FREE BANKING AND PRECAUTIONARY RESERVES: SOME TECHNICAL QUIBBLES

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Introduction

IN THIS ARTICLE we consider an argument put forth by Selgin (1988) in support of the claim that a fractional reserve free banking (FR/FB) system is stable. Selgin argues that, even under an in-concert expansion of fiduciary media by the individual banks, there will be internal mechanisms acting as a brake on such expansion if it is unwarranted by demand to hold such media. Specifically, such banks hold precautionary or risk-adjusted reserves against expected losses, and even if the expectation of reserve losses remains zero, the variance of such losses (adverse clearings) increases under an in-concert expansion and, detecting this increase, the individual banks will recognize the need to hold greater reserves and so effectively contract their note issue. We take issue with this argument on the basis of the fact that such detection would require that characteristics of the underlying data-generating process for the clearings be obtainable from *pathwise* realizations of that process. In other words, there is an implicit assumption of stationarity (or more strongly, ergodicity) in Selgin's argument, and this assumption is at odds with well-known empirical facts of non-stationarity associated with most economic time series. We also point out ways in which techniques of risk management commonly found in the modern financial industry are unlikely to be effective in addressing this problem.

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The Limits of In-Concert Credit Expansion Under FR/FB

A common argument raised against FR/FB is that if the individual banks act in-concert to expand their note issue (*e.g.* by agreeing not to redeem each other's notes as they accumulate throughout the banking system), they can effectively expand such issue beyond market actors' demand to hold such notes. In the course of a different argument,[1] Selgin (1988) rejects this claim. Bagus and Howden (2011) succinctly express his argument:[2]

> Selgin's original innovative argument in his The Theory of Free Banking was to outline a new limit for credit expansion in a FRFB system (Selgin 1988). An in-concert credit expansion by a free banking system, according to Selgin, faces a strict limit on the ability to increase the credit supply: the increase in precautionary reserve demands under credit expansion. While the average reserve demands net out to zero in the long run in a coordinated credit expansion, in a given clearing period a bank may have a debit or credit balance. The variance of these debits and credits increases with credit expansion. Thus, in a concerted expansion banks increase their precautionary reserve demands, limiting their credit expansion (Selgin 1988, 80-82).

Selgin (2011) himself concurs with this characterization (while rejecting Bagus and Howden's own critique of it):

> Bagus and Howden then proceed to dispute my claim that the interbank clearing and settlement process serves to constrain aggregate bank lending even when all banks expand credit in unison, so that none suffers any net average reserve loss. The argument upon which that claims rests is, in a nutshell, that although a uniform expansion doesn't increase any bank's expected reserve loss, it does raise the variance of reserve losses, and therefore raises banks' precautionary reserve needs by confronting them with a heightened risk of default for any given value of reserve holdings.

In his pioneering work on free banking, Selgin (1988) offers some arguments in support of this thesis, not all of which really appear relevant to his central case. He writes (p. 74):

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[1] Selgin (1988, Ch. 6) spends the larger part of his discussion on economic reserve requirements refuting the claim (the so-called conservation theory of reserve multiplication) that there are no systematic forces under FR/FB to expand or limit note issuance in response to changes in demand for such notes. His actual statements against the no-limits argument are relatively brief and explicitly appeal to his previous argument.

[2] The present paper is in fact an elaboration of a point made in footnote 1 of Bagus and Howden (2011), attributed to an anonymous referee.

> Forces operate in a free banking system to make the supply of inside money adjust to changes in demand even when such changes fall upon the banks simultaneously and uniformly. The reason for this has to do with the precautionary demand for reserves. Unlike the average net demand for reserves, the precautionary demand *is* affected by unaccommodated, uniform changes in the demand for inside money. The reasons for this are discussed in detail in the literature on precautionary reserve demand, beginning with Edgeworth's pioneering article. The essential conclusion of this literature, based on the law of large numbers, is that the precautionary demand for reserves rises or falls along with changes in the total volume of gross bank clearings, though not necessarily in strict proportion to the change in gross clearings. Specifically, a uniform increase in the total volume of clearing debits due to an increase in the frequency of payments (such as would occur if there were an across-the-board fall in the demand for inside money with income constant) requires that precautionary reserves increase by a factor at least equal to the square root of the factor by which clearings have increased. A fall in the total volume of clearings will likewise lead to a fall in the demand for precautionary reserves.

He is invoking here the so-called "square-root law", a classic result in banking theory that does not appear widely known.[3] Similar statements are made in Selgin (1996, Ch. 5):

> A well-known proposition of banking theory, known as the "square-root law" of precautionary reserve demand, holds that, for any given, desired level of security against default, a bank's demand for primary reserves for any fixed planning period will be proportional to the square root of bank-money payments made by its clients during the planning period.

In truth, the square-root law is not really relevant to the crux of his argument, but before highlighting this, it is worth noting the intellectual pedigree of the law. Selgin (1988) notes Edgeworth's (1888) contribution here, and in fact Wicksell (who, as is well-known, influenced certain aspects of von Mises' formulation of Austrian business cycle theory) also made use of it:

> It may happen in a particular business that in the course of each month the regularly recurring receipts and payments balance one another. Or it may be that at certain seasons there is an excess of payments but that this can be largely foreseen, so that the necessary funds can be secured by the normal use of credit—on the basis of claims falling due and the like. But at the same time the business

[3] See the survey paper of Jao (1978) for an overview. The square-root law has appeared in other monetary studies, such as Baumol's (1952) Keynesian-flavored model of transactions demand for cash.

> man needs a certain reserve against irregular receipts or unforeseen payments. We have already discussed the amount of this reserve, from both the theoretical and the practical points of view. Let us suppose that experience has shown that over a course of years the excess of payments has never varied in one direction or the other by more than a certain amount. If the business man is provided on the average (for instance at the beginning of each month) with, say, two or three times this amount he is secured to a high degree of probability against the exhaustion of his holding. Let us call the amount of this reserve r. Imagine now a collection of one hundred such firms, which have to be supposed to be completely independent of one another. Then according to the laws of probability the variations of the aggregate holding would only be $\sqrt{100} = 10$ times as great as that of the individual holdings (and so relatively only one-tenth as great). It follows that to the same very high degree of probability an aggregate holding of $10r$ would be sufficient to cover the unforeseen payments of all the firms.
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> If a bank were acting as cashier to all the firms it could content itself with laying by the sum of $\frac{1}{10}r$ in respect to each individual firm without running any risk of impinging on its other funds. It could then concede to these firms the right to withdraw, if necessary, in excess of their balances without limit. Such a right would be available only in a bona-fide case of real need. This would be shown in practice by each firm's balance standing as often above as below the sum originally deposited. The necessary reserve of each firm would then be diminished to one-tenth of what would be necessary in the absence of a banking system, and the velocity of circulation of the money would be increased ten times. With a greater number of depositors the necessary amount of the aggregate holding would be relatively still less, the absolute amount increasing only with the square root of the number of customers.

(From Wicksell [1936, p. 66-67]. Wicksell also invokes the law of large numbers in the paragraph preceding this passage.) Of course, what Wicksell is here referring to is classic risk-pooling that takes place with insurance. The law of large numbers that is appealed to here and elsewhere in the free banking literature refers to the statistical fact that the *sample average* of a large number of *independent* realizations of a random variable (*i.e.*, the realizations are *identically distributed*) will be increasingly centered about the *actual* mean (expected value) of that random variable.[4] On a *per unit* basis the amount of

[4] By "centered" we simply mean the various modes of convergence of sequences of random variables (*e.g.* weak or strong versions of the law). The weak version (convergence in probability) says that for large enough sample size, the probability that the realized average will be arbitrarily greater than the true mean is vanishingly small. The strong version (almost-sure convergence) states that, with probability one, all realizations will

risk-allocation that must be assigned to each unit does indeed shrink as the number of units grows (by the square root of the number of units). But this is largely irrelevant to the point that the relevant quantity of interest, namely the potential variability of the *sum* of the realized random variables, grows with the number of realizations. It is not clear why Selgin (1988) places emphasis on the distinction between the growth of the scaling of gross clearings and the growth of the variability of aggregate clearings (his Figure 6.1 is particularly confusing).

Before turning to the main feature of Selgin's argument that we plan to critique, it is worth briefly noting some objections to the square-root law. First, any appeal to the law of large numbers assumes independence of the random variables making up the realized sample to which the law is being applied.[5] As applied to the case of credit expansion under free banking, it is precisely the assumption of independence that is being challenged. Second, the use of concepts and tools appropriate for insurance assumes the suitability of such tools to the problem at hand. Here, the distinction Mises (1998) makes between class and case probability (or alternatively between risk and uncertainty) is relevant, and there is no indication Selgin acknowledges this distinction in this work.[6] The insurance paradigm applied to FR/FB has been critiqued by Austrians, see *e.g.* Block (1988) or Hoppe *et al.* (1998).[7] Finally, we note that the law of large numbers simply refers to the modes in which a sample average converges (in a probabilistic sense) to the true mean. It does *not* require any assumptions that the underlying process possesses a finite variance, although such an assumption is commonly employed to

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tend towards the true mean as the sample size increases. The strong version thus entails ergodicity; see below.

[5] The law can be weakened by assuming serial correlation between the realizations in the sample, but then the square-root law no longer holds, and the deviation can be quite large depending on the degree of correlation.

[6] Van den Hauwe (2006) makes a similar point. He also notes that Edgeworth himself was very cautious about applying the laws of probability to the science of human action: "Thus we conclude that the first expositor of the 'square-root law' gives evidence of a clear awareness of certain limitations to the applicability of the mathematical theory of probability to the solution of problems of bank management such as the determination of an adequate reserve level. Edgeworth (1888) thus took care to formulate more reservations than more recent expositors have done. Clearly more recent expositors have not always manifested the same caution. Where the theory of probability cannot apply entrepreneurial understanding will resume its role." We will return to this theme later; for a devastating critique of the unqualified adoption of the methods of the physical sciences that characterizes much modern economics, see the brilliant essay by Hoppe (1995).

[7] Selgin (1988) himself notes that these results consider the case where the *frequency* of clearings increase, rather than the *size* of clearings. But he goes on to point out that in this case his argument is strengthened as then the variability of reserves grows *linearly*, so again it is not clear why he emphasizes the square-root law so much.

facilitate proofs of the law. (The law does require an assumption of finite mean, however.) Since the notion of risk-adjusting based on variance is central to Selgin's argument, we should note that Selgin is making a moderately strong assumption here. This point is actually related to our primary argument, which we now turn to.

Adverse Clearings, or Ergodic Clearings?

As we have seen, Selgin's focus on the square-root law and law of large numbers is somewhat of a distraction. His central argument asserts that banks can detect changes in the underlying process that generates clearings from the *realized paths* of those clearings. For example (Selgin [1988, p. 74-76]):

> The intuition behind the square-root result is fairly simple. As the volume of gross clearings increases, so do random fluctuations in their distribution among the banks—the source of variance of net clearings faced by individual banks—only less than in proportion. This comes directly from the laws of probability. Since precautionary reserves are held against deviations of average net demand from its mean or expected value, it follows that precautionary reserve demand rises by the same factor as the variance of net clearings. Since gross bank clearings increase whenever there is an uncompensated, general decline in the demand for inside money (income constant), and gross clearings fall when there is an uncompensated, general increase in the demand for inside money, it follows that bank reserve needs are affected by changes in the demand for inside money even when these changes affect all banks simultaneously and uniformly.
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> If a banking system has a fixed supply of reserves, the square-root law of precautionary reserve demand implies (a) that banks contract their issues in response to a uniform fall in the demand for inside money to prevent their need for precautionary reserves from exceeding the available supply of such reserves (so that they do not come up short more frequently at the clearinghouse); and (b) that banks expand their issues in response to a uniform increase in the demand for inside money so that the aggregate demand for precautionary reserves does not fall short of the available supply.

And (Selgin [1988, p. 82]):

> Under in-concert expansion no member of a system of banks expanding in unison (and in the face of an unchanged demand for money) will experience any increase in its average net reserve demand; the change in expected value of its clearing credits will be exactly equal to the change in expected value of its clearing debits.

> But the growth in total clearings will bring about a growth (though perhaps less than proportionate) in the variance of clearing debits and credits, which increases the precautionary reserve needs of every bank. Thus, given the quantity of reserve media, the demand for and turnover of inside money, and the desire of banks to protect themselves against all but a very small risk of default at the clearinghouse at any clearing session, there will be a unique equilibrium supply of inside money at any moment. It follows that spontaneous in-concert expansions will be self-correcting even without any "internal drain" of commodity money from bank reserves.

In a later work, Selgin (1996, Ch. 4) further affirms:

> Now imagine that, starting from the above equilibrium situation, all the banks expand their balance sheets in unison by an equal amount, although the demand to hold bank money (and its distribution across banks) has not changed. The "in concert" expansion might be a result of formal agreements, or it might be spontaneous. Will it leave the banks unscathed? It will not, because, although every bank would find its average clearinghouse credits and debits increased by the same amount over the course of numerous clearing sessions, the variance of net debit and net credit clearings faced by any bank would also increase, by a factor approximately equal to the square root of the percentage increase in gross clearings. In consequence, each bank would soon discover that its precautionary reserve holdings, though formerly adequate to protect it against above-average adverse clearings in any one clearing session, are no longer sufficient. The increased clearing activity brings with it a greater probability of single-session net debit clearings exceeding a bank's reserves. For this reason, "in concert" expansion will not be profitable or sustainable (assuming banks insist on spot payment of clearing balances). Therefore, each bank will have to reduce its liabilities to their previous equilibrium level.

In all of these passages Selgin assumes a realization of the underlying clearing process can be used to discern the properties of the actual clearing process. Heuristically speaking, he is assuming time-statistics can proxy for space-statistics.[8] In other words, he is making an assumption of *ergodicity* of the underlying clearing process. This is an extremely strong assumption; it

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[8] This is made very clear when he describes his aforementioned Fig. 6.1: "This result can be represented by a set of simple diagrams (Fig. 6.1) showing the frequency distribution of clearing debits at a representative bank before and after a doubling of the total volume of clearings. The smoothness of the diagrams implies a fairly long planning period with many clearing sessions; *one might also interpret them as showing the statistical likelihood of particular net clearings based on a large number of trials*." (Emphasis added.)

refers to a special class of time series which most definitely does *not* include most of the time series associated with economic data.

Let us turn to some definitions. We use the definitive source on econometric methods, Hamilton (1994). A stochastic process Y_t is said to be covariance-stationary (or weakly stationary)[9] if its mean and autocovariances are time-independent:

$$EY_t = \mu \text{ for all } t$$

$$E(Y_t - \mu)\big(Y_{t-j} - \mu\big) = \gamma_j \text{ for all } t \text{ and any } j$$

Note in the above definition these expectations are *unconditional*, as opposed to *conditional*, expectations.[10] Stationarity captures the notion that certain random processes (say, temperature) tend to fluctuate around some stable or long-term level,[11] and that these deviations are in some sense time-invariant. These processes can deviate, sometimes substantially, from that level, but do not tend to wander away from it for very long periods. By contrast, non-stationary processes (such as GDP) do not tend to exhibit any stable patterns or reversion levels, and can wander off significantly for extended periods, giving rise to pseudo-trends (better termed stochastic trends).

Ergodicity is, practically speaking, a special case of stationarity.[12] An ergodic process is one for which time-averages converge (in a particular sense) to process averages. (More generally the process is ergodic if sample moments converge in probability [see footnote 3 above] to the population moments.) The issue is as follows. We are always confronted with paths or realizations of a random process; that is, we observe some set of realizations $\left\{y_1^{(i)}, y_2^{(\square)}, \dots, y_T^{(i)}\right\}$ of the process. Often, the index i (indicating the particular path) is small, sometimes no more than one. To be able to extract

[9] There is an additional notion of stationarity, so-called strict-stationarity, which refers to the joint distribution of the process at different points in time, and need not concern us here.

[10] Intuitively these expectations do not require reference to the information currently available. Roughly speaking, in the modern parlance a conditional expectation is the projection of a random variable onto a information set that is narrower (in some sense) than the set that reveals the value of this random variable.

[11] Note Selgin's (1996, Ch. 4) characterization of the banks' risk adjustment: "The individual bank of issue must monitor two statistics related to bank clearings: the average of net clearings over a given period and the variance of net clearings over the same period. The variance indicates minimum *long-run* reserve needs. Its value tends to increase absolutely (albeit as a decreasing percentage) with increases in gross bank clearings even if average net clearings remain constant." (Emphasis added.)

[12] Examples of stationary, non-ergodic processes tend to be somewhat artificial. This author is unaware of any non-stochastic processes that are also ergodic.

information about the underlying data-generating process from this particular time series, certain assumptions have to be made about that process. It is only for the special case of ergodic processes that we can definitely infer process information from the time series statistics (*e.g.*, to be able to say that the arithmetic average of the time series converges, for large enough realizations, to the process mean[13]).

In general, economic time series are *not* ergodic; indeed, they are not even stationary. This is not a particularly controversial claim, as simply eyeballing stock market prices will instill a strong sense of intuition regarding this point. Hamilton (1994) provides a vast wealth of references on various studies on this claim. As such, it is meaningless to speak of unconditional statistics regarding such time series, and these are precisely the assumptions underlying the use of such results as the law of large numbers (namely, identical distributions underlying the various realizations). But apart from this issue, it is dubious to believe that free bankers will be able to form estimates of the process underlying the realized clearings that they observe from those observations, if that process is non-ergodic.[14] Hence it is questionable that they can form reliable estimates of probabilities of default.[15] In other words, Selgin's argument of *systematic* forces calling forth a retrenchment by the banks is called into question.

Selgin has not established in these works that the kinds of random processes engendered by a FR/FB system will be of such a nature that the bankers can infer appropriate estimates of variability from the realized paths in order to properly risk-adjust. Indeed, as a common argument used in refutation of the Real Bills Doctrine shows (see Bagus and Howden [2010] or de Soto [2006]), free bankers practicing fractional reserves can unilaterally

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[13] It should be stressed that these are *asymptotic* results; *i.e.* they represent limiting behavior for very large samples, their applicability to finite-size samples should always be carried out with great caution. An instructive study in this regard can be found in Zhou (2001).

[14] This leaves aside the point that whatever estimates the bankers infer from the data, they must form a *judgment* to act on these estimates. They are always free to disregard those estimates as being irrelevant to future outcomes, and there is no reason to assume that they will adhere rigorously to a Selginite risk-adjustment rule. For more on entrepreneurial judgment as opposed to knowledge dissemination, see Hülsmann (1997).

[15] Although Selgin seems to use "variance" generically to denote risk (which, as noted, he does not distinguish from uncertainty), it should be pointed out that variance in the technical sense is only sufficient for characterizing process whose distributions are Gaussian or normal, and it is a well-known empirical fact that financial time series exhibit high degrees of non-normality (such as jumps/spikes or stochastic volatility). At a minimum, Hamilton (1994) is a testament to the fact that the statistical tools necessary for analyzing financial times series are far more sophisticated than a recipe for detecting increased variance.

affect demand for their product by lowering the rate of interest they charge on loans.[16] Selgin (2011) resolutely denies that this argument applies to his own system. However, he invokes his standard risk-adjustment argument to do so (*i.e.* banks can't unilaterally expand without triggering the increased variance signals that will cause them to subsequently retract). But as we have seen, the viability of this argument assumes the very thing it intends to establish: that these signals will come from a system that is *already* stable.[17]

The Possibility of Risk Management Under FR/FB[18]

A possible objection to the arguments raised above is that, using sophisticated techniques employed by risk management groups in modern financial firms, free banks employing fractional reserves *can* properly anticipate changes in demand for their note issues and accordingly adjust their reserve positions accordingly.

Before considering this possibility, it is worth noting that while there is little agreement over what caused the financial crisis that was made apparent in the fall of 2008 (and still less over what constitutes the proper response), there is widespread acknowledgement that the crisis entailed a massive, institutional failure on the part of those groups in the banking sector charged with monitoring the exposure of their companies to possible debilitating losses, namely, risk management. Useful discussions of this point can be

[16] This is another reason to seriously doubt that the insurance paradigm applies to banking, for the same reason that no insurance company would offer insurance on an event that depends on the will of the insured, such as suicide (or, if they did so they would be engaged in betting and not insurance). See Hoppe (1997).

[17] It is interesting to note that Selgin (1996, Ch. 5, footnote 3) quotes Olivera (1971) as observing that "the extension of the square-root law from individual banks to the banking system assumes 'that the number of reserve-holders, as well as their shares of the expected market demand [for reserves], remain stationary when the latter grows.'" It is not clear whether the term "stationary" is being used here in the technical, econometric sense, but when Olivera (1969) also speaks of no "structural variation" in the markets subject to the square-root law, it is clear enough that he is envisioning the necessary conditions for the time series in question to be stationary. In fact, Selgin (1988, Ch. 6, footnote 12) had already noted this feature of his system, stating that "the argument assumes that banks are in equilibrium with respect to one another, that is, it assumes that the average net demand for reserves is zero." However, it is clear from his statements here that he is not assuming equilibrium as such, but rather a *stable* equilibrium (that is, one that is robust to certain changes). But the premise of a FR/FB system in stable equilibrium is precisely the assumption challenged by the critics of such a system.

[18] We are indebted to Prof. Guido Hülsmann for emphasizing the relevance of this subject to the debate at hand.

found in Dowd (2009), Kling (2010), and Kashyap (2010).[19] One wonders if risk managers under FR/FB would be any more successful.[20]

Be that as it may, most of the techniques employed by risk management groups suffer from the same problems as those pointed out with Selgin's proposal. First, it should be stressed that the classical square root law discussed above has little, if any, relevance to these modern methods, which are centrally concerned with the accumulation of variability *through time*.[21] Second, these methods attempt to discern the probability (over some time horizon) of some financial loss to the company given certain movements or changes in the prices of their underlying assets and hedging positions. But this probability is of course a function of the probability of the changes of those prices. As such, some means of estimating this price behavior must be resorted to. Any such method must *presuppose* that its results (necessarily historical) can be applied in the future. In other words, an assumption of stationarity or time-invariance must be made in extracting information from the observed price series who future realizations pose potential threats to a company. To be clear, this does not mean that the time series themselves are assumed to be stationary, only that some aspect of them (*e.g.*, price returns) are. The results of such methods (such as simulations of prices, leading to distributions of losses) are only useful to the extent that the historical data on which they were derived can be expected to be relevant in the future, *i.e.* that past conditions can be expected to prevail in the future.[22] Of course, as was

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[19] The most recent crisis is not unique in this regard; see also McLean and Elkind (2004).

[20] Of course, there were moral hazard and incentive issues at play in the current crisis that would *not* be a part of the system most FR/FB supporters envision, such as government deposit insurance or "too big to fail" regulatory regimes. However, this is irrelevant to the fact that, in practice, a sufficiently assertive corporate government can override the formal restrictions of risk management, even if the latter were not subservient to begin with. There is no reason to think that these aspects of the crisis would not be repeated under FR/FB, where the incentives to ignore formal constraints would likely be just as great.

[21] An example being the "square-root of time" law for the variability of standard Brownian motions that underlie many mathematical techniques (such as stochastic calculus) employed in this industry.

[22] Almost all Austrians are deeply skeptical about the applicability of standard probability theory to studies of human action, see *e.g.* Block (2003). In some Austrian circles rather strong (but vague) claims about "radical uncertainty" are made, but it should be noted that skepticism over how uncertainty is modeled by mainstream economists is not confined to Austrians. Post-Keynesian Paul Davidson (2009) pithily notes that the future is not a statistical shadow of the past. Davidson also notes the ergodicity at the heart of such approaches: "Since drawing a sample from the future is not possible, efficient market theorists presume that probabilities calculated from already existing past and current market data are equivalent to drawing a sample from markets that will exist in

made apparent in the current financial crisis, past history was *not* a good guide for future conditions. In fact, to the extent that market conditions during the (phony) boom phase were relied upon for making future projections, not even the present was a useful guide in the near term, as the suddenness of the bust attests.[23,24]

There is in fact a critical difference between the situation faced by financial firms and free banks in regards to risk management. Although of course from an Austrian perspective *every* action has some effect on price, it can be reasonably be said that in many applications, the effect on prices by any particular individual or institution is negligible and can be ignored. This is largely the situation faced by financial firms attempting to gauge their exposure to future price realizations (*i.e.*, they can safely be treated as price-takers, in the neoclassicist vernacular). This is not the case faced by free banks holding fractional reserves. They *themselves* are the source of the uncertainty they face. There is no history they can appeal to in crafting estimates of the future variability they are exposed to. Any current market data from which they could "back-out" forward-looking estimates of their exposure are based on conditions they themselves brought about. They cannot be regarded as mere price-takers in this regard. The case for employing risk management successfully under FR/FB must be met with great skepticism.[25]

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the future…the presumption that data samples from the past are equivalent to data samples from the future is called the ergodic axiom." Fields of study such as Extreme Value Theory suffer from the very same problem, even if they offer improvements in some ways over standard assumptions of normality.

[23] Commonly, some aspects of price history are replaced by current market prices for those relevant entities, such as forward prices and, occasionally, option prices (yielding price volatilities). Very rarely, however, can important entities such as correlations be extracted ("implied") from current market prices.

[24] In an article emblematic of the intellectual laziness that pervades much of the American media, Salmon (2009) attempts to lay the blame for the crisis at the feet of quantitative analysis employed by many banks. Leaving aside the reality that most such groups (largely cousins of risk management, if not glorified computer programmers) are of little practical consequence in most financial institutions, Salmon himself notes that the innovation of many of these techniques rested in their ability to be readily "calibrated" to market prices, allowing them to be used in the valuation of other, related but non-traded (structured) products. But, if the markets on which such calibration was based were themselves based on illusion (a state of affairs that had nothing to do with quantitative analysis as such), then these techniques could hardly be said to have instigated the crisis. For more on the illusion underlying the boom-bust cycle, see Hülsmann (1998).

[25] A common argument by free bankers is that the difficulties and outright calamities that occur under the current system of monopoly central banking cannot be necessarily

Conclusions

In this paper we have argued that Selgin's seminal work on free banking makes some unsubstantiated assumptions to support his case that there are internal checks on an in-concert credit expansion, and that therefore the system must be regarded as stable.[26] He argues that the system will be self-equilibrating because the increased variances of clearings (and hence increased probabilities of default) due to expansion beyond the demand to hold banknotes will be detected and accounted for by risk-averse bankers. However, the ability to appeal to statistical theory in making this argument assumes that the underlying stochastic process that generates the observed clearings is stationary in a very strong sense (specifically, ergodic). That is, the system manifesting the process is *assumed* to be stable, and Selgin's argument is circular. We have further argued that modern risk management techniques suffer from many of the same problems, and are thus not likely to be much help in serving as a check on these actions by such a banking system.

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projected onto a system of decentralized banking. Although this is technically true, none of the objections made here depend in any way on the existence of central banking.

[26] In truth, the argument made here also applies to Selgin's (1988) more general objective of refuting the claim that free banking lacks a mechanism for systematically responding to changes in demand for fiduciary media. However, as this point has not really been objected to in Austrian circles (to be sure, there *is* objection to the claim that such mechanisms would be properly focused), we have chosen to concentrate on the more contentious claim within Austrian circles concerning the possibility of unchecked expansion in unison. Still, it should be noted most Austrians would accept the free bankers' claims of responsiveness to demand on the familiar grounds of entrepreneurial action ("alertness," so to speak) that they attribute to most lines of production in an unhampered market, and *not* the risk-signaling arguments Selgin invokes here.

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