AUSTRIAN BUSINESS CYCLE THEORY: ARE 100 PERCENT RESERVES SUFFICIENT TO PREVENT A BUSINESS CYCLE?

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Economists in the tradition of the Austrian school have shown that one type of maturity mismatching can cause maladjustments and business cycles.[1] When banks expand credit, by granting loans and creating demand deposits, they generate immediately withdrawable liabilities to finance longer-term loans. The newly created demand deposits do not represent a reduction of consumption, i.e., that characterized by real savings. As a consequence, interest rates are artificially reduced under the level they would have been in a free market reflecting real savings and time preference rates.[2] Thus, entrepreneurs are prone to engage in more and longer projects than could be financed with the available supply of real savings. Before all projects that are financed by the credit expansion are finished, a bust occurs. An absence of real

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[1] On Austrian Business Cycle Theory (ABCT) see: Bagus (2007, 2009), Garrison (1994, 2001), Hayek (1929, 1935), Huerta de Soto (2006), Hülsmann (1998), Mises (1998), and Rothbard (2000, 2001).

[2] This is not necessarily so, as Hülsmann (1998) has pointed out. If entrepreneurs anticipate the effects of credit expansion on prices, they will bid up interest rates including a price premium. This is also implied by the «Lucas Critique» (1976) and by rational expectations theorists (Muth 1961; or Sargent and Wallace 1975).

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savings to sustain the factors of production in the production processes and to produce complementary and necessary capital goods becomes evident. As a result, malinvestments are liquidated and the structure of production is brought in line with consumer preferences again. This is the Austrian Business Cycle Theory (ABCT) in a nutshell.

As a remedy Austrian economists such as Selgin (1988) and White (1999) have argued that a free banking system would be a means to inhibit the excessive credit expansion that causes business cycles. They maintain that the competition between banks would limit the credit expansion of the banking system effectively. Other Austrians such as Rothbard (1991) and Huerta de Soto (2006) have gone further and advocate a 100 percent reserve banking system ruling out credit expansion altogether.[3] In this article it is argued that a 100 percent reserve system can still bring about artificial booms by maturity mismatching if there is a central bank or government support and guarantees for the banking system. *Even if* we accept the case for a 100 percent reserve requirement, we see that the maturity mismatching of liabilities and assets (borrowing short and lending long) is itself perilous–and in the same sense that fractional reserves are perilous.

I
THE «GOLDEN RULE»

At the core of the traditional Austrian business cycle there is maturity mismatching in the term structure of the assets and liabilities of the banking system. In the process that underlies the business cycle, banks use short-term liabilities with zero «maturity» (i.e., demand deposits)[4] to finance long-term projects

[3] The present author (Bagus, 2007; and Bagus and Howden, 2009) has also argued in favor of a 100% reserve requirement. In this article it is shown that the 100% reserve requirement is not sufficient to prevent business cycles if other government interventions into the financial system remain intact.

[4] Strictly speaking demand deposits do not have any maturity. They are available on demand and do not mature. In contrast, loans mature and have a maturity. For the difference between loans and deposits see Huerta de Soto (2006).

via longer-term loans. However, the current economic turmoil is marked not only by massive maturity mismatching in the form of fractional reserve banking, but also by maturity mismatching on the part of investment banks via structured investment vehicles (SIVs), that use short-term repurchase agreements or short-term financial papers to finance longer-term investments. Naturally, the following question comes to mind: If one kind of maturity mismatching, i.e., the use of demand deposits to finance loans, can cause the business cycle, would not other kinds of maturity mismatching have similar effects, i.e., the use of funds obtained from the issue of short-term commercial paper to finance longer-term loans.

In fact, Mises himself came close to considering this question as early as 1912. As Mises (1953, 263, citing Knies (1876, 242)) states about maturity mismatching in general:

> For the activity of the banks as negotiators of credit the golden rule holds, that an organic connection must be created between the credit transactions and the debit transactions. The credit that the bank grants must correspond quantitatively and qualitatively to the credit that it takes up. More exactly expressed, «The date on which the bank's obligations fall due must not precede the date on which its corresponding claims can be realized.» Only thus can the danger of insolvency be avoided.[5]

Mises shows that maturity mismatching violates the golden rule of banking that goes back to Hübner (1853). When a bank or other financial entity takes on short-term liabilities to invest them for a longer term, it violates the «golden rule.»[6] Yet Mises does not follow up with an investigation concerning the effects of the violation of this institution with respect to the structure of production.

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[5] Mises should have written «illiquidity» instead of «insolvency.»

[6] This procedure is occasionally referred to as borrowing short and lending long. However, the downside of this terminology is that demand deposits could be considered as short-term borrowing. Yet, it is questionable that demand deposits are loans in a legal sense. See Huerta de Soto (2006, ch. 1-3).

In a similar way, Murray N. Rothbard comes close to an analysis of maturity mismatching (2008, p. 98):

> *Another way of looking at the essential and inherent unsoundness of fractional reserve banking is to note a crucial rule of sound financial management–one that is observed everywhere except in the banking business. Namely, that the time structure of the firm's assets should be no longer than the time structure of its liabilities.* (Italics in the original)

Rothbard also regards the practice of maturity mismatching as unsound and even puts it on par with fractional reserve banking. Yet, he neither investigates if maturity mismatching absent from fractional reserve banking, i.e., with 100 percent reserves, could distort the structure of production nor if the changes induced by it are sustainable. In this article, I try to close this theoretical gap by analyzing the effects of maturity mismatching. I will first argue that the time dimension of savings is a very important factor for the structure of production and its sustainability. The role and nature of maturity mismatching in a free market is discussed. This analysis is then contrasted with the role of excessive maturity mismatching in a hampered economy, showing fractional reserve banking as a special case of maturity mismatching and fractional reserve banking, central banking, and government guarantees as promoters of this practice.

1. The Time Dimension of Savings

The time preference schedules of all individuals in society determine the proportion of savings to consumption. Real investments are limited by real savings. The savings, like the investments, have a time dimensions as well as a magnitude.

This can be illustrated by an example from the Robinson Crusoe world. In Böhm-Bawerk's (1921, 136-39) famous example, Robinson Crusoe accumulates berries-his savings. These real savings are able to sustain him for a certain amount of time. Robinson Crusoe needs this time in order to build his bow and

arrow, i.e., capital goods, which will enable him to hunt more effectively. His time preference determines if he will have accumulated enough berries to finish his project. Not only the amount of berries he saves is important but also their quality, i.e., the nutrition they contain. It is an entrepreneurial task to estimate how long Crusoe's savings can sustain him. When his savings are depleted Crusoe may want to increase consumption. In fact, Robinson Crusoe only saved in order to consume more in the future.[7] If Crusoe's time preference increases before the bow and arrow are built, then he must abandon the project and start collecting berries again to provide for his consumption. It is therefore essential that Robinson Crusoe correctly anticipates future changes in his time preference schedule to correctly finish the project.

The same is true for a monetary economy with one important difference. In a monetary economy, savings are usually in monetary terms. Individuals abstain from consumption and accumulate money in order to invest directly or to lend to an investor. As in the case of Robinson Crusoe, the essential point is how long they are willing to save and abstain from consumption before they desire to increase their consumption. This implies that not only the amount of money that is saved is important, but also the term that this money is saved for and not demanded to increase consumption. Monetary savings have, thus, two dimensions: the nominal amount and the duration. Only the nominal amount is visible and observable. The time length depends on the invisible time preference schedules. In contrast, in the Robinson Crusoe economy both dimensions are integrated as the real savings of berries lasts for a certain period of time.

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[7] Thus, Böhm-Bawerk (1901, p. 49) writes:

When Crusoe on his island saves up a store of provisions in order to gain time for the fashioning of better weapons, with which he hopes later to secure a much larger quantity of provisions, these relations are all clearly discernible. It is obvious that Crusoe's saving is no renunciation, but simply a waiting, not a decision not to consume at all, but simply a decision not to consume yet; that furthermore there is no lack of stimulus to the production of capital goods nor of demand for the consumption goods subsequently to be produced by their aid.

The importance of the time dimension of savings is clear in the Crusoeian world. Yet, there has not been much emphasis placed on the time dimension of savings in a monetary economy. As savings thus have a dual-nature–a magnitude in the present, and an availability in the future, it is for certain purposes misleading to portray the world as if there was only one term for savings.

In the loanable funds model of Roger Garrison (2001) there is only one market for loanable funds. Implicitly, all savings have the same maturity. However, in reality there are markets for loanable funds of different maturities. For instance, there are various loanable funds markets: the market for savings accounts, the 3 month commercial paper market, time deposits of 6 months, 1 year loans, 30 year bonds, etc. To simplify and assume that there is only one market for loanable funds, might be legitimate for certain theoretical questions or as a simplifying heuristic assumption. However, in this way, an important question disappears. Indeed, it is precisely this question that we want to answer in this paper: Assuming a constant money supply (and 100 percent reserves for demand deposits), does maturity mismatching cause distortions in the structure of production? With a constant money supply in Garrison's framework (2001), the supply of loanable funds remains the same. Nevertheless there are important changes in the economy if there is an additional dimension manifested through maturity mismatching.

The prices paid in the different markets for loanable funds comprise the yield curve. The yield curve is usually upward sloping, which means that interest rates are higher the longer the term of the loan. This is so, as the longer someone lends money the higher is the loss of availability and the risk of loss, hence, the interest rate must increase to compensate for this loss and risk. The longer the time dimension of savings, the higher the compensating interest rate will tend to be. Changes in the supply and demand in the different time markets affect the different interest rates. Therefore, if banks use short-term loans to finance long-term credits, *ceteris paribus*, short-term interest rates will rise and long-term interest rates will fall, *even with a constant money supply*.

II
MATURITY MATCHING AND SAVINGS

Now let us assume that there is a world of matched maturities.[8] Lenders reduce consumption for a certain period of time, granting loans to investors who invest in projects expected to have the same duration to completion. The transaction between lenders and borrowers can be direct or indirect via banks, defined as negotiators of credit. Thus, the structure of production is sustainable and coherent with consumer time preferences.

Now let us suppose that the social time preference rate is reduced. Savings are increased relative to consumption. This can reflect itself in two forms. First, the amount of real resources saved for a given period can increase without a decrease in savings for another period. For instance, ceteris paribus the supply of one-year loans may increase. This enables lenders to sustain more one year investment projects. Individuals restrict their consumption for one year in order to have command over more consumption goods in following years. Second, the duration the real resources are saved for may increase. Individuals restrict their consumption for a longer time than they did before, granting more time for the projects to amortize and increase the supply of consumer goods. For instance, the supply of one-year loans decreases in favor of the supply of five-year loans. This means that savers do not demand to increase their consumption after one year, but only after five years. Effectively, in a monetary economy with a separation of lenders and investors an increase in savings could

[8] The methods of financing would be very different than in our world of maturity mismatching. There would be probably more financing with equity and less overall indebtedness. Cash balances and liquidity would be temporarily invested at the stock market. As Huerta de Soto (2006, 460-61, fn 60) points out, the stock market has lost importance due to credit expansion. However, it has also lost importance due to maturity mismatching. Financing with equity eliminates the roll-over problem inherent in maturity mismatched loans. The roll-over problem consists in the necessity to renew the short-term borrowing until the long-term lending matures. Furthermore, without credit expansion there would be probably a greater amount of longer-term loans, as in the form of standardized long-term bonds. For example, standardized 20 year and 30 year bonds could be traded continuously and provide ample liquidity.

reflect itself either as an increased amount of loans of a certain maturity or in a conversion of shorter-term loans into longer-term loans. In both cases the increased or longer abstention from consumption allows for more roundabout production processes-those that yield a higher quantity or quality of consumer goods when complete.

III
MARKET MATURITY MISMATCHING

Let us now turn to the case of maturity mismatching in a free market. If future changes in time preference rates are correctly anticipated, maturity mismatching is not problematic. To illustrate this point, we contrast maturity matching and mismatching in a non-monetary economy. Consider the case of Robinson Crusoe who restricts his potential consumption of 10 berries a day to 5 berries in order to save 5 berries per day. After 20 days he has saved 100 and can engage in the production of the bow and arrow, which he expects to take him 20 days to complete.

Now consider that Robinson is financed by a loan from Friday. He gets 100 berries for a 10 day period. However, it will take him 20 days to complete his project. After 10 days Crusoe has to pay back the loan even though his project is not completed yet. He has to renew Friday's loan in order to be able to complete the project. There is a mismatch between the time structure of the savings and the investment. We see, therefore, that maturity mismatching does not lead to unsustainable change in the structure of production, when savings are renewed or «rolled over» and this is correctly anticipated by entrepreneurs.

In a monetary economy the process would be similar. A company can finance itself with a loan that is as long as the project lasts (or longer or, alternatively, with equity), i.e., until it amortizes; this will imply matched maturities. Alternatively a company can finance itself with a loan of a shorter maturity than it needs to amortize the project. In this case, the company will need to renew or roll over the loan until the project amortizes. If people are willing to renew the credit under the same conditions, and are

willing to restrict their consumption for a longer term, the change in the structure of production is sustainable.

Entrepreneurs can, of course, successfully forecast the future availability of funding. They can and must, for example, forecast future time preference rates and the stability of the real savings available. By correctly anticipating the amount of future savings they make short term funds available for long term projects. There is no particular reason why entrepreneurs in a free market would systematically under- or overestimate the future availability of savings.

IV
LIMITS TO MATURITY MISMATCHING IN THE FREE MARKET

Now we shall examine what restricts the amount of maturity mismatching in a free market. First, maturity mismatching is a risky and speculative venture, as it relies on rolling over saved funds. Entrepreneurs usually try to avoid such risks and therefore try to avoid partaking in such behavior. Thus, rules of sound finance demand a maturity match as Rothbard (2008, 98) points out and a positive net working capital. A maturity mismatch, in fact, puts in danger the success of the whole project. If there is an unanticipated increase in time preference rates and funds are not rolled over, the investment project cannot be finished as planned. In fact, sudden increases in social time preference rates due to wars, natural catastrophes, etc., cannot be discarded as irrelevant for this very reason. These events can lead to panics and cause mismatched banks and companies to find themselves in financial troubles. A bankruptcy of a bank can induce more fear and cause people to refrain from rolling over loans. Because of this risk of mismatching, there has evolved a «rule» in finance, that assets should be financed with liabilities of the same or longer-term (i.e., duration matching). Therefore, entrepreneurs have usually preferred to rely on matched finance durations when planning for investment projects.

In a free banking system there are limits to the practice of maturity mismatching by banks besides the wish to comply with

the wisdom of the principles of sound finance and secure financing sources. These limits are similar to the limits of credit expansion for banks in a free banking environment as shown in the free banking literature most notably by Selgin and White (1987), Selgin (1994, 2000), Dowd (1996a, 1996b) and White (1984, 1999). In a free banking system, a bank that expands credit too aggressively or issues too much currency is confronted with redemption demands. As a consequence, the bank might be forced to suspend payments. In order to prevent this from happening banks tend to hold high and liquid reserves as a precautionary means. In other words, in a free banking system clearing transactions threaten the reserve base of banks and put limits on the credit expansion. Moreover, banks can try to drive their competitors into bankruptcy. This strategy in relation to bank notes has been called «note dueling» (Selgin 1987). Banks collect notes of a competitor and present them for redemption in specie at a competitor at once in order to force the competitor to suspend payments.

A similar procedure limits the amount of maturity mismatching in a free banking system. Thus, extreme cases of mismatching can lead to a sudden end to roll-over options by creditors. For instance, more sound competitors or speculators might lend to the maturity mismatched banks on a short-term basis.[9] Then they wait until the bank lends out the funds on a longer term basis. Together they could initiate a run on the bank in the sense that they suddenly refrain from allowing the bank to roll over with fresh loans. Moreover, they could spread rumors of its insolvency. This would place a considerable check on the amount of maturity mismatching in practice.

Additionally, speculators could assume a position as a short-term lender to such banks and simultaneously short the bank's stock. By eliminating or reducing the amount of maturity roll over, the maturity mismatched bank can suffer severe liquidity problems, resulting in a falling stock price and benefits reaped by the speculators. A «white knight» may even step in at some point and buy the maturity mismached bank at a discount.

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[9] If a business is mismatching, a business competitor could do the same through a middle man.

Another check to maturity mismatching is provided by bank customers. Bank customers estimate the risk of maturity mismatching. As a result of the inherent forces of a free banking system, banks mismatch as much as their customers want. They earn profits as a reward for the risk taking, if maturity mismatching is successful (Selgin and White 1996). Competitors and customers restrict maturity mismatching within narrow limits. As a result, banks cannot deviate too far from maturity matching. Banks are also forced to maintain an adequate level of bank capital. The greater the mismatches, the higher level of capital (i.e., assets minus liabilities) banks will have to maintain–to keep problems of illiquidity from becoming problems of insolvency. In case of a roll-over stop, bank capital may support the long term lending.

V
EXCESSIVE MATURITY MISMATCHING

1. Credit expansion as a special case of maturity mismatching

The practice of credit expansion, i.e., the granting of credits with demand deposits, is a special case of maturity mismatching. A fractional reserve bank assumes short-term liabilities that are due instantaneously on demand, and lend them for longer terms. Furthermore, fractional reserve banks engage in interest rate arbitrage. They take on short-term liabilities increasing the interest paid for them. In fact, without the arbitrage the depositors would have to pay the bank for the safekeeping service of the deposited money. Now, depositors gain a positive interest rate, due to the high demand of interest arbitrage. At the same time the supply of longer-term loans is increased which indicates to investors that long-term savings have increased and are available to finish long-term projects.

Thus, fractional reserve banking is maturity mismatching *in extremis*, as it relies on liabilities with zero maturity and the need to roll them over continuously. As Huerta de Soto (2006, 412) points out, credit expansion by granting credits out of demand

deposits leads to an unsustainable lengthening of the structure of production. This is so, because the monetary income of the factors of production increases, and if they do not increase their ratio of savings and consumption, they will bid up consumption goods' prices. The relative increase in consumer goods prices triggers the bust as profits in the consumption sector rise relative to profits in capital goods industries. However, if all the newly created funds made available by the credit expansion are saved when they are received by their ultimate holders (the owners of factors of production), then it is possible to lengthen the structure of production. This is tantamount to a reduction in time preference rates. In other words, if the created funds are rolled over continuously a lengthening of the structure of production is sustainable. As Huerta de Soto expresses it:

> *However unless the entire process is accompanied by a simultaneous, independent, and spontaneous increase in voluntary saving of an amount at least equal to the newly-created credit banks extend* ex nihilo, *it will be impossible to sustain and complete the new, more capital-intensive stages undertaken, and the typical reversion effects we have examined in detail will appear, along with a crisis and economic recession*. (2006, 412) [Italics in the original]

Only if all the generated income is saved may the lengthening of the structure of production be sustainable (Hayek 1941, p. 394.) In this case, financial intermediaries and entrepreneurs would have anticipated correctly a decrease in time preference rates (Hayek, 1935, p. 153). If they do not anticipate it correctly, engaging in the expansionary boom was an entrepreneurial error. This insight applies to other kinds of maturity mismatching. If all short-term savings are rolled over and saved until the projects are finished, a lengthening of the structure of production is sustainable. In other words, if all short-term credit created by interest rate arbitrage is saved for the term of the financed projects, the lengthening works out fine. Entrepreneurs anticipating the future roll-over, which also means a decrease in time preference in regard to the non roll-over situation, can engage successfully in the completion of their projects.

The difference between fractional reserve maturity mismatching and other forms of maturity mismatching is that via fractional reserve banking the money supply is increased. More specifically, the amount of demand deposits is increased. These demand deposits can be used again for granting longer-term loans. Via the banking system, an initial demand deposit can increase the money supply several times. This is different for other kinds of maturity mismatching where the amount of demand deposits is not increased. Only short-term funds are increased, thus the money supply is not affected.

Another difference between fractional reserve banking mismatching and other mismatching is its legal and ethical status. Some authors, such as Huerta de Soto (2006), Rothbard (1991), and Hülsmann (2000, 2003) have argued that fractional reserve banking is of dubious legal legitimacy and unethical. This is so, because the nature of the demand deposit contract is not clear. It is not clear if the depositors transfer the availability of the funds to the bank. Other maturity mismatching, however, is not problematic. Bagus and Howden (2009) have shown that borrowing short and lending long does not violate the rights of the short-term lenders.[10] They transfer the full availability of the funds for the term of the contract to the long-term lender. Thus, while fractional reserve banking rests on shaky legal grounds, there is no similar argument contra maturity mismatching between deposits and loans.

2. Fractional Reserve Banking as a Promoter of Excessive Maturity Mismatching

Fractional reserve banking boosts the use of maturity mismatching by increasing overall liquidity and financing opportunities. Financing through interbank lending reduces the risk of the practice of maturity mismatching (Freixas and Rochet 2008, 4). The roll-over risk is reduced, as banks can use demand deposits

[10] In contrast, Barnett and Block (2009) maintain that any maturity mismatching is illegitimate.

to finance short-term liabilities if it is necessary. In a world without fractional reserve banking, banks who want to mismatch maturities, have to attract real short-term savings. Economic agents must restrict their consumption, at least in the short-term. Yet, in a fractional reserve banking system this restriction of consumption may not be necessary as new funds can be easily created by credit expansion. If short-term loans cannot be rolled-over, not fully loaned fractional reserve banks can fall back on demand deposits as a substitute. As an alternative they can get loans created by other fractional reserve banks through the use of demand deposits (interbank lending). Moreover, the inflation of the money supply produced by fractional reserve banking decreases the roll over risk in the future as an increase in available funds in the future can be expected. Thus, fractional reserve banking acts as an immense amplifier of maturity mismatching.

3. Central Banking as a Promoter of Maturity Mismatching

Central banking as a lender of last resort reduces the roll-over risk for maturity mismatched banks, including the risk of holding fractional reserves. By creating money a central bank acts as a roll-over lender of last resort. The existence of the central bank also boosts the interbank market that can be helpful with roll-over problems. When banks mismatch maturities, they borrow short and invest in long term assets. If the central bank accepts those long term assets as collateral against new loans, the risk of maturity mismatching is reduced. When individuals do not roll over anymore, the central bank might just accept assets of banks and discount them. Thus, the central bank provides banks with liquidity acting as a roll-over substitute. In addition, the central bank may actually create a safe secondary market for government debt (Palyi 1961, 16-17) as well as other otherwise more illiquid assets.

Effectively the central bank removes the limits to maturity mismatching in general and credit expansion in particular that exist in a free banking system. Competition between banks must not be feared anymore as the central bank is there to assist. For

bank customers mismatching is no longer of great importance, because banks can be regarded as generally safe if there is a central bank willing to assist.

Without the central bank, in the case of a reduction in roll over availability, banks might be forced to conduct a «fire sale» of their assets. If the bank suffers losses from these sales, it draws down its equity. These losses might cause a loss of confidence in the bank and cause even more clients to stop rolling over–a bank run on the short-term assets ensues. The loss of confidence can spill over to other banks and cause roll over problems for the whole financial system. The possibility of such a panic situation is greatly reduced by the existence of a central bank that can buy assets of banks in such a situation. Alternatively, the central bank can discount banks' assets creating a market for troubled assets that otherwise would not exist. Central banks can step in to roll over in the case that bank lenders and depositors refrain from rolling over.

It should be noted that while central banks in a fiat monetary system might be able to save banks in case of trouble, they cannot create *real* savings. When there are malinvestments committed due to maturity mismatching this cannot be made undone by bailing out banks. When people stop rolling over deposits, consumer goods' prices tend to increase relative to capital good prices, which leads to a tendency to shorten the structure of production. The fact that the central bank renews the loans to the banks only saves them from illiquidity. Yet, it does not create the real savings necessary to maintain the structure of production.

4. Government Guarantees as a Promoter of Maturity Mismatching

Government guarantees can also enhance the amount of maturity mismatching. Thus, government guarantees help to remove the limits to maturity mismatching that exist in a free banking system. When a government guarantees, explicitly or implicitly, the liabilities of public institutions or banks deemed too big to fail, moral hazard ensues. Banks or financial institutions will mismatch

maturities more than without this guarantee, because if they get into roll over problems, the government will step in and roll over the financing. This is what happened recently in the U.S. with government sponsored agencies (GSEs) like Freddie Mac and Fannie Mae. As these financial institutions were sponsored by the government they were thought to have an implicit promise of bailout. The consequence of this moral hazard was a risky maturity mismatching practice. The GSEs financed long-term mortgages with short-term loans (which were in turn financed by credit expansion of the banking system). The result of bailout promises is a greater maturity mismatch.

Investment projects are undertaken, even though there was no abstention from consumption for the same term. Interest rate arbitrage paved the way for these investments. These investments cannot be finished, if not all funds are rolled over, including the demand deposits. Moreover, by cartelizing the industry and bailing out failing banks, the guarantees together with fractional reserve banking and central banking remove the limits to maturity mismatching that were set by competition on the free market via runs on short-term assets and short-selling.

VI
CONSEQUENCES OF EXTREME MATURITY MISMATCHING

Borrowing short and lending long is a very attractive business. Banks can induce maturity mismatching by exploiting the yield curve, namely, by taking advantage of the fact that short-term interest rates are normally lower than longer term interest rates. Thus, banks offer slightly higher interest rates in order to attract short-term loans and demand less long-term loans. People then might decrease their long-term savings and invest in short-term loans. A restructuring of the term length of savings take place. Of course, these short-term loans are expected to be rolled over.

In doing so banks exploit the yield curve; they engage in interest rate arbitrage. Banks increase demand for short-term funds

and the supply of long-term funds. Interest rates for short-term obligations tend to increase as banks demand these funds to invest them for longer-terms. The supply of long-term loanable funds increases and tends to depress longer-term interest rates. The demand for short-term credits pushes short-term interest rates upwards while the increased supply of longer-term loans pushes long-term interest rates downward. By increasing the supply of longer-term credits above the amount that has been saved for the same terms, longer-term interest rates are reduced below the level that would have otherwise obtained. This relative reduction of interest rates indicates to entrepreneurs an amount of savings that in fact might not be available over the course of the investment project if banks cannot roll-over their funding–an artificial boom may result. It is important to note that as a result of maturity mismatching the yield curve tends to flatten. Taking on short-term obligations and investing long-term leads to a tendency of rising short-term and falling long-term interest rates. In fact, maturity mismatching provides the linkage between short-term interest rates and long-term interest rates. If a central bank manages to reduce short-term interest rates, there is a tendency that banks increase maturity mismatching leading towards the tendency of falling long-term interest rates.

If the short-term savings are not rolled over, excessive maturity mismatching has occurred. This process has detrimental effects for the structure of production. Banks have made more funds for investment available for a particular period than there have been real savings for the particular period. The supply of credits for certain terms has increased, even though people did not save or reduce consumption in the same amount for the same or longer terms. Consequently, the supply of credits did not reflect accurately the development of time preference rates which has instead evolved into a distortion. Entrepreneurs invested as if savings and the corresponding resources would have been available to finish their long-term investment projects. Yet, consumers were not willing to continuously reduce their consumption until these projects were finished. The only way, the longer term projects could have been finished, would have been to continuously roll over the short-term loans. There has been an

unsustainable boom and malinvestment if it turns out that savings are not renewed before projects are finished.

VII
A 100 PERCENT RESERVE BANKING SYSTEM AND EXCESSIVE MATURITY MISMATCHING

At this point, it is easy to see that there can be economic cycles without the credit expansion of a fractional reserve banking system. Even with 100 percent reserve banking[11] and a constant money supply there can be economic cycles, when banks engage in excessive maturity mismatching induced by the existence of government guarantees or a central bank that can step in at times of roll-over problems.

A central bank or a government can induce moral hazard in maturity mismatching. Banks borrow short-term and lend long-term, arbitraging the yield curve. For instance, they attract funds saved for one year and lend them for 10 years. Therefore, banks decrease long-term interest rates, even though there is no increase in savings. There is the illusion that via maturity mismatching, reduction of long-term interest rates and central bank bail outs, investments can sustainably be increased.[12] Entrepreneurs consequently engage in longer investment projects than are possible with the available savings. Banks do engage in this behavior, because there is a central bank or the government ready to bail them out, when they suffer losses or have roll-over problems.

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[11] It is also possible that banks hold 100 percent reserves and expand the money supply in a central banking system. For instance, in a fiat paper system, banks might grant new loans and the central bank provides the banks with the reserves by granting them loans backed by the new created loans. If maturity mismatching is involved in this procedure, a business cycles is possible. I thank Juliusz Jablecki for helping me arrive at this conclusion.

[12] In allusion to Hülsmann (1998) we can speak of the possibility of a maturity mismatching illusion cycle.

VIII
CONCLUSION

We have seen that the time dimension of savings is essential to understanding the business cycle. This dimension can vary and have effects on the structure of production. Entrepreneurs can anticipate future decreases in time-preference rates and the roll-over of short-term savings. In a free market, the inherent risk of this practice will have customers striving for safety and competition putting harsh limits on maturity mismatching.

In a hampered market the extent of maturity mismatching increases out of several reasons. First, and most importantly, fractional reserve banking raises incentives for maturity mismatching as financing through the creation of demand deposits becomes possible. Expected increases in the money supply increase maturity mismatching. Second, central banks enhance credit expansion and fractional reserve banking. Central banks can also bail out banks, in cases where a roll-over is not possible. This effectively removes the limits that competition sets to maturity mismatching in a free banking system. Third, government guarantees can increase the amount of maturity mismatching, as its risk is effectively socialized. Maturity mismatching greatly increases the distorting effects that a fractional reserve banking system alone has. Building on the distortions of fractional reserve banking, additional long-term funds are offered even though time preference rates have not decreased, an incident that makes people stop rolling over, leading to a break-down of the mismatched structure. This incident is provided by the economic crisis that maturity mismatching in a hampered market itself provokes.

Maybe the most important conclusion of our analysis is that not only fractional reserve banking can lead to an Austrian business cycle. Even with 100 percent reserve requirements for demand deposits and a constant money supply, excessive maturity mismatching induced by government guarantees and central bank lending of last resort can lead to unsustainable booms. Future research should be directed on the question how excessive maturity mismatching and the business cycle could be effectively prevented. Our conclusion indicates that a 100 percent reserve

requirement in a free monetary system would prevent excessive maturity mismatching. In light of these considerations, excessive maturity mismatching helps to explain the extent and length of historical boom and bust cycles like the current crisis.

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