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Reducing the Lower Bound on Market Interest Rates

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Abstract: This paper critically discusses three proposals to overcome the zero interest bound, which have recently been proposed by prominent economists. We trace back the historical origins of these proposals, reaching back to the late 19th century, and comment on their theoretical and practical deficiencies. We propose a much simpler method to spur real investment in times of a deep recession, based on long term central bank loans with low but non-negative base rates. With the prospect of decreasing default risks after the recession, this measure has a similar effect like negative base rates in time of crisis. We therefore hope to convey the message that the effects of the zero interest bound can at least be mitigated without substantially changing the existing monetary regime.

I. INTRODUCTION

Hopefully, the financial crisis of 2007/2008 will indeed turn out to be an 'once-in-a-century event' (IMF 2009, p. 3), although history seems to convey another message (Kindleberger 2005, Reinhart and Rogoff 2009). Not only had the recent financial turmoil serious repercussion on output and employment, it also shattered some dearly held believes concerning the effectiveness of conventional monetary policy and the ability of central banks to prevent financial crisis.[1] As the crisis hit the real economy, central banks around the world lowered their base rates substantially and market rates for the private sector should have gone done down as well. However, the reduction in base rates was offset by an increase in credit spreads between corporate and government debt of the same maturity and compared to other post-war recessions, this increase was enormous. While in the 1981-1982 recession credit spreads for financial and non-financial firms had risen by 100 and 50 basis points respectively, in the wake of the Lehman collapse in September 2008 they surged to 900 and 700 basis points. These spreads were considerably reduced after government and central bank interventions had successfully

[1] See Bernanke's (2004) insightful remarks about the causes of the Great Moderation.

averted a meltdown of the finical system, although spreads have remained considerably above pre-crisis levels (Gertler 2010, pp. 131-132). Thus, with central banks' base rates approaching zero, conventional monetary policy had run out of options concerning the reduction of market interest rates. Thus a growing credit spread in combination with the zero floor to nominal interest rates caused real interest rates for the private sector to rise in the midst of recession.

Given the potential disastrous consequences of a prolonged crisis, the monetary authorities around the world and the FED in particular turned to what was labeled 'unconventional' monetary policy,[2] a combination of 'qualitative and quantitative easing' (Buiter 2009a), policies with which central banks affect asset prices and financial conditions by balance sheet policy in contrast to conventional interest rate policy. Although there is little doubt that these policies were effective in avoiding a deflationary crisis (Minegishi and Cournède 2010, p. 6), they were devised and conducted in great haste with little or no attention to their long term implications such as distortion of competition as they favor some borrowers over others or the financing of public debt with the ensuing risk of inflation (Borio and Disyatat 2010, pp. 85-86, see also Wheelock 2010, p. 105). Indeed, research that aims to look into the effectiveness of unconventional monetary policy is now coming forward,[3] but it is plausible to assume that it will take years and the benefit of hindsight to evaluate their potentially serious side-effects. Nevertheless, the current debate suggests that there are serious incentive issues, especially with respect to market discipline and moral hazard.

Given these considerations, some scholars have put forward a more radical solution: the removal of the zero bound by altering the existing monetary regime in such as was as to allow base rates to become negative (Mankiw 2009, Buiter 2009b). The idea might seem absurd at first glance, but, as Mankiw points out, the same applied to the idea of negative numbers, which had been rejected by early mathematicians as impossible as well. As will be argued below, respective proposals have been available since the late 19th century. However, all of them would require substantial changes in the existing monetary regime with unforeseeable consequences and thus they stand little chance of being implemented. Therefore in this paper we propose another, less far-reaching method to reduce market rates in times of crises.

The simple idea is fixing the base rate for more than one period on a very low level, which might even be zero, thereby generating a reduction in mid-term credit costs for the private sector. In theory this rather simple provision might lower market rates substantially and thus might reduce market interest even in case that the lower zero bound has been reached by the central bank's base rate. Hence our proposal builds on the already existing measures for providing longer-term liquidity that were originally initiated in order to reduce the spread between long and short-term rates (Minegishi and Cournède 2010, p. 12). This rather simple measure does not interfere with the current monetary regime, but only requires sufficiently long term loans by the central bank to private banks at a low, though non-negative base rate.

The remainder of the paper is organised as follows. In Section two, we shortly sketch the rationale behind removing the zero bound. Although we believe that the proposals are theoretically sound and deserve probably more attention by the academic community as has been awarded to them up to now, with reference to the igneous proposal of the separating

2 For a review of the various measures taken see Minegishi and Cournède (2010).

3 See for example the theoretical studies by Gertler and Karadi (2010) and Cúrdia and Woodford (2010).

the numeraire and payment function of money first made by Buiter (2005a), we outline the substantial necessary changes to the monetary system as well as the practical problems associated with it. In Section three, we develop the argument for our proposal with the help of a simple theoretical model and discuss possible objections to and the limitations of our proposal. The last section concludes.

II. REMOVING THE ZERO BOUND: THEORETICALLY DESIRABLE BUT PRACTICALLY CUMBERSOME

Given the undesirable side-effects of unconventional balance sheet policies, some scholars have made proposals for removing the zero bound to nominal interest rates as a more efficient way for dealing with large demand side shocks which might turn into a deflationary spiral. Generally speaking, the zero bound to nominal (base) rates refers to the implicit zero interest on coin and bank notes. Together with commercial bank reserves, they constitute base money, the most liquid of assets, and a rational economic agent will not hold any other type of asset unless it earns a higher return than base money does (Buiter and Panigirtzoglou 2003, p. 727). Today coins and currency constitute only roughly 10 % of M3 in the developed world, and therefore the zero bound results primarily from the central bank`s practice of storing bank reserves for free (Goodfriend 2000, p. 1015). It would be trivial to pay a negative tax on commercial bank reserves and any form of registered account in order to make implicit interest on these assets[4] negative (Buiter and Panigirtzoglou 2003, p. 730). However, this cannot be done with coin and currency, because these are anonymous bearer bonds and their transfer is not registered but by delivery. Inducing the anonymous holders of cash to pay the interest due is rather difficult since they lack the incentive to do so. Given the existence of currency with a zero nominal interest rate, any attempt to levy negative interest on registered accounts above the carry and storage costs of currency would cause substitution of the former by the latter.

Therefore, given the current form of paper money, the zero bound sets a limit to the domain over which the nominal interest rate can be set by the monetary authorities. This in turn sets a floor to market rates, which under the assumption of perfect capital markets would equal zero, but are a lot higher in reality since they contain risk premium and administrative costs. Once base rates are close to zero, conventional monetary policy is ineffective for reducing market interest rates any further. Hence, if one seeks to fully remove the zero bound, levying negative interest rates on the whole monetary base becomes inevitable. Instigated by the Japanese experience of persisting deflationary pressure and economic stagnation from the 1990s onwards,[5] various scholars modelled the effects of the zero bound and made practical proposals for implementing negative interest rates in order to revive the economy via conventional monetary policy.[6] The most frequent method suggested is a tax on money, a proposal that runs back to the German anarchist Silvio Gesell,[7] and has been taken up by various authors and could be implemented

4 Taxing coins is deemed to be unnecessary, since storing great quantities of small change would incur high costs (Goodfriend 2000, pp. 1015).

5 According Krugman (1998) Japan was facing a liquidity trap.

6 For a review on the history and current proposals of negative interest rates see Ilgmann and Menner (2011).

7 See Gesell (1958) for the latest English edition of his economic theory.

by various schemes, the most simple being proposed by Buiter (2009b): abolishing coins and notes altogether in favour of electronic cash which would exist in registered accounts only and could thus be easily taxed.

As stated above, any of the proposed schemes would lead to radical changes in the current monetary regime, a fact which can be demonstrated by referring to the Buiter (2005a) proposal of separating the means of payment function of currency and its unit of account role,[8] already suggested by Einaudi (1953) and Gaitskell (1969).[9] The proposal draws on Eisler (1932), who proposed a similar program for financial reconstruction. Eisler distinguished between the function as "unit of account" on the one hand and as a "medium of exchange" as well as "store of value" on the other hand.[10] He was rather not concerned about the implications of the zero bound, but his motivation was to protect people from the negative effects of inflation. Nevertheless, in the recent literature Eisler's proposal is taken up as a method for removing the zero bound by separating the means of payment function of currency and its unit of account role (Boyle 2002, Davies 2004, and Buiter 2005a).

In contrast to Gesell's solution, which were never tried on a larger scale, Eisler-like schemes have been adopted in Latin America, most notably in Chile. The basic idea runs as follows (Eisler, 1932, p. 234): Consider an economy in which currency, e. g. Sterling, fulfills both the function of payment and the function of account. Now all Sterling notes and coins are withdrawn, and replaced by a new government-issued currency which serves as legal tender. Thus under the new system there are two forms of money, (1) legal tender, which Eisler calls '*current* money', and (2) Sterling which serves as a unit of account, called '*contract* money'. Under this scheme the existing monetary unit of account is basically maintained, since all monetary obligations, wages, contracts, taxes and accounts are still marked in Sterling. However, '*current* money' now fulfills two functions. On the one hand '*current* money' is legal tender, and on the other hand it serves as a unit of account for petty trade as prices of commodities of daily consumption and prices of commodities that are subject to high price fluctuations are denominated in '*current* money'.

In order to guarantee stable purchasing power Eisler suggested that the internal exchange rate between Sterling and '*current* money' is to be determined by the cost-of-living index. The cost-of-living index is calculated on the basis of average costs of commodities that are subject to price fluctuations and respectively are marked in '*current* money'. The underlying intuition is that an increase in '*current* money' leads to an increase in commodity prices, and the cost-of-living index respectively, which implies a depreciation of '*current* money' relative to Sterling. Analogously, an increase in the amount of Sterling, e.g. due to credit expansion, boosts demand which results in rising prices. Since by assumption all commodities that are affected by a monetary expansion are captured by the cost-of-living index, and since the cost-of-living index determines the internal exchange rate, 'current money' will depreciate relative to Sterling. In a nutshell, every change in the amount of money that affects the price

8 Other proposals for removing the zero bound are discussed at length in Ilgmann and Menner (2011).

9 Einaudi (1953) and Gaitskell (1969) pointed out that the separation of the payment and numéraire function of money offers an additional instrument of monetary policy, although they did not refer to the problems associated with the zero bound.

10 This is in compliance with Keynes' statement, that a distinction between the "unit of account" and the "currency" or "legal tender" may be made (see Keynes 1930, p. 3).

level is compensated by an adjustment of the exchange rate. Thus the purchasing power of Sterling is stable.

The introduction of an indexed unit of account, in the style of Eisler, was implemented successfully in Chile[11] in 1967 in order to cope with hyperinflation. Previously Chile had suffered from high inflation rates and was thus not able to attract capital from international financial markets. By introducing an indexed unit of account Chile created a stable currency with steady purchasing power. The Unidad de Fomento (UF), which is the equivalent to Sterling in the Eisler world, is used for establishing prices, contracts and wages[12]. The exchange rate between the unit of account and legal tender, the Peso, is defined using an index number, with all payments being made in Peso. More precisely, the UF is an amount of currency related to the Indice de Precios al Consumidor (IPC), the consumer Chilean price index (Shiller, 1998, p.3). An increase in the price index, which is measured in Peso, leads to a depreciation of Peso relative to UF. Since all contracts are denominated in UF, a worker's nominal wage exhibits constant purchasing power.

In 2005 Buiter picked up Eisler's proposal as feasible method for overcoming the zero bound. According to Buiter's scheme, the existing currency is withdrawn and replaced by a new government-issued currency as described above. But in contrast to Eisler, this new currency only serves as legal tender and cannot be used to denominate prices of commodities and hence all prices, wages and contracts are denominated in Sterling. Since there is no more Sterling currency, the lower bound on Sterling interest rates no longer exists.

Within Buiter's theoretical framework, there are both safe one-period Sterling-denominated bonds and safe one-period 'current money'-denominated bonds (see Buiter 2009b, p. 29). Buiter (2005a, p. 9) argues that if bonds, denoted in Sterling, and bonds, denoted in current money, can both be issued to the private sector, their inflation-adjusted returns should be equal. Thus the movement of the exchange rate will be determined by the covered interest parity (CIP). Therefore the exchange rate is determined by the interest rate differential.

Let us assume that the Sterling interest rate set by the monetary authority was negative, e. g. -3% according to the applied monetary policy rule, then the '*current* money' interest rate could remain zero, provided the monetary authorities announce a credible depreciation of '*current* money' in terms of the Sterling by 3% (see Buiter 2009b, p. 32). According to CIP, the depreciation of '*current* money' relative to Sterling equals the absolute value of the interest rate differential between Sterling and '*current* money'. Hence there is no arbitrage option, since Sterling is appreciating relative to '*current* money. Consequently, the whole monetary base is subject to negative interest rates, although the nominal interest rates on currency or '*current* money' respectively remain zero.

However, besides the tremendous effort and potentially occurring difficulties with the technical implementation, there is also one serious theoretical objection to this scheme: The basic requirement for this plan to work is that Sterling remains the unit of account. If '*current* money' would adopt the function as numéraire with prices, wages and contracts being denominated in terms of '*current* money', decoupling the functions of money would be completely ineffectual

[11] The Unidad de Fomento has been copied in Columbia, Ecuador, Mexico and Uruguay.

[12] In Chile the UF is primarily used for mortgages, long-term government securities, taxes, pensions, rent, payments, alimony, child support, etc. (see Shiller 1998, p.4).

because the depreciation mechanism would not work. Buiter (2009b, p. 37) himself admits that the whole affair would then resemble a renaming of the existing cash to '*current* money' without having any effects. Even if it was prohibited to denominate bank deposits and contracts in '*current* money', it would still be uncertain whether the scheme would work because 'what serves as unit of account in an economy is determined through a collective but uncoordinated, decentralized social choice of the agents making up the economy' (Buiter 2009b, p. 37). Further criticism can be directed against the determination of the internal exchange rate. In Buiter`s model, it results exclusively from interest rate parity and not from purchasing power parity, which is a contradiction to Dornbusch's monetary quantity theory. Since all goods are quoted in Sterling, explicit '*current* money' prices do not exist. They only result from multiplication of Sterling prices with the internal exchange rate. Hence the exchange rate does not result from an adjustment process of differentials in Sterling and 'current money' prices, which would be appropriate with respect to Dornbusch's model.

In summary, the Eisler proposal considered here would require substantial alterations of the existing monetary regime, and its success is not certain. Indeed, any of the methods proposed for removing the zero bound are yet untested and would require substantial changes to the existing monetary system. This is not an argument against monetary reform per se. Indeed, there might be considerable benefits from removing the zero bound to interest rates, especially in case of a large deflationary shock (Ilgmann and Menner, 2011). Nevertheless, one important objection regarding the practical implementation is the lack of research into the matter. Indeed, the group of scholars who have worked on the subject is up until now quiet limited and risk adverse policy makers will probably need a broader scientific base for such a fundamental reform. We therefore believe that – while removing the zero bound might be desirable – more research into the matter will be a prerequisite for reform. In the meantime, one should look for simpler pragmatic methods for mitigating the effects of the zero bound.

III. A SIMPLE PROPOSAL

Suppose the economy is in a recession and the risk of firm failure – the probability, that neither interest nor redemption will be paid – is $0 < R_f < 1$. The central bank`s base rate, which is also used as discount rate in bank calculations, is $i > 0$. Then, in the simplest case of a credit for one period, the present value of this credit is

$$PV_f = -1 + \frac{(1 + r_f)(1 - R_f)}{1 + i}. \tag{1}$$

In (1) the credit volume is normalized to unity and r_f is the interest which the firm promises to pay. In order to make the present value zero, the necessary interest rate which the firm credit must earn is

$$r_f^0 = \frac{1 + i}{1 - R_f} - 1 . \tag{2}$$

Obviously, this minimum required market interest rate inclines in R_f and inclines in i, so the central bank could principally lower $r^0{}_f$ by simply reducing the base rate, if necessary even below zero. However, there is a lower bound because of the alternative of simply holding cash,

which earns a positive interest if the base rate is negative. The present value of this alternative is

$$PV_c = -1 + \frac{1}{1+i}. \tag{3}$$

By equating (1) and (3), the rate of interest on firm credits which satisfies $PV_c = PV_f$ is easily calculated as

$$r_f^c = \frac{R_f}{1-R_f}. \tag{4}$$

According to (2) and (4) $r^0_f = r^c_f$ requires $i = 0$, so the lower interest bound is reached when the base rate is zero. In this case, the floor to market rates where banks will be indifferent between lending and hoarding cash is solely determined by the risk of default. Reducing this floor to market rates via a negative base rate does not work unless the negative interest is also applied to currency as to stop hoarding of real cash, which is cumbersome for the reasons discussed above. Moreover, the afore mentioned schemes use a sledgehammer to crack a nut, because there is another way out, which is much simpler and less intrusive concerning the design of the monetary system. The key idea rests on making binding contracts for more than one period, both between firms and banks and between banks and the central bank. As is well known from steady state capital theory, a positive interest rate has similar effects to a negative interest rate if it is below the growth rate. In other words, the same interest rate which is insufficient to pay for the risk R_f if it is only earned in a single period might well be acceptable if it is still paid for a number of subsequent periods with lower risk. Therefore, if a positive but low interest rate is fixed for a number of periods exceeding the time of recession, it may well spur giving credits to firms and, thereby, real investment.[13]

Turning back to our model, let the duration of the credit be n periods. For simplicity, it is assumed that the firm`s fallacy risk is R_f in Period 1, but zero after the firm has survived that period. The intuition is that during crisis short term expectations are depressed and perceived and real default risk is way above normal levels. However it is unlikely to assume that economic agents will presume that the crisis will last forever and therefore they will expect default risk to decrease in the long run. Thus R_f could also be interpreted as additional crisis related risk of default, which returns to zero once the economy emerges from recession. Hence the present value calculation of the credit is analogous to (1) given by

$$\begin{aligned} PV_f(n) &= -1 + \frac{r_f(1-R_f)}{1+i} + \frac{r_f(1-R_f)}{(1+i)^2} + \cdots + \frac{r_f(1-R_f)}{(1+i)^{n-1}} + \frac{(1+r_f)(1-R_f)}{(1+i)^n} \\ &= -1 + r_f(1-R_f)(S-1) + \frac{(1+r_f)(1-R_f)}{(1+i)^n}. \end{aligned} \tag{5}$$

[13] Note that this idea is decisively different from simply raising inflation expectations via a long term commitment to expansionary policy, which is frequently proposed for escaping the zero bound (see for example Jung *et al.* 2005).

In (5), S denotes the totals formula of a finite geometric series, which is

$$S \equiv \frac{\frac{1}{(1+i)^n} - 1}{\frac{1}{1+i} - 1}. \tag{6}$$

By setting (5) to zero, the minimum interest rate which the firm has to pay is given by

$$r_f^0(n) = \frac{(1+i)^n - (1-R_f)}{(1-R_f)\left[S(1+i)^n + 1 - 1(1+i)^n\right]}. \tag{7}$$

(7) reduces to (2) for $n = 1$ and approaches $r^0_f = i/(1 - R_f)$ for $n \to \infty$.

Because $S \geq 1$, with a given base rate i, the required firm interest rate $r_f^0(n)$ declines in n. The simple intuition is that the credit, after the firm has survived the first (recession) period, pays interest above i for $n - 1$ additional periods. Hence the lower interest bound on market rates declines in n. In order to show this, the present value of holding cash is calculated analogously to (3):

$$PV_c(n) = -1 + \frac{1}{(1+i)^n}. \tag{8}$$

Setting (5) equal to (8) yields the lower interest bound

$$r_f^c(n) = \frac{R_f}{(1-R_f)\left[S(1+i)^n + 1 - 1(1+i)^n\right]}. \tag{9}$$

Obviously, because of $S \geq 1$, also $r^c_f(n)$ declines in n. Like in the case of one period, $r^c_f(n)$ is achieved with a zero base rate, for equality of (7) and (9) requires $i = 0$. Because S is not defined for $i = 0$, one has to calculate the limiting value of (9) for $i \to 0$, which is a generalization of (4):

$$\lim r_f^c(n; i \to 0) = \frac{R_f}{(1-R_f)n}. \tag{10}$$

It is therefore proposed here that the central bank lowers the market rate for firm credits below the value given by (4), by setting the base rate to zero for more than one period. In principal, the central bank could even reduce the floor to market rates to (nearly) zero by choosing a respective high n.

In addition, our model is also helpful to explain the harm done by public deficit spending. Holding cash is not the only alternative for giving credits to firms. Another option, being particularly relevant in a crisis, is lending money to the government, as long as it is perceived as credit worthy. In a recession, not only government deficit spending is typically extended, but public bonds are also exceptionally attractive as an asset because of their relative low risk. Suppose that government bonds pay interest r_g and bear a risk R_g, the latter being defined analogous to R_f above. The present value PV_g of investing in bonds with term n in Period 1 is given by (5) again, replacing r_f and R_f by r_g and R_g respectively. With the same substitutions, (7) applies to government bonds as well. Thus it follows from (7) that

$$\frac{r_f^0(n)}{r_g^0(n)} = \frac{\left[(1+i)^n - (1-R_f)\right](1-R_g)}{\left[(1-R_f)(1+i)^n - (1-R_g)\right]}. \tag{11}$$

Equation (11) gives a straight relationship between r_g and r_f. At first glance, both r_g and r_f are only dependent on the base rate and on their respective risks parameter. However, one has to take into consideration that R is a subjective assessment which will normally vary among capital lenders. If more capital is demanded, more capital lenders who are relatively pessimistic and cautious must be persuaded to invest. Therefore, R is not the average but the marginal value of risk assessment, and hence the lower bound of the market interest rate for firm credits increases by public deficit spending.

The figures below give an impression of the relevant relations. *Figure 1* shows the change in the market rates which is caused by a change in (perceived) default risk of firm credit. If the latter were zero, the interest curve would simply be a 45° line through the origin. The underlying numerical assumptions in *Figure 1* are n =1, and R_f= 10% and 15% respectively. Under the constraint that nominal interest rates cannot be negative, the lower interest bounds for market rates will be $r^c_f\,(R_f = 10\%) = 11{,}11\%$ and $r^c_f\,(R_f = 15\%) = 17.65\%$ respectively according to (10).

Figure 1

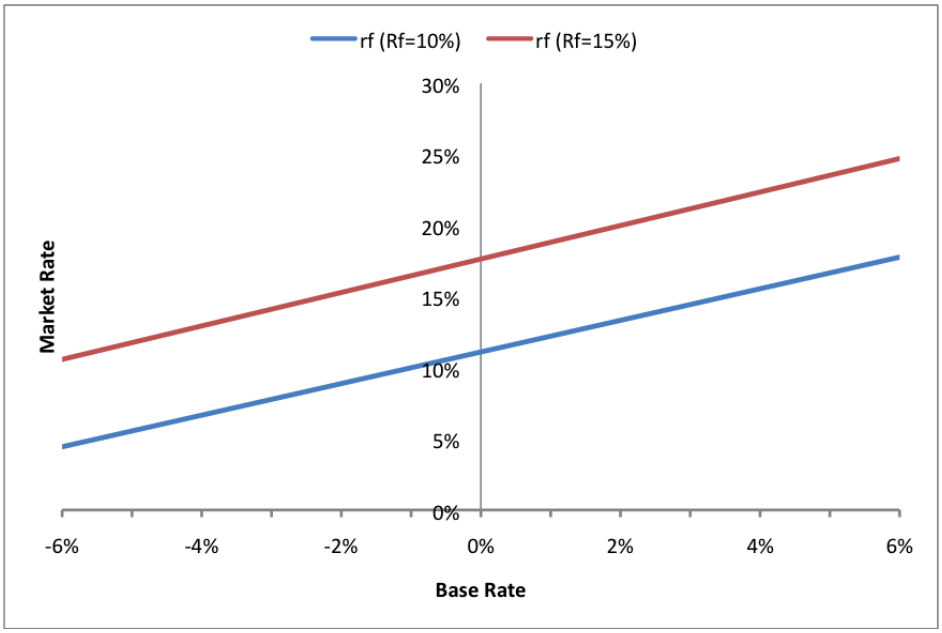
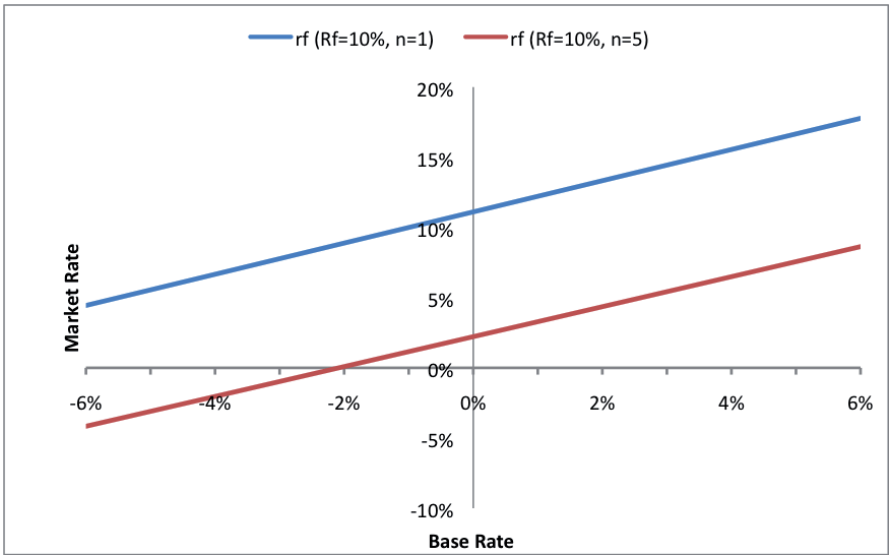


Figure 1 shows the impact of a term extension on the lower interest bound (for the case with R_f= 10%). With n = 5, the latter decreases to $r^c_f(n = 5) = 2.2\%$, which is – in accordance with (10) – only one fifth of the former value, which was $r^c_f(n = 1) = 11.11\%$. Therefore, while the rise of public debt increases the minimum market interest rate, the latter can substantially be lowered by a prolongation of the term for which central bank credits are given at a guaranteed low base rate. In the limiting case of $n \to \infty$, the lower interest bound was even zero irrespective of R_f.

Figure 2



Given the high costs and unforeseeable consequences of changing the existing monetary regime, this kind of anti-cyclical monetary policy promises to be both cheaper and more efficient than conventional government deficit spending. Instead of generating crowding out effects at the capital market, it lowers the interest burden of the real economy and channels liquidity towards where it is most urgently needed, namely to private firms struggling to survive in the recession.

Against this rather simple proposal, various objections may be raised. For example, it might be objected that the banks could simply hoard the cheap money they borrow interest-free from the central bank in the first (critical) period and only start lending it afterwards when perceived risk decreases, thereby circumventing the initial purpose of the measure. Since we assumed that the risk is zero after Period 1, from Period 2 on the money could actually be lent at a very low interest which is just about sufficient to compensate for the zero revenue in Period 1. This does not invoke a real problem, however, because competition on the financial market would eventually make the present value of this strategy zero too, so no disincentive concerning the strategy of immediate lending to firms occurs.

Another objection might point to the fact that default risks differ among firms, so scream skimming could occur by lending the cheap money just to those firms which are least affected by the crisis. Again, however, this is only a pseudo-problem, since in a market economy, adjusting the interest rate to the default risk of a specific firm is one of the key reasons why a financial sector exists. For firms with different risks R_f will simply have to pay different interest rates r_f according to (9) respectively, with all of these lending contracts having in common that their present value for the banks is zero in equilibrium. Nevertheless, all of these firms will benefit from the monetary policy described above by a decrease in the particular interest rate which fits their specific risk. One might also argue that flooding financial markets

with long term liquidity may raise inflation expectations and inflation respectively. Again this is a welcomed side effect. As mentioned afore, probable commitment to a high rate of inflation is considered to be one possible way out of the liquidity trap since a rise in price level sets the same incentives as taxing currency.

Last but not least there is one problem that the above proposed method cannot solve. If the perceived *long term* default risk remains high due to a persistent lack of economic confidence, long term contracts will have no effects on the floor to market rates. In fact, the effectiveness of our scheme hinges on the fact that long term prospects are better than short run expectations. Beyond this, it is also possible that credit demand remains low due to a lack in economic confidence in the private sector. Thus simply increasing the supply of capital will not be enough to restart the economy. In this case, a demand stimulus in combination with good governance and structural change would be appropriate (Ullersma 2002, pp. 290-293).

IV. CONCLUDING REMARKS

Undoubtedly, unconventional monetary policy played an important role in mitigating the effects of the financial crisis and central banks around the world and the FED in particular were determined not to repeat the mistakes of the Great Depression, where the financial system was more or less left alone in order to enforce market discipline (Wheelock 2010, p. 103). Nevertheless, as stated above, many of the measures involve a lack of market discipline and a considerable amount of moral hazard that in the long run may render the system even more risk prone. On the other hand, the more radical proposal of removing the zero bound via negative interest rates, while avoiding many of the above mentioned possible negative side-effects, would require substantial and costly alterations to the existing monetary system. Risk adverse policy makers may not want to commit to a far reaching reform on the limited research available at the moment. Thus, while a theoretically desirable solution, its practical implementation in the near future is at least doubtful.

In this context, we have presented a pragmatic proposal for alleviating the negative effects of the lower zero bound. Our simple model indicates that there is a considerable difference between the zero floor to rates on money borrowed from the central bank and the much higher floor to market rates. Because the lower bound on market rates is simultaneously determined by the risk of default and the central bank's base rate for a given period, an increase in perceived default risk can offset any reduction in base rates. Hence market rates may be substantially above the zero base rate, as it was observable during the current financial turmoil. However, long-term contracts with a very small base rate could well reduce current market rates and therefore increase the flow of capital to the private sector. If default risk is perceived to decrease after the end of crisis, this simple measure can reduce the lower floor of market rates substantially. Although this scheme cannot remove the zero bound, it would give monetary policy a simple and effective method for combating recession within the current monetary regime.

APPENDIX

Proof of equation (10):

$$\lim r_f^c(n;\, i \to 0) = \frac{R_f}{(1 - R_f)n} \tag{12}$$

Equation (12), respectively (10) follows from:

$$\lim S\,(i \to 0) = n. \tag{13}$$

To proof the latter relationship, S needs to be derived:

$$S = 1 + \frac{1}{(1+i)} + \frac{1}{(1+i)^2} + \ldots + \frac{1}{(1+i)^{n-1}}. \tag{14}$$

This finite geometric series will be multiplied by $\frac{1}{1+\ i}$ resulting in,

$$\frac{1}{(1+i)}\,S = \frac{1}{(1+i)} + \frac{1}{(1+i)^2} + \ldots + \frac{1}{(1+i)^{n-1}} + \frac{1}{(1+i)^n} \tag{15}$$

Subtracting equation (14) from (15) generates equation (16),

$$\left(\frac{1}{1+i}\right)S = 1 - \frac{1}{(1+i)^n}, \tag{16}$$

which can be transposed as follows:

$$S \equiv \frac{\frac{1}{(1+i)^n} - 1}{\frac{1}{1+i} - 1}. \tag{17}$$

From equation (14) it can easily be attributed that for $i \to 0$, $S = n$.

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