

What are the limits on Commercial Bank Lending?

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Abstract

Asset backed securities have been extensively criticised for creating a moral hazard in loan issuance by removing any incentive on the lender to ensure that the recipient of such loans could repay them. However the inter-relationship between money and loans within the commercial banking system, also suggests that deeper systemic issues can accompany any form of unlimited commercial bank lending. This paper examines the question of why speculative demand for credit during credit bubbles is not naturally constrained by regulated limits within the banking system on the supply of loans. In particular, we propose an explanation for the current credit crisis, as a fundamental, systemic failure in the system of rules governing the behaviour of the reserve based banking system, which have resulted in the effective removal of central bank control over money and loan supply expansion. This situation has arisen from the presence of two 'bugs' in the underlying regulations controlling the banking system: securitized loans, which allow the sale of loans issued against fractional reserve controlled deposits to entities outside of the commercial banking system; and allowing debt instruments, in particular securitized loans to be part of bank equity capital reserves which are used for the purpose of regulating the total quantity of credit created by the banking system. We argue that the interaction of these two problems has led to unregulated growth in both the money and loan supplies, and to a dangerously destabilising imbalance between total money and loan supply growth, in that total lending from the commercial bank sector has increased at a faster rate than the accompanying money supply growth supporting it.

Introduction

Recent research on the causes of the current credit crisis has implicated securitized lending, for removing any financial consequences of loan default from the issuers of successfully securitized loans. However an accompanying issue appears to be the large, and seemingly exponential nature of the growth in total borrowing, which these instruments have contributed to. Figure 1(a) for example, shows the growth in debt within the United States economy over the last 30 years. Similar growths can be seen in most major currencies over this period.

An increase in lending of this kind, and indeed duration, raises the question of what, if anything, constrains the total amount of lending that can be provided within an economy? Debt in all its forms, represents a series of agreed transfers of money between two parties over time. However, it is incorrect to simply compare the totals of money and debt, since debt is effectively a contractually agreed flow of monetary tokens. In a continuous, real time economy, the amount of money that is required to meet instantaneous requirements for debt repayment is a function of the interest and capital repayments for that debt. A further complication is that part of the total debt within the economy is provided by a system of reserve based lending which in day to day operation influences the supply of money used to satisfy debt, and consequently can cause the money supply to expand or contract for systemic rather than economic reasons.

An upper bound can be placed on the total amount of all forms of debt that can be supported by any economy by simply observing that there must be sufficient money available for repayments within the loan accounting period. However, it seems likely that the practical upper bound for macroeconomic mathematical insolvency is considerably lower than the theoretical maximum, given the uneven distribution of money and money substitutes within today's monetary system, and that not all parts of the economy are financed through debt exchanges.

Although there do not appear to be any systemic limits on the total amount of lending within an economy, beyond the upper bound on repayment capability, local limits do apply to some of the forms of debt that can be created. Government and local government debt is ultimately controlled by the amount of tax revenue it can raise to support interest repayments, and in democratic states governments are subject to varying degrees of supervision by their electorates on these issues. Similarly, corporate and business lending through bonds, although theoretically unlimited, is monitored through accounting practices, which can be used by investors to avoid lending to companies that will clearly be unable to meet repayments.

The limits on the total quantity of loans that can be issued from the banking system though, are less immediately obvious. Although individual banks are tightly regulated, and have clear restrictions on their lending, based on their equity capital holdings, this does not necessarily result in systemic control of the total lending by the banking system.

Banks lend against the value held in their customers deposits, but this money is then redeposited into the banking system, and can itself be lent against. (Whether money is actually created by the process depends on the rate of lending versus the rate of loan repayment.)

An empirical analysis of the widespread growth in borrowing over the last 2 decades certainly seems to indicate that there are no effective limits on the supply of bank originated credit within certain economies. Figure 1(a) shows the growth in credit for different components of United States domestic debt. This growth has occurred during a period that was otherwise marked by consistently low consumer price index (CPI) inflation, and a public commitment to stable monetary policies, which argues against the cause of the credit increases being deliberate monetary expansion. Similar patterns can also be seen in many other economies over the same period.

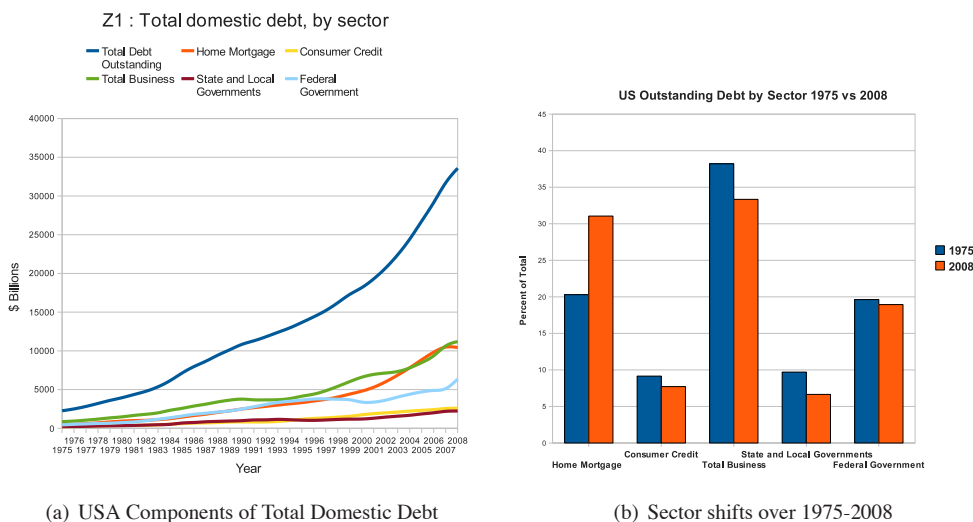


Figure 1: Loan Supply Statistics

Proportionally too, a far larger part of this increase in credit appears to have originated from commercial bank lending than any other source, including government lending. A comparison between the sectoral breakdown for 1975 and 2008 from the Federal Reserve Flow of Funds data, is shown in Figure 1(b). It shows a shift in the proportion of total borrowing during this period away from government borrowing, and towards private sector borrowing, in particular for mortgages. Since mortgage lending originates in large part from reserve based lending entities such as commercial banks, this raises the question of how they were able to increase their lending to such an extent, and also what limits apply to the total quantity of loans they can issue over any given time period.

The question of what limits the supply of credit is also of interest in understanding the periodic excesses in lending and borrowing that have come to be termed credit bubbles. If there is no limit on lending within the banking system, and the growth in credit is being supplied from there, then there is no particular mystery about the cause of credit bubbles. Any expansion in the demand for borrowing is liable to trigger a simple positive feedback loop if the asset being purchased with the credit is in limited supply. As loans make more money available to purchase the assets, the price of the asset will rise.

In any market where credit is being provided to buy goods in limited availability, for example real estate, or stocks, expansion of the amount of credit available also risks an expansion in borrowing. Rational speculation by investors occurs on the observable expectations of short term price rises, which triggers demand for further loans, and consequent asset inflation. The use of margin loans to purchase shares leading to the 1929 stock market collapse is one example. Such feedback loops will be especially vicious if the item being purchased can serve as some form of collateral for further loans. If the money being borrowed is originating within the banking system, then collateral damage from the uncontrolled expansion and subsequent contraction of the money supply creates further issues for the larger economy.

Conversely if there is a limit on the total quantity of loans, but expansion of the loan supply from the commercial banks has not reached it, then a credit bubble could be regarded as an unusually large variation in credit demand, within known limits. In this case policy towards controlling the damage caused by credit bubbles could be directed to detecting and preventing this increase. In this context, it is interesting that there appears to have been no discussion on systemic credit limits during the current crisis.

The sources of net lending for the United States economy are available from series F1 in the Federal Reserve's Flow of Funds report and are shown in Figure 2. They indicate that the single largest source of credit over this period has been the commercial banks, followed by the Federal Mortgage pools (Fannie and Freddie Mae), and the Asset Backed Security issuers. (The Federal Mortgage Pools do not originate loans, they purchase loans from commercial lenders, and securitize

them as bonds, so it is not clear if their total is an additional component to commercial bank lending, or a form of double counting.¹)

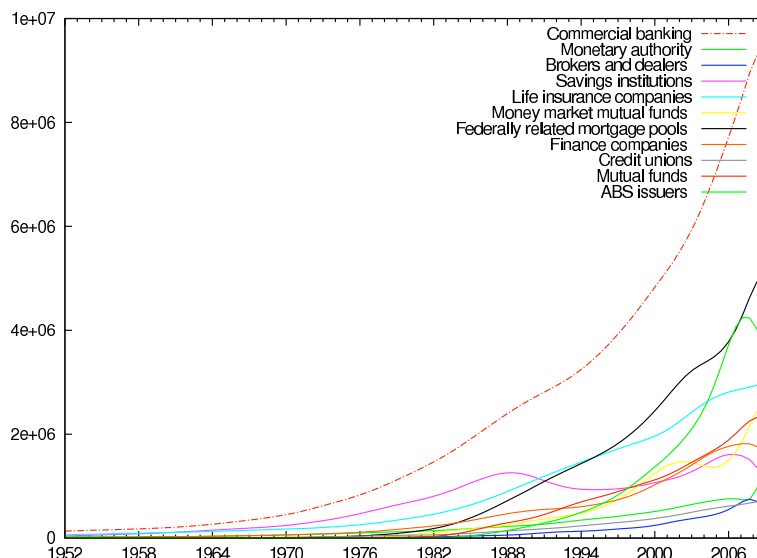


Figure 2: Flow of Funds Report: F.1 Net lending

Commercial banks derive their ability to lend from the the amount of money they are able to attract in deposits, which they then use to create loans, retaining a portion of deposits in reserve to handle day to day requests for funds in what is essentially a form of statistical multiplexing between the amount of money kept on reserve, and daily transfer requirements. Increases in the total amount of commercial bank lending can consequently have two causes, an increase in the money supply leading to an increase in lending; or an increase in lending - which then results in an increase in the money supply as the loan principal is redeposited in the banking system.

Any growth in the total credit supply from commercial bank lending within a single currency, can then either be the result of, or the cause of an increase in the money supply. It can also cause further increases. Theoretically however the money supply is held to be under the control of the central banks through their position as lender of last resort, and their control of the bank reserve requirements; and should either be relatively constant, or increase only under their control.

Although the idea that loan supply increases lead to money supply increases is not unknown to Economics; Rochon [9] has an extensive discussion of the various debates that surround "Endogenous Credit"; it appears to be a matter of some controversy. What may be under appreciated, is that the exact relationship between the money and loan supplies from commercial banks and similar organisations, depends very critically on the precise implementation details of the banking system for any particular historical period and currency. These are known to have varied considerably over time and place, and sometimes even within a single currency, as can be seen currently within the Eurozone.

There is then a third possible explanation for credit bubbles, and the one that this paper will explore. This is that while there may in theory be a limit on the loan supply from commercial banks, in practice, through the periodic invention of novel financial instruments and practices, the banking system is able to circumvent this limit, leading to periods of unregulated credit supply, and major and consequent distortions in that part of the money and loan supply that is controlled by the institutions performing reserve based lending.

1 Theoretical Models of the Banking System

1.1 Fractional Reserve Based Lending

The modern banking system is based on a fractional reserve process that has been in use for several centuries. It is effectively a distributed system², based on a set of rules that determine a relationship between the total amount of money that is held by the commercial banks, and the total amount of debt that can be issued by them against that money. The complication in this system, and the cause of considerable confusion both among mainstream economists, and their critics, is that when loans are granted by the banks, the resulting money is deposited back into the system, causing the creation of more deposits. Since regulation of the total amount of lending by any given bank is in part dependent on the amount held in their deposits, this leads to the creation of money. However, money is also removed from the banking system (and from the deposits), when loans held by the commercial banks are repaid. The behaviour of the money supply then, depends on

¹One of the best explanations of the considerable intricacies of the American Mortgage Market, can be found at the online blog Calculated Risk, in a series of postings by the late Doris "Tanta" Dungey. <http://www.calculatedriskblog.com/2007/07/compleat-ubernerd.html>

²A distributed system is any system that operates on the basis of organised, message based, communication between separate members.

the net behaviour of lending versus repayment within the commercial banking system, and on the rules governing how much may be lent against their deposits by individual banks.

Loans within the economy can consequently be classified into two types, transfer loans such as Bonds and Treasuries, which are a direct exchange of debt for money, and reserve based loans, which are issued against deposits of money. Reserve based loans may have accompanying money supply implications, which transfer loans do not. The distinction between reserve based lending generated directly by the commercial banking system, and transfer based lending originating outside of it, is consequently critical, since operations on these two types of financial instrument, although they both superficially represent a stream of debt payments, are not equivalent. Some financial operations such as transfer or sale which have no monetary impacts when performed on transfer loans, can carry systemic side effects when performed on commercial bank loans, as will be shown below. The creation of new financial instruments over the last decades which allow these two very different forms of debt to be traded interchangeably is one of the contributory factors to the series of credit bubbles and subsequent crises that has accompanied them.

The standard theoretical description of this system is described, correctly, as a recursive process, where as loans are issued against deposits, the money they represent is redeposited back into the banking system, creating a recursive feedback process that acts to expand both the total quantity of bank deposits, and the loans that are generated from them. As each deposit is made at individual banks, a required fraction of the deposit is held back as a reserve by the bank, and the remaining money may be provided as further loans. In order to ensure that individual banks conform to this requirement, they were historically required to keep a portion of this reserve, on deposit at the central bank for their currency.

As shown in Figure 3(a) and as typically described in foundational Economic textbooks such as Mankiw[8], with a reserve requirement of 10%, the eventual expansion of the money supply is 10 times the original deposit, and that of the loan supply, 9 times the original deposit. Under this theoretical model, the bank originated loan supply is always constrained to be a fraction of the money supply, 90% in the example shown, and cannot exceed the money supply. The actual behaviour of the components of the US money supply over the last 40 years is shown in Figure 3(b).

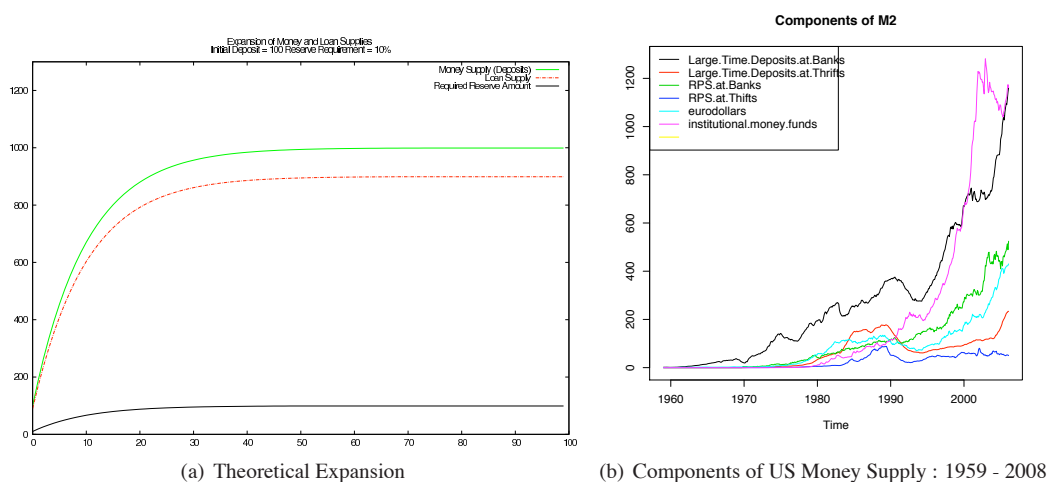


Figure 3: Theoretical vs Actual Money Supply Behaviour

Although this textbook model is an accurate representation of the redeposit process, it is somewhat confusing in the context of the current state of a system to which the "initial deposit" was made several centuries previously.³ The textbook model also implicitly assumes that there is no possibility of loan default, that there is a clear distinction between "money" and "loans" within the financial system, and that the reserves are held completely in "money". None of these assumptions hold true in today's banking system.

Assuming that this model were accurate, then the upper limit on commercial bank loans would always be a fraction of the total deposits. Once expansion had reached the limits imposed by reserve requirements, new loans could only be made as old ones were repaid, freeing up loan capacity. Both the money and loan supplies would though be able to vary within those limits. For example, if loans are repaid and new matching loans are not extended, then the money supply will contract as the original process reverses itself. Hart[6] in his analysis of the behaviour of the banking system during the Great Depression of the 1930's, attributes net repayment of debt with removing more money from the money supply, than bank failure. This 'feature' of the banking system is perhaps best regarded as a purely mathematical consequence of linking the loan and money supplies in this fashion, and consequently may not be well co-ordinated with actual economic activity, except in its ability to disrupt it.

³For currencies with a continuous history. It may be of interest to economic historians, in that the introduction of fractional reserve banking to any economy would necessarily result in a lengthy inflationary period as this expansion occurred.

1.2 Reserve Based Lending

Today's banking system has moved away from the theoretical model described above, particularly with respect to the fractional reserve requirement. Use of this requirement to regulate bank lending has been increasingly removed, and now only applies to a minority of deposits. In the American system the full reserve requirement is limited to "Net Transaction Accounts", which are a small portion of total deposits. Regulation of individual bank lending has shifted to the use of "Equity Capital Requirements".⁴

Equity capital is an amount completely separate to customer deposits held by banks as a shield against loan defaults. In order to prevent loss of customer deposits, loan defaults are first covered from profits, and then from equity capital. The Basel Banking Treaties place limits on the type of financial instrument that can be used to hold equity capital under two tiers of quality, and also provides recommendations on the amount that must be held. To be well-capitalized under American federal bank regulatory definitions, which is a requirement to avoid extra supervision, a bank must maintain a ratio between its risk adjusted loans and its equity capital of at least 10%. This means, that assuming it has sufficient deposits to lend against, it can create loans of up to ten times its equity capital amount.

As will be shown, one consequence of these changes is that it is no longer strictly accurate to refer to Basel compliant systems as *fractional* reserve systems, since the systemic requirement that loans should comprise a fraction of deposits has effectively been removed. It has been replaced with a requirement that loans should be a limited multiple of equity capital reserves. Although this may seem a sensible approach from the perspective of individual banks, when the role of equity capital as protection against loan losses is considered, it can create issues at higher levels within the banking system, when the interaction of monetary flows are considered. When banks do make sufficient losses to require the use of equity capital, there is an immediate reduction in the lending capacity of the afflicted bank, and an effect on the larger money supply as reduced lending causes monetary contraction.

2 Failures in Systemic Regulation

2.1 Asset Backed Securities

Asset Backed Securities (ABS) are freely traded financial instruments that represent packages of loans issued by the commercial banks. The majority are created from mortgages, but credit card debt, commercial real estate loans, student loans, and hedge fund loans are also known to have been securitized. The earliest form of ABS within the American banking system⁵ appears to stem from the creation of the Federal National Mortgage Association (Fannie Mae) in 1938, a Great Depression measure aimed at creating loan liquidity within the banking system. Fannie Mae, and the other Government Sponsored Enterprises buy loans from approved mortgage sellers, typically banks, and create guaranteed financial debt instruments from them, to be sold on the credit markets. The resulting bonds, backed as they are by loan insurance, are widely used in pension funds and insurance companies, as a secure, financial instrument providing a predictable, low risk return.

The creation of a more general form of Mortgage Backed Security is credited to Bob Dall and the trading desk of Salmon brothers in 1977 by Lewis[7]. Lewis[7] also describes a rapid expansion in their sale beginning in 1981 as a direct side effect of the Savings and Loans crisis. The introduction of loan insurance in various forms, including purchased insurance from several major insurance companies, and the formalization of credit default swaps in 1997, led to another rapid expansion in their issuance during the late 1990's and early 21st century, since a loan that is insured against loss appears, superficially at least, to be a perfectly safe investment.

Analysis of the systemic effects of Asset Backed Security has concentrated chiefly on their ability to improve the quantity of loans, or loan liquidity, which has been treated as a positive feature. Wolfe[13] for example noted that securitization allowed banks to increase their return on capital by transforming their operations into a credit generating pipeline process, but didn't consider the effects of this mechanism on the larger banking system. Recently, Shin[10] has also analysed their effect on bank leverage and the stability of the larger financial system, within an accounting framework. He also highlights the significance of loan supply factors in causing the sub-prime crisis. Although his model appears not to completely incorporate the full implications of the process operating within the reserve banking system as described below, it presents an alternate, matrix based analysis of the uncontrolled debt expansion that these instruments permit.

The problem with Asset Backed Securities in a reserve banking context, is that they allow banks to escape both the reserve and equity capital based regulation on the total amount of loans being issued against customer deposits. Thus the extra liquidity they create, also causes, as a side-effect, an increase in the ratio of reserve based lending to money, within the larger monetary system. This causes the banking system to move from a fractional reserve state, where the total quantity of loans available from the banking system to the economy is less than the total amount of money on deposit

⁴Nomenclature within this area is both confused and confusing. The Equity Capital requirements are also referred to as the capital requirement and Tier 1 and 2 capital within the Basel framework. In this paper we follow the usage in American banks' call report listings.

⁵Ludwig von Mises,[12] writing in 1912 describes the Austro-Hungarian Bank "refusing to issue bills ... to increase the difficulty of speculative repurchase of home securities from abroad", suggesting that a loan sale problem may also have been present in parts of the 19th century banking system as well.

in the banking system, to one where total bank originated lending exceeds the total amount of money on deposit. In the process, it also removes any limit on bank based lending that was provided by central bank control.

The following example demonstrates the problem using two commercial banks, A and B. For simplicities sake the fees related to loans and ABS sales are excluded. It is also assumed that the deposit accounts are simple Net Transaction accounts under current US banking requirements,⁶ and therefore carry a 10% reserve requirement, and that both banks fully meet the requirements for being classed "well capitalized" under FDIC and Basel treaty definitions. In this example, equity capital amounts are also considered to be held completely in money. These are the strictest set of conditions currently available within the American banking system, and in most cases, the reserve requirement in particular, would not apply. The main implication of the absence of a reserve requirement would be to speed up the expansion process, and increase the amount of profits that the institutions involved could extract from it.

⁶Feinman[4] has a review of current and previous reserve requirements within the US system.

The example proceeds as a series of interactions as money flows between the two banks. The liabilities (deposits) and assets (loans) are shown, and the fractional reserve between deposits and loans is shown separately as cash in order to clarify the flow of funds between the two banks. (In practice, it is simply the difference between deposits and loans, actual holdings of physical cash by banks are determined by daily customer demand for currency.) In order to make the example as clear as possible, Bank B has made no loans. However, if it had, balancing between the banks through normal inter-bank and central bank lending mechanisms would enable the bank to compensate for the temporary imbalance that occurs during the process. All deposit money used within the example remains on deposit at either Bank A or Bank B throughout the process.

Initial State						
Bank	Deposits	Loan	Cash	Equity Capital	Σ Deposits	Σ Bank Loans + MBS
A	1000	900	100	100	2000	900
B	1000	0	1000	100		

Step 1: Bank A creates a \$900 Mortgage Backed Security from the loan made against its deposits. This loan is sold to the *depositor* at Bank B. \$900 is transferred to Bank A in payment for the loan by the depositor at Bank B. Bank A now has no loans outstanding against its deposits, and the securitized loan has been moved outside of the banking system. Notice that the total amount of money ("Cash") within the system is constant, but the amount represented as deposits by the two banks has shrunk. This is a direct consequence of using a reserve based lending system.

Step 1						
Bank	Deposits	Loan	Cash	Equity Capital	Σ Deposits	Σ Bank Loans + MBS
A	1000	0	1000	100	1100	900
B	100	0	100	100		
<i>Mortgage Backed Securities: \$900</i>						

Step 2: As Bank A now has no loans against its deposits, and is within its equity capital ratios, it can issue a new \$900 loan made against its deposits. The funds paid as a result of this loan are deposited at Bank B. Total money ("Cash") remains constant as it is transferred between banks, but the quantity of loans held by the banks increases, and causes an increase in deposits.

Step 2						
Bank	Deposits	Loan	Cash	Equity Capital	Σ Money	Σ Bank Loans + MBS
A	1000	900	100	100	2000	1800
B	1000		1000	100		
<i>Mortgage Backed Securities: \$900</i>						

Step 3: Once again, Bank A securitizes the loan, and sells it to the *depositor* at Bank B. This returns the system to the identical state held in Step 1, with the addition of \$900 of securitized loans held outside of the banking system.

Step 3						
Bank	Deposits	Loan	Cash	Equity Capital	Σ Money	Σ Bank Loans + MBS
A	1000	0	1000	100	1100	1800
B	100	0	100	100		
<i>Mortgage Backed Securities: \$1800</i>						

Step 4: As in Step 2, Bank A issues another loan whose proceeds are deposited at Bank B, and can then be securitized as before.

Step 4						
Bank	Deposits	Loan	Cash	Equity Capital	Σ Money	Σ Bank Loans + MBS
A	1000	900	100	100	2000	2700
B	1000		1000	100		
<i>Mortgage Backed Securities: \$1800</i>						

Since the Deposit and Loan positions of the two banks are identical in all respects in Steps 1 and 3, and Steps 2 and 4, this process can continue indefinitely, resulting in an expansion of the total commercial bank originated loan supply, independent of central bank control.

Although this is a simplified version of the flows between loans, deposits, and asset backed securities that are occurring daily in the economy, there is nothing that currently prevents the process being engineered exactly as described. At no point in this sequence has either bank needed recourse to central bank funds, or broken any of their statutory requirements with respect to capitalization or reserve requirements. Since there is no involvement of the central bank, there is also no control. Permitting the sale of loans outside the regulated banking system (i.e. to holding entities other than regulated banks), has thereby created a systemic and exploitable loophole in the central bank's regulation of the loan supply.

Since lending by commercial banks against their deposits was historically based on a fractional relationship between deposits and loans, this creates an unprecedented situation. The requirement that no individual bank should lend more than their deposits, has been enforced by required reserves at the central bank since the 19th century in Europe, and the early 20th century in the USA. Individual banks have been strictly monitored on that basis, since exceeding regulatory limits has typically resulted in bank failure. The sale of Asset Backed Securities does not allow any individual bank to exceed this ratio, but it does allow the banking *system* to do so, thereby creating a mechanism for unconstrained growth in commercial bank originated lending.

Besides creating a debt money imbalance within the economy, other problems are created as money flows through these instruments and the accompanying loans are repaid. The pattern of retail mortgage lending that has emerged in major economies over the last few years, is one of relatively short period loans (3-5 years), being periodically renewed. This clearly allows those selling the loans to maximise the associated profits from loan fees, and loan resale. However, it also acts to progressively concentrate money within the financial sector, and creates a dislocation in the proportional distribution of wealth within the general economy.

Part of the systemic problem is that bank deposits are now represented by a multiple of loans, rather than a fraction. Eventual default on part of the loans is probably inevitable for that reason, but before that happens, money is preferentially transferred within the economy from deposit holders to debt holders, as money flows are directed into increasing amounts of debt. Were it not for a separate problem within the financial system, this arrangement would have imploded very quickly, as the mechanism would over time increase the total debt within the system to the point where the available money supply at a given point in time would simply be insufficient to cover capital and interest payments for that period.

The other systemic issue arises from the increase in debt itself, which acts to direct money flows within the economy away from general activity, and specifically into activities that are debt funded. Because the origin of this increase is a mathematical loophole within the financial system, it carries no useful economic information, with respect to supply and demand, and simply acts to create a credit bubble for debt funded activities. Because the debt itself carries no economic costs for its providers, and in fact allows them to profit from it fairly considerably, debt originated funds operate at an advantage to non-borrowed sources, and progressively economic activity is funded by debt rather than savings or earnings.

2.2 The infiltration of Debt Instruments into Equity Capital

Although the Asset Backed Security problem explains the growth in debt that has occurred, it does not explain the growth in the money supply that has accompanied it. Somewhat uniquely of the many regulatory challenges that the reserve banking system has created down the centuries, the Asset Backed Security problem, in and of itself does not cause the banks, or the banking system to "print money."

The regulatory failure that is allowing the banking system to do this, lies in permitting the inclusion of debt instruments as part of equity capital.

Individually, commercial banks are limited in the amount of money they can lend. They are limited first, by the total amount of money they have on deposit, secondly by any reserve requirements for those accounts, although these have been severely reduced in most banking systems, and finally by the ratio of their equity capital to their outstanding, risk weighted, loans.

To be adequately capitalized under the Basel accords, a bank must maintain a ratio of at least 8% between its Tier 1 and Tier 2 capital reserves, and its loans. Equity capital reserves are provided by a bank's owners and shareholders when the bank is created, and represent a quantity of assets which exists to protect the bank's depositors against loan defaults. Understandably, the Basel treaties place considerable emphasis on the safety of the financial instruments the reserve is held in, and only a restricted set of instruments can qualify.

The separate reserve requirement on customer deposits has been removed within the American and many other banking system for most classes of deposits, with the exception of 'Net Transaction Accounts' which are a small percentage of the total.⁷ In the absence of reserve requirements, the ultimate limit on lending at any point in time is the sum of the equity capital within the banking system. Since banks invariably maximise their lending, this in turn raises the question of how the total quantity of equity capital within the banking system is controlled.

Individual banks may increase their equity capital amounts if they have an excess of deposits, and are profitable, however there does not appear to be any explicit central bank control over the total amount of equity capital within the banking system, except perhaps the supply of financial instruments that can be used to hold it.

⁷In the USA, reserve requirements are 10% on Net Transaction accounts, and 0% on non-personal time deposits and Eurocurrency liabilities. <http://www.federalreserve.gov/monetarypolicy/reservereq.htm>

The banking industry's perspective on both forms of reserve is that they are a cost and hindrance to full profitability; rather than a critical part of the regulatory process. From the purely selfish perspective of each individual bank, this may seem a reasonable argument, and one which has led to both the relaxing of reserve requirements, and to allowing a wide range of interest paying financial instruments to be used as equity capital. Unfortunately it ignores the roles both forms of reserve play in the systemic regulation of the banking system, and the interdependencies within that system of the money and loan supplies.

If regulatory capital was required to be held in some form of financial instrument that was guaranteed to be held in fixed or at least regulated supply, this would be less of a problem, although it would probably be more accurate to say that a different set of problems would be promptly created. However, the total amount of lending by all the commercial banks would at least be constrained by the fixed availability of regulatory capital instruments. In the current implementation though, this does not appear to be the case. Equity capital can be held in a variety of instruments, including those representing commercial bank loans. Specifically, Mortgage Backed Securities can be included in Tier 2 capital, which is allowed to comprise up to 4% of the equity capital reserve as stated in the Basel Capital Accords:

41. Loans fully secured by mortgage on occupied residential property have a very low record of loss in most countries. The framework will recognize this by assigning a 50% weight to loans fully secured by mortgage on residential property which is rented or is (or is intended to be) occupied by the borrower.⁸

This provision in the Basel accords, effectively allowed loans to be used as regulatory capital, and in the process become the regulating instrument for the issuance of, more loans. This creates a feedback loop between loans and regulatory capital, which unlike the asset backed security loophole, does have money supply implications. We proceed as before to show the flows between two banks.

⁸Basel Capital Accords. International Convergence of Capital Measurement and Capital Standards. (<http://www.bis.org/publ/bcbsc111.pdf?noframes=1>)

In the initial starting condition, Bank A has made loans of \$900 and Bank B has no loans outstanding.

Initial State						
Bank	Deposits	Loan	Cash	Equity Capital	Σ Money	Σ Bank Loans + MBS
A	1000	900	100	100	2000	900
B	1000	0	1000	100		

Step 1: Bank A creates a \$900 MBS, and sells \$850 of it to a depositor at Bank B for \$900.⁹ It keeps the remaining \$50 AAA rated tranche.

Step 1						
Bank	Deposits	Loan	Cash	Equity Capital	Σ Money	Σ Bank Loans + MBS
A	1000	0	1000	100	1100	900
B	100	0	100	100		
In Addition:						
\$850 MBS owned by depositor at Bank B						
\$50 MBS owned by Bank A						

Step 2: The remaining \$50 MBS can be counted as part of its profits, so Bank A moves the \$50 MBS into equity capital where it can be counted as part of the equity capital reserve at 50% of its value. It withdraws \$10 from equity capital and pays that as a bonus to an account holding employee. The net result of this is to increase equity capital by \$15 and its deposits by \$10

Step 2						
Bank	Deposits	Loan	Cash	Equity Capital	Σ Money	Σ Bank Loans + MBS
A	1010	0	1010	115 (\$50 MBS)	1110	900
B	100	0	100	100		
In Addition:						
\$850 MBS owned by depositor at Bank B						
\$50 MBS owned by Bank A and held as part of Equity Capital, where it is valued at 50%						

Step 3: Assuming there is a reserve requirement for the deposits at Bank A, then Bank A can now lend \$909. This money is deposited at Bank B, resulting in an increase in the money supply, beyond that achieved in Step 1.

Step 3						
Bank	Deposits	Loan	Cash	Equity Capital	Σ Money	Σ Bank Loans + MBS
A	1010	909	101	115 (50 MBS)	2019	1809
B	1009	0	1009	100		
In Addition:						
\$850 MBS owned by depositor at Bank B						
\$50 MBS owned by Bank A						

As before, this process can continue indefinitely, as long as loans can be securitized. The rate of expansion of the money supply as a result will depend upon the time taken to issue and securitize loans, and the level of profits extracted by the banks from these loans. It is independent of central bank control, except insofar as the central bank can restrict demand for loans by raising interest rates.

Foundational economic textbooks such as Mankiw[8], are very specific about money creation, stating that “the Federal Reserve is responsible for controlling the supply of money in the economy”. Unfortunately, as this example demonstrates, this theoretical control is dependent upon assumptions about *implementation details* of the reserve banking system, that no longer appear to be correct.

This process may also help explain the large amount of these instruments that were still in possession of the banks, when the current credit crisis began which was commented on by Diamond[3], since securitizing banks would have preferentially moved mortgage backed securities into their equity capital holdings to take advantage of this ‘feature’ of the current regulatory environment.

Over the eight years that figures are available for¹⁰, the total amount of equity capital held by all US banks has nearly double from \$629,169,018 in 2001 to \$1,191,116,687 in 2008. The 10:1 ratio of lending to equity capital has consequently

⁹Public information on the exact proceeds of MBS sales does not appear to be available. All that is necessary for this process to operate is that it is possible to sell the MBS for more than the face value of the loans issued, whether that is achieved through loan fees, securitisation commissions, or by some other mechanism. The amount of profit generated from the instrument, will determine the time period of the subsequent money supply expansion.

¹⁰Data taken from FDIC Call Reports for American Banks available at <https://cdr.ffiec.gov/public/PWS/DownloadBulkData.aspx>

allowed the deposits held by the commercial banks to increase from \$6,488 billion in December 2001 to \$12,423 billion at the end of 2008, with a commensurate increase in lending. This is in addition to the excess loans that have been created through the securitisation loophole.

It is worth considering the effect of this on the banking system itself. If two banks of similar size in 2000 are selected, and it is assumed that one aggressively pursues a securitisation policy with its loans, and the other confines itself to more traditional banking practices, then the bank that successfully manages to securitize its loans will grow far faster than the bank that does not. By growing, and in the short term appearing to be extremely profitable, it is able to attract more investment, more deposits, etc. Consequently, it is inevitable that securitisation as a process will create "too large to fail" institutions, that inevitably must fail in the long term. Uncontrolled loan securitisation will eventually create an economy where a significant number of loans cannot be repaid, since in the limit, it allows the loan supply to exceed the capacity of the money supply to support loan repayments. At that point, the Banks that have most profited from the securitisation loopholes will be first affected by their equity capital losses as loan failure occurs within their Tier 2 Mortgage Backed Security holdings, and they will also be adversely affected by the failure of loan securitisation itself, and the removal of profits being derived from loan fees, and exploitation of the equity capital bug.

Consequently, excessive profits within the Commercial Banking System, should always be regarded with some suspicion. Any malfunction within the reserve based lending system will preferentially favour the institutions performing it, above those who are not, and lead to their excessive growth. This will occur regardless of whether the individuals controlling the banks are aware of the precise nature of the malfunction. Money is an economic signal, and is correctly used throughout society to determine whether activities are profitable and the level of them that is required. This should not be taken as an argument per se for direct control of bank profits, since that would be merely treating the symptoms; but it is an observation that the precise source of profits from all reserve based lending activity must be examined far more closely than that of other economic activities.

3 Quantitative Analysis

3.1 United States of America

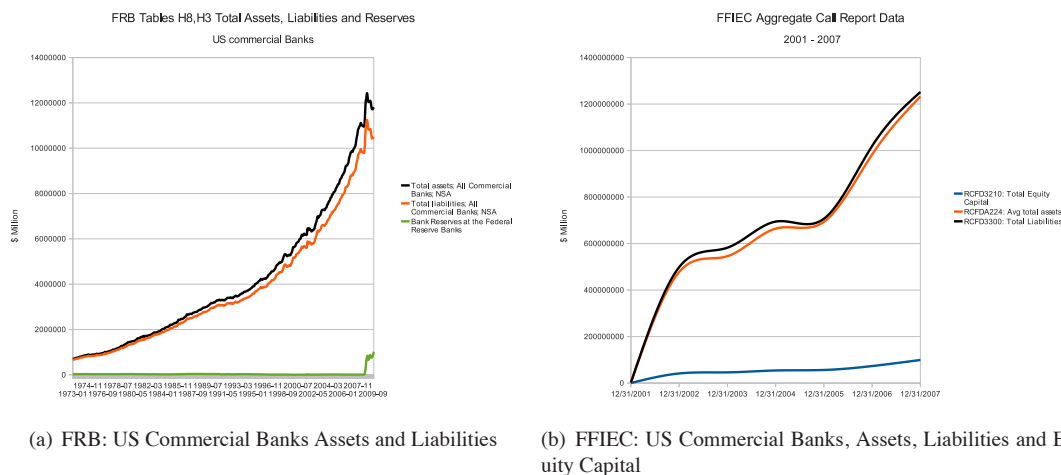


Figure 4: Assets and Liability Growth of the US Commercial Banks

Continuous growth in the deposits(liabilities) and loans(assets) controlled by the American commercial banks can be seen in the Federal Reserve statistical analysis, shown in Figure 4(a). (Table H8 data aggregates commercial bank equity capital positions into their total assets, which explains the appearance of an excess of assets over liabilities, which would otherwise indicate a severe regulatory problem). When the reserves held at the federal reserve central banks are included from the H3 Federal Reserve Statistical Release Table it can be also be observed in Figure 4(a) that there is no relationship between bank reserves held at the central bank, and the growth in deposits and loans. This supports the hypothesis that the mechanisms described in this paper circumvent central bank reserve based control.

Detail on equity capital holdings is available separately from FFIEC data derived from US Bank quarterly call report filing, and is publicly available from 2001¹¹. Figure 4(b) shows the growth over the period 2001 - 2007, before the data was distorted by the increase in commercial bank holdings at the federal reserve caused by the introduction of interest payments from the federal reserve on bank reserve holdings.¹² This figure shows that bank liability growth is

¹¹<https://cdr.ffiec.gov/public/PWS/DownloadBulkData.aspx>

¹²This caused the sudden growth in reserves shown in Figure 4(a). The interest rate currently payable is 3.5%.

linked directly to equity capital, rather than reserve control, and also shows near exponential growth, again supporting the contention that the system is currently evolving independently of central bank attempts at control.

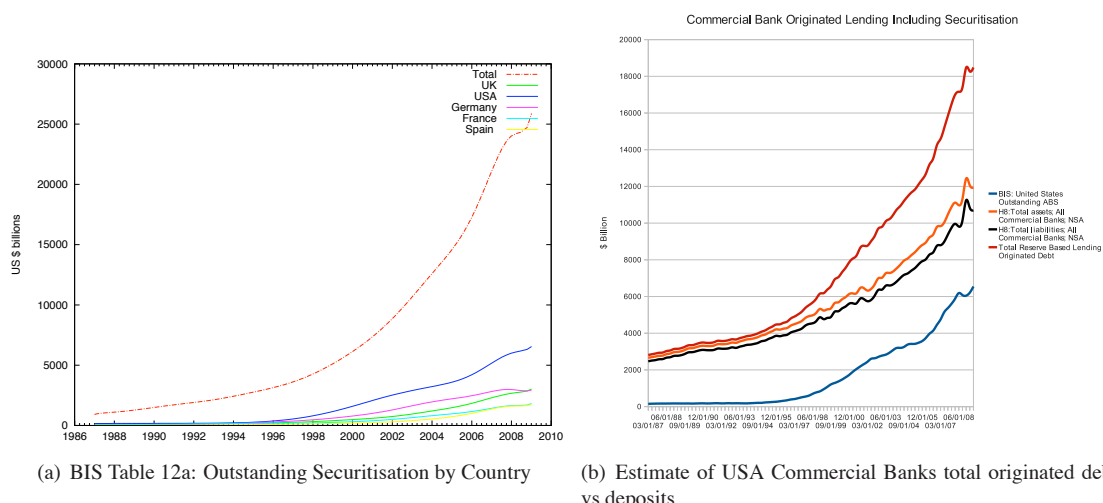


Figure 5:

Total lending by the US commercial banks however, exceeds the quantity of loans currently under their direct control, as it does not include the total amount of asset backed securities that have been sold on by the US commercial banks. Detailed figures on ABS issuance and ownership do not appear to be publicly available, but gross figures are available from data provided by the Bank of International Settlements.¹³ Figure 5(a), shows the total outstanding ABS issuance, and the amount attributed to the top 5 issuing countries as of 2009; while Figure 5(b) shows the aggregate of US outstanding ABS issuance, and US Banks assets. However, the aggregate BIS figures include ABS still owned by the US Commercial Banks, potentially as part of equity capital holdings. Figures on Mortgage Backed Security holdings by the US banks, which are the largest part of ABS issuances, are newly available (since July 2009) in the Federal Reserve H8 Table, and show total MBS positions of \$977 billion in October 2009. This indicates that a ballpark estimate for the total excess issuance of loans by the commercial banks within the USA is approximately \$5 trillion, or around half their total deposit liability, assuming that BIS figures include securitized lending by the GSE's. Figure 5(b) also illustrates how the growth in total debt is increasing faster than the total of underlying liabilities (money), as a direct consequence of loan securitisation.

BIS Table 12a - International Debt Securities
Net Issuance, USA & All Countries

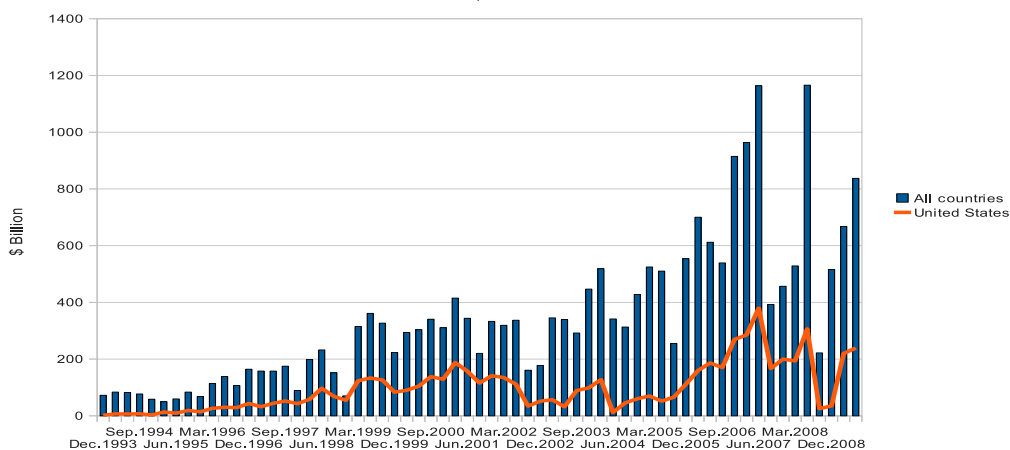


Figure 6: BIS Table 12a: Net Securitisation

Close examination of the recent behaviour of net securitisation issuance figures from the BIS is also interesting in the context of the current and continuing credit crisis. The USA is the largest single issuer of Asset Backed Securities, and as shown in Figure 6, there is a close correlation between the drop in Asset Backed Security issuance and the beginning of the credit crisis in 2007, as well as its worsening in 2008. In conjunction with the increase in Commercial Bank lending over this period, this suggests that the credit crisis was triggered by the removal from the credit markets of the loans

¹³<http://www.bis.org/statistics/secstats.htm>

represented by new securitized loans.¹⁴ Since the recovery of the US securitisation market has been primarily due to Federal Reserve intervention, this does not augur well for future financial stability.

3.2 Iceland

Iceland is of interest as an example of a very small banking system, operated using Basel rules, with an independent currency, which was deregulated in 2003. Because the economy is so small, and the deregulation is recent, it is possible to directly observe the consequences on the monetary system.

The growth in commercial bank lending triggered by the introduction of Mortgage Backed Securities in 1978, escalated dramatically during the 1990's and 2000's as increasing computerization, dramatically reduced the costs associated with issuing and packaging loans, and effectively turned the process into a production line as described by Wolfe[13]. However, the new technology also caused accompanying increases in economic productivity. This served to partially mask the impact of the securitisation and equity capital regulatory problems, by providing a background deflationary force on the world economy. In addition as money was transferred into the financial sector from savers and depositors by the leverage exerted by the securitized loans, it increasingly stayed in the financial sector in the form of a variety of exotic financial instruments, rather than returning in the form of inflation. Over time, a perceived savings glut began to build up from these funds. Both effects to some extent have masked the full impact of the two regulatory issues within the monetary system described in this paper, until relatively recently.

Against this background, it may perhaps be fairly observed, that Iceland did not pick the ideal time to deregulate its banking system in the year 2000. Figure 7 shows the behaviour of the M1, M2 and M3 money supplies for Iceland since

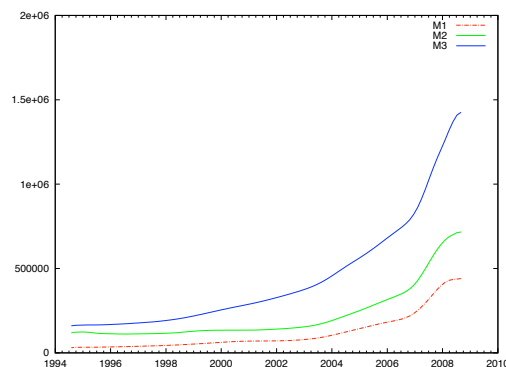


Figure 7: M1, M2, M3 Monetary Measures: Iceland 1994 - 2008

1994. Note that M2 and M3 money statistics include loan instruments and so cannot be regarded as measurements purely of the money supply. The figure shows a clear divergence in the M1 measure beginning in 2003, which coincides (with a small lag), with the full privatization of the banks in 2002. The equity capital, loan triggered feedback loop necessarily incurs a lag time to get started, as it is dependent on loan issuance, and its associated time scales.

Whatever economic consequences might follow from bank privatization, an increase in the general M1 money supply measure does not accord with either standard economic theory, or the presumption of central bank control over the money supply.

As the money supply expanded following privatization, it appears that the Icelandic central bank then followed textbook advice, and raised interest rates in order to control the monetary expansion. This had the reverse effect to that intended since it acted to attract foreign deposits to the system, further increasing the amount of deposits that could be used to support the loan supply, and allowing a small number of favourably connected Icelandic businesses to engage in an international borrowing and investment spree. This acted to further increase monetary growth, leading to a doubling in the M1 money supply in 2007, and a subsequent currency collapse.

This is perhaps one of the clearest demonstrations in history of the very fundamental issues raised by a system that directly couples the total money supply to a varying and uncontrolled loan supply. Some presumption of choice can be made over individual decisions about debt levels and borrowing, and those incapable of servicing their debt can be regarded as fiscally irresponsible. But there can be no protection for any individual's savings when borrowing by others can directly cause an expansion of the money supply and consequent inflation. In Iceland's case, the currency has devalued by approximately half since 2004, and is currently being sheltered by exchange controls.

¹⁴The proximate cause for the failure of the ABS markets was the failure of the insurers providing bond insurance for the Asset Backed Securities.

4 Credit Bubbles Revisited

At the macro-economic level of the gross statistics of money and loan supply to the economy, the reserve banking system creates a complex interplay between money, debt, supply and demand for goods, and the general price level. Rather than being constant, as implied by the theoretical description, money and loan supplies are constantly changing at a rate dependent on the average loan period, and a complex of details buried in the implementation and regulation of any given banking system.

Since the majority of loans are made for relatively long periods, months or years, the results of these interactions play out over a long enough time scale, that gross monetary features of regulation failure, such as continuous asset inflation often come to be regarded as normal, e.g. "House prices always go up". Price level however, is not only dependent on purely monetary factors, but also on supply and demand, which it in turn then influences. As a gross simplification, if constant demand for goods and services is assumed as shown in Table 1, then there are two possible causes of price inflation, either the money supply available to purchase the good in question has increased, or the supply of the good has been reduced.¹⁵ Critically, the former is simply a mathematical effect, whilst the latter is a useful signal, providing economic information that can be used locally by consumers and producers to adapt their behaviour. Purely arbitrary changes in both the money and the loan supply that are induced by historical behaviours of the fractional reserve banking system must be viewed in this context.

Money Supply	Product Supply	Price level
Increases	Constant	Inflation
Decreases	Constant	Deflation
Constant	Increases	Deflation
Constant	Decreases	Inflation

Table 1: Money and Productivity effects on Price Level

The majority of central banks, Iceland's included¹⁶, are assessed primarily on their ability to control inflation, apparently with the implicit assumption that this is an accurate indicator of their regulatory control over the money and loan supplies. This assumption breaks down, in periods such as the present where advances in technology are causing dramatic increases in productivity, and commensurate increases in the supply of goods and services, which create a deflationary effect on the price level.

The low inflation rates and absence of variability during the period that has been referred to as the "Great Moderation" by Watson[11], should not then be regarded as the result of successful regulation of the monetary system. Rather they appear to be the result of an uncontrolled expansion in the money and loan supplies being masked by a large increase in global productivity, as a result of the widespread introduction of computers and cheap, low latency communications. In the absence of the monetary irregularities described here, the considerable deflation experienced in the computing and electronics industries would have been far more widespread.

Credit bubbles are often explained as a phenomena of irrational demand, and crowd behaviour. In the light of the supply side dynamics outlined in this paper, an alternate explanation can be offered, which is that their root cause is a failure in the regulation of the loan supply within the commercial banking system. From this perspective the narrative of the history of periodic credit bubbles that have been a marked phenomena of the financial system over the last three centuries can be rewritten as follows.

Periodically, events in the larger economy act to trigger an increase in demand for loans which are used to purchase items in fixed, or relatively constrained supply. As the loan supply increases to meet this demand, prices begin to rise, as more and more money is lent for purchases, causing asset inflation. Rational speculation triggered by increasing prices then begins, and fuels demand for further loans. Absent any limit on the total amount of credit being supplied, the only practical limit on borrowing is the availability of borrowers and their ability to sustain the capital and interest repayments demanded for their loans.

Owing to the systemic latency created by loan duration's of months and years, excessive borrowing can build up over several years, before eventually this limit is reached. As general insolvency as well as a consequent Fisher[5] debt deflation occurs, the money supply contracts further as the reserve based system removes money from the economy either when recapitalizing, loan repayment, or as a result of bank failure. This leads to a domino effect on bankruptcies, as businesses that have been dependent on borrowed money fail, and trigger further defaults. Monetary expansion and further lending is also constrained by the absence of qualified borrowers, and by the general unwillingness to either lend or borrow that results from the ensuing economic collapse. Further complications, as described by Bernanke[1] occur when interactions between currencies are considered, in particular in conjunction with gold based capital regulation, because of

¹⁵Population increases are also a factor, but are relatively slow compared to the other factors. Understandably, underlying changes to the money supply itself are an unwanted complication to many theoretical economic analyses, but Bordo [2] provides a more nuanced analysis of price behaviour during the gold standard period supporting the simplistic relationship below.

¹⁶The Icelandic Central Bank's target inflation rate is listed somewhat quixotically on its web page as 2.5%. Actual inflation over the last 2 years has ranged between 4%-20% as the price level has adjusted to the money supply increases shown in Figure 7

the difficulties in establishing the correct ratio of gold for each individual currency, and maintaining it in a system where lending and the associated money supply are continually fluctuating.

This also provides an explanation for the generational nature of the phenomena. Although the fundamental cause is a failure in regulation of the loan supply, the trigger is an increase in demand for loans. In the aftermath of a credit collapse, lingering behavioural changes among borrowers act to reduce demand for loans, qualification for loans is also a problem, and so the problem created by the absence of loan supply regulation is not exposed since there is no demand for loans.

The debt money imbalance created by the widespread, and global, sale of Asset Backed securities may be unique to this particular crisis. Precise details are hard to obtain, but the Bank of International Securities provides national aggregates that may be useful. Figure 8 shows the world wide total of outstanding securitized debt (approximately \$25 trillion US dollars) for the period for which statistics are available, and also the level of increase for the five largest securitizing economies¹⁷. A complication of this data is that it includes Pfandbriefe issues within the central European economies, in particular Germany¹⁸ Pfandbriefe are securitized loans which retain their reserve requirement, and consequently should not create the problem described in this paper. Within the Euro zone there also appear to have been considerable variations in the regulations of lending and loan sales, and this is presumably creating some degree of internal stress within the euro based economies.

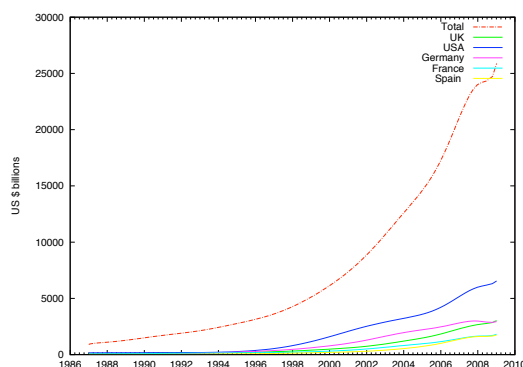


Figure 8: BIS Table 12a, Total Outstanding Debt Securities

Although Asset Backed Security issuance dropped considerably in 2008, as the resale markets were temporarily frozen, current stated policy in several countries, including the United Kingdom, is to encourage further securitisation to assist the recovery of the banking sector. Unfortunately this appears to be succeeding.

5 Conclusion

Detailed examination of the behaviour of the fractional reserve banking system, as a system, seems to have been overlooked during late 20th century modifications to banking rules and regulations. In particular, the systemic implications of securitized loan instruments, and in allowing loan instruments in general to be used as regulatory capital appear to have been missed. The result is that in large parts of the current banking system, there are no effective limits on commercial bank lending.

A complete understanding of the behaviour of the reserve banking system under different assumptions for centralised reserves, equity capital bases, and the treatment of loan defaults does not appear to have ever been completely formulated. Rather each period and particular implementation has had its own, partial understanding of the system's behaviour, and this has led to a succession of attempts to fix specific problems that have failed to completely account for systemic behaviours. This is not entirely surprising, the variability of the money and loan supplies under this scheme, and the financial instabilities that it causes only emerge over a time scale measured in loan cycles, and may well take years or even decades to realise. As changes are introduced within that period, the actual behaviour of the system at any given instance, is a moving target.

Simulation of the dynamic behaviours of the reserve banking system is now well within the capabilities of computer science, and should be regarded as a priority for research efforts. A framework where the behaviour of different implementations of this system can be independently verified, and the effects of any proposed modifications can be tested and understood is badly needed. Removing asset backed securities at this point in time will only cause a new credit crisis, as the credit they supply is withdrawn from the system, with knock on effects on other forms of borrowing. In the longer term, since the instruments themselves are money supply neutral once they are outside of the banking system, their effect on the economy will decline, but in the short term their removal would create an ongoing monetary crisis as loans are

¹⁷Source: <http://www.bis.org/statistics/secstats.htm>

¹⁸Confirmed in correspondence with the BIS.

repaid, or defaulted on, the exact consequences of which are hard to predict. Similar considerations apply to stabilizing the money supply by properly regulating equity capital and reserve requirements.

Asset Backed Securities themselves may have inadvertently created an opportunity for finally understanding the economic implications of the purely mathematical interactions of fractional reserve banking with the larger system. This observation follows from the behaviour of these instruments on repayment. Repayment of a commercial bank held loan necessarily causes instantaneous contractions in the money supply, as deposits are removed from the system in the same way they were originally created. This effect is masked in recent macro-economic statistics by the underlying expansion of the money supply resulting from the equity capital bug's effects on the loan supply, but it is still present in the short term operation of the system. However, once a loan has been removed from the banking system by securitisation it becomes a transfer loan, and its repayment is then money supply neutral. (Repayment and default are not neutral in terms of their effects on the larger economy, but those problems are created at a higher level.) It is possible that this is part of the explanation for the 'Great Moderation', since the macro-economic consequences then of Asset Backed Securitisation are not only to increase the total amount of debt outstanding, but to also proportionally change the proportions of the different types of debt within the economy. If this is indeed the case, it should be possible to correlate variability, with the known proportions of the different types of debt within the financial system over time, given access to the appropriate datasets.

Unfortunately, the end result of this, and the other changes that have been introduced into the banking system by the Basel treaties, may have been to protect the individual members of the system, the banks; at the expense of the structural integrity of the system itself.

References

- [1] Harold James Ben Bernanke. The gold standard, deflation, and financial crisis in the great depression: An international comparison. NBER Working Paper No. 3488, 1990.
- [2] Michael D. Bordo and Angela Redish. Is deflation depressing? evidence from the classical gold standard. NBER Working Paper No. 9520, 2003.
- [3] Raghuram Rajan. Douglas W. Diamond. The credit crisis: Conjectures about causes and remedies. *Working Paper 14739, National Bureau of Economic Research*, February 2009.
- [4] Joshua N. Feinman. Reserve requirements: History, current practice, and potential reform. *Publications of the Federal Reserve*, 1993.
- [5] Irving Fisher. The debt-deflation theory of great depressions. *Publications of the Federal Reserve*, 1933.
- [6] Albert Gailord Hart. *Debts and Recovery 1929 to 1937*. Twentieth Century Fund, Inc., 1938.
- [7] Michael Lewis. *Liar's Poker : Rising through the wreckage on Wall Street*. Penguin, 1990.
- [8] N. Gregory Mankiw. *Principles of Economics*. The Dryden Press, 1997.
- [9] Louis-Philippe Rochon and Sergio Rossi. *Modern theories of money: the nature and role of money in capitalist economies*. Edward Elgar Publishing, 2003.
- [10] Hyun Song Shin. Securitisation and financial stability. *The Economic Journal*, 2009.
- [11] James H. Stock and Mark W. Watson. Has the business cycle changed and why? *NBER*, August 2002.
- [12] Ludwig von Mises. *The Theory of Money and Credit*. Yale University Press, 1953.
- [13] Simon Wolfe. Structural effects of asset-backed securitization. *The European Journal of Finance*, pages 353–369, 2000.