ranks equally on the information margin. However, free banking does not dominate the New York Fed and Richmond Fed doctrines. While free banking is in a stronger position with respect to incentives, both the New York Fed doctrine and the Richmond Fed doctrine are more information-compatible with their stated goals, acquired at the price of weakening incentive compatibility. However, only the New York Fed doctrine is more stable. Since we have established that the Richmond Fed doctrine does not represent a stable political equilibrium—a way to tie the monetary authority's hands has yet to be devised, let alone practiced—the relevant comparison is between the two extremes of market discipline and complete discretionary authority.

The preceding analysis, from the standpoint of examining how lender of last resort doctrine has evolved as a result of the introduction of an extramarket actor, also suggests that more limited responses will naturally "drift" to more expansive—and hence discretionary—interpretations. This is likely due to the already-familiar time inconsistency problems (Kydland and Prescot 1977) and is consistent with the theory of the cumulative interventionist process (Mises 1988; Ikeda 2004). A reasonable interpretation is that the long-run choice regarding the lender of last result function will be between market and political processes. In the latter case, we have strong reason to believe that systemic events are endogenous, meaning attempts to avert banking panics by extramarket means will instead result in an environment wherein the behaviors that can cause such panics will be practiced regularly.

Theory and history suggest the market-based lender of last resort interpretation results in a more desirable state of affairs. However, this by itself does not prove that radical shifts in the institutional framework of money provision are unambiguously desirable. The efficacy of various lender of last resort mechanisms is only one margin on which the comparative institutional analysis of monetary regimes ought to be conducted. If one interprets the evidence in such a way that the gains from instituting a robustness-compatible lender of last resort are swamped by other costs, then the status quo may be a constrained optimum. And even if the status quo is not a constrained optimum, if we are living in a world of the second-best (Lipsey

Table 1 Ordinal rankings of robustness criteria

	Information	Incentive	Stability
Free banking	3	1	2
Classical (Bagehot's rules)	3	2	3
Richmond Fed[a]	2	3	4
New York Fed[b]	1	4	1

[a] No historical examples

[b] Based on 2007–2008 financial crisis

and Lancaster 1956), a return to more market-based mechanisms may not be feasible. The ambitiousness of our reforms may have to be limited to improvements within the current institutional framework. The obvious target here is the top-heaviness of the Fed's primary dealer system, as Selgin (2012) argues. Selgin's prescriptions (2012: 312) are explicitly formulated to realign the public lender of last resort authority on Classical lines.

However, Selgin makes it clear that "mere tinkering with our existing, discretionary central banking system" will do little to reduce the specter of future financial crises (2012: 304). These are likely merely second-best solutions. In light of serious concerns over whether the Fed has, on its own terms, been unsuccessful in bringing about increased macroeconomic stability (Selgin et al. 2012), the claim that radical institutional reconsiderations are undesirable from a cost-benefit perspective is becoming increasingly hard to sustain.

Fortunately alternatives to modern central banking are being discussed rigorously in the modern literature. Boettke and Smith (2013c) remind us that such noteworthy scholars as Milton Friedman, James Buchanan, and Friedrich Hayek have proposed systems to constrain the monetary authority with strict rules, constitutional provisions, and denationalized competing currencies, respectively. White (2010) has also discussed ways of bringing central bank behavior under the rule of law, and elsewhere (2012b) has described a way of returning to the gold standard. Long before the crisis, Sumner (1989, 1995) and Dowd (1994) suggested ways market actors might themselves enforce the monetary authority's chosen rule, preferably a nominal income target.[42] Commenting favorably on the policy, Selgin writes, "Its main virtue is that it significantly reduces the discretionary element in monetary base adjustments aimed at implementing the nominal GDP rule, and thereby comes close to making the monetary supply adjustment process an entirely automatic one, largely free from any reliance on bureaucrats' judgment" (2010: 472). The works mentioned here show there are numerous proposals for monetary institutional reform. It is beyond the scope of this paper to describe any one of them in detail, let alone evaluate them. Rather, in analyzing the robustness of various lender of last resort doctrines, this paper adds weight to the claim that these kinds of radical reforms should be on the table.

8 Concluding remarks

This paper applied the standard of robust political economy to lender of last resort doctrine. It considered the three most prominent versions of lender of last resort doctrine: the Classical system of central bank lending on good collateral at a penalty rate, the Richmond Federal Reserve system of open market operations to prevent liquidity drains, and the New York Federal Reserve system of commitment to taking any and all action necessary to prevent the spread of financial contagion. These were compared to free banking systems, where there was no lender of last resort. The chief concern was to determine the ordinal ranking of these doctrines, based on robustness to agent imperfections in the form of information and incentive frictions. The paper showed that free banking weakly dominates the Classical system. Free banking also outperforms the New York Fed and Richmond Fed systems on the incentive margin, but is weaker on the information margin. In addition, the paper discussed how the New York Fed doctrine is the only stable "interventionist" doctrine, since the limited response

[42] See Sumner (2011, 2012) for the theory behind a nominal income target, especially in the context of the financial crisis.

necessitated by the Classical and Richmond Fed doctrines are not credible. The paper discussed the ramifications of these findings, and reaffirming the necessity of radical reconsiderations as to the form and function of monetary institutions.

Milton Friedman, himself a proponent of radical reforms to monetary institutions towards the end of his life, famously wrote, "Only a crisis—actual or perceived—produces real change. When that crisis occurs, the actions that are taken depend on the ideas that are lying around" (2002 [1962]: xiv). It is incumbent upon scholars working at the intersection of money and banking theory and comparative institutional analysis to provide these ideas. Robust political economy, because it takes seriously both incentive and information concerns in its attempt to discern institutional arrangements that facilitate social coordination, is the framework on which such ideas can be built. By applying the standard of robust political economy, this paper reaffirmed the strengths of market-based lender of last resort responses, as well as highlighting the undesirable unintended consequences associated with more interventionist doctrines.

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