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Working Paper

Negative nominal interest rates: History and current proposals

CAWM Discussion Paper, No. 43

Provided in Cooperation with:
University of Münster, Münster Center for Economic Policy (MEP)

This Version is available at:
http://hdl.handle.net/10419/51360

Negative Nominal Interest Rates: History and Current Proposals

Cordelius Ilgmann[†] – Martin Menner[‡]

[preliminary and unrevised version]

Abstract:

Given the renewed interest in negative interest rates as a means for overcoming the zero bound on nominal interest rates, this article reviews the history of negative nominal interest rates and gives a brief survey over the current proposals that received popular attention in the wake of the financial crisis of 2007/08. It is demonstrated that 'taxing money' proposals have a long intellectual history and that instead of being the conjecture of a monetary crank, they are a serious policy proposal. In a second step the article points out that, besides the more popular debate on a Gesell tax as a means to remove the zero bound on nominal interest rates, there is a class of neoclassical search-models that advocates a negative tax on money as efficiency enhancing. This strand of the literature has so far been largely ignored by the policy debate on negative interest rates.

Keywords: negative interest rates, history of economic thought, Silvio Gesell, zero bound, search-theoretical models, monetary policy

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Introduction

The current recession is without doubt the most serious economic crisis since the end of World War II, a real 'once-in-a-century event' (IMF, 2009, p. 3). Nearly three years after the onset of the crisis, most central bank base rates are still close to zero, with high although eventually diminishing interest spreads on financial markets. Investment and capacity utilization however have remained far below normal levels in many industrial states. With central banks' base rates approaching zero, conventional monetary policy has run out of option concerning the reduction of market interest rates which is necessary to revive the ailing economy. Being left with no other option, central banks around the world have turned to a combination of quantitative and qualitative easing,[1] policies whose success in reviving the economy have been fairly small, especially in the United States.

Thus, Gregory Mankiw (2009), in an article in the New York Times, reflected on the possibility of negative interest rates as a way to revive lending. The idea might seem absurd at first glance, but, as Mankiw' points out, the same applied to the idea of negative numbers, which were rejected by early mathematicians as impossibility. Indeed, in an internal study, the Federal Reserve Bank specified the ideal interest rate at minus five percent (Guha, 2009) and the Swedish central bank actually cut its deposit rate to minus 0.25% at the height of the crisis (Sveriges Riksbank, 2009). Thus, the financial crisis fired a monetary policy debate that took place mainly in the blogosphere, in parliamentary or congressional evidence or in speeches (see for further references Buiter, 2010, p. 216). As a consequence negative interest rates received popular attention beyond the small group of academics who have worked on the issue since the millennium.

In fact, the (academic) debate on negative interest rates stretches back over more than a century to the late 19th century. Silvio Gesell is widely accredited to be the first proponent of negative nominal interest rates. Gesell's ideas have attracted a small, but convinced group of followers, and he must be regarded as the founding father of a persistent social movement: the *Freiwirtschaftsbewegung* (free-economy movement).[2] And even if his proposal of a negative tax on money was never adopted on a large scale, there were some regional initiatives during the Great Depression.[3] Moreover, in the course of the 20th century, Gesell's idea was taken up by various prominent economists such as Irving Fisher and John Maynard Keynes. Indeed, Fisher was a stout proponent of taxing money ('stamp script') which he saw as

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1 See Buiter (2009) for a suggested distinction between the two.
2 See Bartsch (1994) for the history of the free-economy movement.

a feasible method for reflating the economy of the 1930s, and Keynes endorsed parts of Gesell's theoretical reasoning, calling him a 'strange, unduly neglected prophet' (Keynes 1936, p. 353).

Nonetheless, during the post war era, orthodox authors have paid little attention to the possibility of negative interest rates, and scholars of the history of economic thought have called Gesell a 'typical monetary crank' (Garvy, 1975, p. 392). Recently, however, Japan's experience of persistent deflationary pressure and economic stagnation, instigated a handful of scholars to re-examine Gesell's idea of taxing money as a means of overcoming the zero bound on interest rates. While these authors have made repeated references to Gesell as the first proponent of negative interest rates, they pay little attention to his economic theory. Consequently, this literature examined the benefits of negative interest rates in Walrasian dynamic stochastic general equilibrium (DSGE) models, in which money is not necessary for the efficient allocation of resources.

Hence, in the policy debate, only models where money has no allocative effect and is thus neutral were used to justify the call for negative interest rates. In fact, most of their advocates had overlooked that there is another class of models that considers a tax on money as efficiency enhancing. The common feature of these monetary search models, which build on the seminal work of Kiyotaki and Wright (1991, 1993), is that they set up an environment where money eases bilateral trade by eliminating the need for a double coincidence of wants. Hence, money plays an essential role in the sense that some of the allocations achievable in a monetary equilibrium cannot be achieved in a barter economy, and therefore the use of money increases welfare. Nevertheless, monetary economies can still suffer from several kinds of inefficiencies. In early applications of search-models researchers considered a tax on money as a 'proxy for inflation', and in some examples as a means to overcome inefficiencies in the monetary exchange process. These authors were seemingly unaware of Gesell and the zero bound and did not have in mind negative interest rates as an additional policy tool as in the current debate. Modelling advances made the 'proxy for inflation' role of money taxes obsolete, since the effects of inflation could now be studied directly. Since a tax on money had not been not recognized as a policy instrument itself, its efficiency enhancing role has not been studied further in modern search models.[4]

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4 In a companion paper (Menner, 2010), one of us takes a new hold on the efficiency properties of a tax on money in a last-generation search-model, as well as on its effectiveness to foster output and employment in a recession scenario, and on its role to achieve negative nominal interest rates.

Thus, the aim of this paper is to give a concise review of the various strands of the literature dealing with negative interest rates from past to present. We show that, besides its anarchistic origins, there are two orthodox strands of research that show the potentially beneficial effects of negative interest rates, but have so far been unconnected in the literature. By highlighting the diverse origins of the proposal, we hope to convey the message that negative interest rates are not the 'idée fixe' of a monetary crank, but a serious policy proposal and that the issue should be further examined.

The remainder of this article proceeds as follows. Section two depicts the historical origins of negative interest rates and their reception up until the end of the 20th century. Section three reviews the existing literature on the negative interest rates as a means for removing the zero bound. Section four elaborates on the so far overlooked efficiency enhancing property of negative interest rates in monetary search-models and connects the two existing modern strands of the literature. The last section examines the practical implications of taxing money and concludes.

Silvio Gesell and free money

It is commonly recognized that the idea of a tax on money was first proposed by Silivo Gesell, a successful businessman, autodidactic economist, and prominent social reformer. He proposed a libertarian economic theory and political economy that aimed at creating a truly competitive market that would ensure the just distribution of income. Thus, he strongly refuted the Marxist economic theory and their proposed solution of collective property as 'the death of personal freedom' (Gesell, 1958, p. 15), embracing the 'Manchester System' as the natural economic order he aimed to create, in which everyone would be remunerated with the full proceeds of his own labour (Gesell, 1958, pp. 11-12). Gesell's followers claim that he laid the foundations of a libertarian anarchist economic theory, which went beyond Marx's call for collective property (Bartsch, 1989, pp. 29-31), and constitutes an independent 'third way' (Flik, 2004, p. 124) for reconciling socialism with economic and personal freedom, 'an alternative beyond hitherto realized economic systems' (Onken, 2000, p. 614). In addition, Gesell developed a rather colourful social utopia which combined Darwinian elements with the philosophies of Nietzsche and Stirner.[5] This mingling of economic theory, political ideas and social utopia made his reputation as an 'anarchist prince' (Preparata, 2002, p. 218).

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5 For a concise introduction to Gesell's utopia of an 'akratic' society see Bartsch (1989, pp. 24-31).

Gesell begun his autodidactic reflections on the monetary system instigated by the on-going economic and social crisis in 19th century Argentina, where he had opened his own business after his emigration in 1887.[6] In his debut treatise, *Die Reformation im Münzwesen als Brücke zum Sozialen Staat*, Gesell (1891, pp. 51-55) presents his main concept of negative interest rates on ready money, which he later named *Freigeld* (free money). Concerning the practical implementation of negative interest rates, Gesell advocated that in order to remain legal tender, a stamp worth a thousandth of the note's face value had to be attached to it once a week, amounting to an annual depreciation rate of approximately 5 % (Gesell, 1958, pp. 266-276). It is this proposal of taxing money that is commonly referred to by authors working on the subject as Gesell's main contribution to economic theory.

However, Gesell not only invented the instrument, in his main work, *The Natural Economic Order* (Gesell, 1958), he also offers an economic theory that justifies and explains his call for taxing money. In fact, some scholars of the history of economic thought have argued that Gesell importance for economic thinking is not to be found in his invention of the policy instrument, but rather in his radical theory of interest which appears as a direct predecessor to Keynes's deliberations on interest as a monetary phenomenon. In his doctoral dissertation in 1940 and two subsequent articles in 1942, Dudley Dillard was the first economist to demonstrate the close kinship between the monetary theories of the famous French anarchist Proudhon, Gesell, and Keynes,[7] and this conclusion was independently upheld by various other authors working on the subject.[8] The striking theoretical similarities are further evidence in support of the Post Keynesian claim that the *General Theory*'s main theoretical innovation – a monetary theory of interest – has been completely ignored by mainstream economists (Ilgmann, 2009).[9]

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6 See Werner (1990) and Onken (1999) for overviews on Silvio Gesell' life and work. Ilgmann (2009) offers a short discussion on Gesell's place in the History of Thought.

7 Dullard established striking theoretical similarities between Keynes, Gesell and the Proudhon (Dillard, 1942b, pp. 75-76), with Gesell 'primarily interesting as the link between the other two' (Dillard, [1940] 1997, p. 6). In a further article on Keynes' political economy, Dillard (1946, p. 149) argued that 'Keynes' judgement of the relative merits of Marx and Gesell, [...], would seem to reveal much more about Keynes than it does about either Marx or Gesell' and in his book on Keynes, Dillard (1948, pp. 322-323) maintained that studying Gesell indeed furthers the understanding of Keynes's theoretical innovations.

8 See also Michael Herland (1977) and Jérôme Blanc (1998; 2002). The most radical view is put forward by Guido Preparata (2002) who accuses Keynes of plagiarism of Gesell's idea of a monetary rate of interest. Darity (1995) comments on the similarities in their political economy.

9 This interpretation of the General Theory is suggested in Ilgmann (2009) and is akin with the Post Keynesian interpretation. It is supported by various statements made in defense of the General Theory, e. g. Keynes (1937a, p. 216): 'The rate of interest obviously measures [...] the premium which has to be offered to induce people to hold their wealth in some other form than hoarded money.' He also defended his view in an article in The Economic Journal where he stated '[...] the rate of interest is that rate at which the demand and supply of liquid resources are balanced. Saving does not come into the picture at all (Keynes, 1937b, p. 668). Keynes (& Robertson, 1938, pp. 318-319): 'Now that we have got away from the idea of the rate of interest being depended on saving and have reached

A complete analysis of Gesell's theory is beyond the scope of this article; nevertheless because Gesell's economic theory has rarely been discussed in the literature, in the following we will attempt a brief sketch of his reasoning.[10] Gesell's starting point is that holding money does not involve carrying charges. Goods on the other hand are subject to natural decay and thus holding them incurs considerable costs. Therefore, money holders may withhold their money from circulation while those possessing goods, producers and merchants, cannot. Gesell now assumes that this difference in the quality between money and goods leads to strategic behaviour on the part of the money holders. They might withhold from buying, thus leaving the suppliers of goods with the losses caused by natural decay. Therefore the latter are willing to pay a 'bribe' (in Gesell's terminology) to the money holders in order to avoid the depreciation on their goods and products. This is the source of 'basic' interested, unearned income due to the different physical properties of money and goods.[11] This is the kernel of his theory: interest as a pure monetary phenomenon due to its negligible carrying charges.

Moreover, this micro analysis holds serious implications for Gesell's macro model, which is founded on the Quantity Theory. According to Gesell, production, which is constant in the short run, determines aggregate supply, while the amount of money divided by the price level times velocity of circulation constitutes aggregate demand. Thus, supply is given by exogenous, in the short run constant factors, while the velocity of circulation depends on the strategic behaviour of the money holders. They will only bring their money into circulation if they receive a profit margin – basic interest. Therefore, while aggregate supply is determined by the stock of goods, aggregate demand is subject to fluctuations and may therefore differ from supply. Gesell thus rejects Say's law that each supply creates its own demand (see also Dillard, [1940] 1997, p. 161). Consequently, in Gesell's model, aggregate supply and demand are only in equilibrium, if the supply side is able to generate a profit margin above the production costs that allows them to pay basic interest.

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the idea of its being in some sense a monetary phenomenon, the remaining difference of opinion cannot be fundamental and agreement should be within reach.' Several Post Keynesian authors have underlined their interpretation of Keynes by referring to Keynes' praise for Gesell. See, for example, Argitis (2008, pp. 251-253), Davidson (2000, p. 49), and Cowen and Krozner (1994, pp. 387-388).

10 The following paragraph draws on the interpretation of Gesell and Keynes' embracing comments as suggested by Ilgmann (2009).

11 Gesell assumed that 'basic' interest had been between four and five percent throughout the ages, denying that the competition between money lenders would drive the rate of interest down. The only limits to the monetary determined rate of interest were the amount of money that needed to circulate for the essential needs of everyday life, such as food, as well the competition of barter once money interest rates become prohibitively high. It must be noted, however, that Gesell acknowledged that interest rates contain risk and inflation premiums (Gesell, 1958, pp. 431-436), but he maintained that these would only be slightly above zero after the introduction of negative interest rates. Risk premium, understood as the marginal costs of lending, will be low, because most savers will invest their money in life insurance, which, in turn, will invest in real assets that act as securities (Gesell, 1958, pp. 407-408).

This reasoning of Gesell is somewhat confusing to a modern economist. Basically, he assumes that basic interest is added to the production costs of a product, which corresponds to the cost of capital in modern accounting. However, he argues that real capital only offers a positive yield because it is scarce and it is kept scare because of the existence of basic interest. Because the productivity of real capital must equal at the margin the monetary rate of interest, the capital stock, which would normally expand until the marginal efficiency of real capital would become zero, falls always short of demand because any growth that would push down capital's marginal efficiency below the monetarily determined basic rate is impossible. This inclusion of capital costs in the production costs of goods is what he assumes to be the 'transfer of basic interest to the wares' (Gesell, 1958, pp. 387-389).

Based on these insights, Gesell explained the occurrence of economic crises.[12] Effective demand as determined by money supply is only available in the absence of deflation and deflationary expectations respectively.[13] As the capital stock, including the amount of commodities, rises, prices begin to fall, lowering marginal capital productivity and, because deflation raises the real interest earned on money, while lowering it on real capital assets, disinvestment takes place, reducing general output. Moreover, in such a situation people will find it increasingly difficult to service their liabilities. This notion is nothing less than a description of a deflationary spiral in the spirit of Irving Fisher, in which, once deflation sets in, effective demand decreases, which in turn further depresses prices. If the monetary authorities now increase the amount of money in order to increase demand and to offset deflation, the additional money will simply be hoarded.[14] The system will only be restored to equilibrium when capital endowment and hence output have fallen to such an extent that the marginal productivity of capital equals once again basic interest.

Given this analysis, Gesell's cure for economic crises is therefore to subject money to natural decay via taxation, thereby restoring the validity of the Quantity Theory and Say's Law. With depreciative fiat currency, money involves carrying charges, and those possessing it are no longer able to hoard, which in turn would render the velocity of circulation and effective demand constant. This enables the authorities to ensure price stability by steering the amount

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12 As (Dillard, [1940] 1997, p. 171) pointed out, Gesell 'offers no separate theory of crisis'. Rather, he explains disequilibria through the nature of interest.

13 'When confidence exists, there is money in the market; when confidence is wanting, money withdraws – such is the teaching of experience' (Gesell, 1958, p. 260).

14 'Supply therefore becomes larger and more urgent, because demand hesitates, and demand hesitates simply because supply is too large in proportion to demand' (Gesell, 1958, p. 232). 'This therefore, is the law of demand, that it disappears when it becomes insufficient' (Gesell, 1958, p. 235 [bold type in the original]).

of money in circulation by means of an independent monetary policy[15]. In addition, interest and the power of the rentier would disappear while the capital stock would expand until its marginal efficiency is zero, raising output and employment. This is – in a nutshell – the essence of Gesell economic theory, which constitutes the foundation of an independent anarchist economic theory (Bartsch, 1989, pp. 20-30).

Given the seemingly simple solution offered by Gesell, it is no wonder that his proposal of taxing money has received recognition mainly in times of crisis, probably most prominently during the interwar period,[16] when Gesell briefly became the Minister of Finance in the Bavarian Soviet Republic. During the same period, his policy proposal and theoretical reasoning was also taken up by Irving Fischer (1933) and J. M. Keynes (1936). Fisher on the one hand promoted negative interest rates in his book on stamp scrip, but remained overly sceptical of Gesell's theory: 'There is much in Gesell's philosophy to which, as an economist, I cannot subscribe, **especially his theory of interest**; but Stamp Scrip, I believe, can, in the present emergency, be made at least as useful an invention as Manuel Garcia's [a singer] laryngoscope' (Fisher, 1933, pp. 17 [our emphasis]).

During the Great Depression, Fisher was labelled 'the patron saint of the stamp scrip movement' in the United States by one commentator (Reeve, 1943, 165) and his assistant, Hans R. L. Cohrssen, a committed free-economist, counted approximately 450 U.S. municipalities that wanted to issue stamp script. Moreover, in 1932 there was a short-lived legislative initiative (Bankhead-Pettengill Bill) which asked for the creation of one billion Dollars of stamp script in order to finance labour intensive public works. For the same reason, the state of Oregon planned to issue 80 million Dollars in stamp script in 1933, but the plan was stopped by the Treasury, who was willing to accept stamp script on a local level, but did not endorse general monetary reform (Cohrssen, 1991, p. 5; see also Gatch, 2006, p. 19). Moreover, most local currencies were designed as 'self-liquidating', meaning that a note was meant to circulate until it accumulated sufficient stamps to redeem the note at face value against dollars. Therefore, the bills were stamped per transaction and not per period of time, as Gesell and Fisher had suggested which amounted to an additional sales tax. Worse, in order to increase its acceptance, sponsors of the plan pledged to deposit an equivalent amount of

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15 Gesell's matter of concern was the achievement of price stability in an environment where money keeps circulating steadily and interest rates are low. His periodic tax on money was meant to disincentivate the hoarding of money without recurring to high interest rates or positive inflation rates. Therefore, it is not comprehensible that Gesell was labelled an 'inflationist' by Ludwig von Mises (1952), F.A. Hayek (1976) and other Austrian economists.
16 Gesell was comparatively well-known pre-World War II, as is shown by Dillard's (1942a, p. 348) list of works referring to Gesell and by his appearance in the Encyclopedia of the Social Sciences (Garvy, 1975, p. 392).

Dollars in escrow in order to ensure redemption, a measure practically nullifying the inflating effect of the additional currency. Thus, the majority of local currencies during the Great Depression neither served Fisher's or Gesell's goals, as only a handful of municipalities introduced time based script (Gatch, 2006, pp. 27-29; see also Warner, 2010)

Keynes (1936, p. 353) on the other hand praised Gesell's 'flashes of deep insight' because he defined interest as 'being in some sense a monetary phenomenon' Keynes (& Robertson, 1938, pp. 318-319) caused by money's superior liquidity premium, but dismissed negative interest as 'not feasible in the form in which he [Gesell] proposed it' (Keynes, 1936, pp. 356-357). Followers of Gesell have typically taken this as an implicit acceptance of the latter theoretical stance and tend to ignore that Keynes (1936, p. 356) also stated that 'there is a great defect in Gesell's theory' because 'the notion of liquidity-preference had escaped him'. Indeed, Keynes called Gesell's theory only 'half a theory of interest' (Keynes, 1936, p. 356) because in his opinion Gesell failed to understand the role of uncertainty in determining liquidity preference and hence the rate of interest. Nevertheless, these embracing remarks shed new light on the extent of Keynes' attack on the classics, which he accused of having failed to develop an adequate theory of interest.[17] Keynes thus did not embrace negative interest as such, but the underlying idea of interest as a monetary phenomenon (Ilgmann, 2009). Indeed, Pigou (1936, p. 124) saw the implication of Keynes appraisal of Gesell clearly: 'For example, on p. 355, he seems to agree with Gesell that "the rate of interest is a purely monetary phenomenon." If this were in fact his view, Mr. Keynes' divorce from classical thought would be complete.'

Summing up the afore said, Gesell theory rest entirely on the different carrying charges of money and goods and from today's perspective appears rather naive. It seems rather unlikely that taxing money would cure the ills of modern day capitalism as his supporters claim. Nevertheless, in retrospect Gesell has remarkable achievements as an autodidactic scholar. He advocated modern fiat money, even before World War One, at a time when the 'golden fetters' were firmly in place and his idea of price stability as the sole target of monetary policy is not far away from what most central banks nowadays strive for (Huth 2005). Moreover, he advanced the notion of interest as a purely monetary phenomenon even before Keynes, a remarkable deed that is often obscured by the fact that the extent of Keynes' attack on his 'fellow economists' has largely been underestimated. Finally, as Irving Fisher said, he invented

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17 'Now I range myself with the heretics. I believe their flair and their instinct move them towards the right conclusion. [….] There is, I am convinced, a fatal flaw in that part of orthodox reasoning […] due to the failure of the classical doctrine to develop a satisfactory and realistic theory of interest' (Keynes, 1935, p. 36).

an instrument, albeit by accident, that could prove to be a valuable additional monetary policy tool.

Removing the zero bound

Whatever the merits of Gesell as economist are, during the period of relative stability following the Second World War, his idea of negative nominal interest rates was quickly forgotten. Interest in Gesell's proposal was only renewed through the Japanese experience when the country faced a liquidity trap like situation during the 1990s, which rendered monetary policy useless in fighting deflation and recession.[18] For this to happen, the existence of a lower (zero)[19] bound is a necessary condition (Ewans, Guse & Honkapohja, 2007, p. 1438) and since then, the implications of the zero bound and possible remedies were discussed yet again (see Buiter, 2005b, Yates, 2004, and Ullersma, 2002, for reviews on the relevant literature). However, before the outbreak of the financial crisis, the case of Japan remained somewhat a curiosum since the majority of developed countries enjoyed a period of stable growth in the last twenty years,[20] and previous to the current crisis, the risk of hitting the zero floor to rates was considered to be very small, with the case of Japan being looked at as a rare exception (Yates, 2004, p. 428; Ullersma, 2002, p. 293).[21]

Thus, it is safe to say the zero lower bound was considered a 'ghost' from the past (Buiter, 2005b) in mainstream economics, in particular in the light of high inflation rates in the 1970s and 1980s (Ullersma, 2002, pp. 273-277). Some authors nevertheless took up Gesell's proposal of a tax on money as a means of overcoming the zero bound on interest rates, as for example, in Goodfriend (2000), Buiter and Panigirtzoglou (1999; 2003), Fukao (2005) and Buiter (2005a,b; 2007; 2010). It was only the current crisis with central bank rates close to zero and

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18 Krugman (1998), in his seminal work, argued that Japan faced a liquidity trap like situation at that time. We use the term in the sense of Krugman (1998, p. 137), who defines it as 'that awkward condition in which monetary policy loses its grip because the nominal interest rate is essentially zero, in which the quantity of money becomes irrelevant because money and bonds are essentially perfect substitutes'. A deflationary spiral is described as a situation, 'where inflation and expected inflation fall, nominal interest rates at some point come up against the zero bound, real interest rates rise, aggregate demand and expected inflation fall even further, real rates rise by yet more, and so on' (Yates, 2004, p. 427).
19 Benhabib et al. (2000b, pp. 26-27) have rightfully pointed out that for a liquidity trap to persist, the existence of some lower bound is a sufficient condition, given that the central bank conducts a Taylor-type monetary policy.
20 'One of the most striking features of the economic landscape over the past twenty years or so has been a substantial decline in macroeconomic volatility. [....] Similar declines in the volatility of output and inflation occurred at about the same time in other major industrial countries, with the recent exception of Japan, a country that has faced a distinctive set of economic problems in the past decade' (Bernanke, 2004).
21 Some authors even questioned whether liquidity traps had developed at all during the Great Depression (Bordo & Filardo, 2005, p. 817), although the latter is widely held as the textbook case (Ullersma, 2002, p. 276).

stagnating growth rates in many (western) economies which raised the awareness of a wider audience for the possibility of negative interest rates.[22]

The problem

The zero bound argument refers to the implicit zero interest on coin and currency as a risk free instrument which forms the larger part of the monetary base, the remainder being commercial bank reserves with the central bank. Since base money constitutes the most liquid form of assets, a rational economic agent will not hold any other type of asset unless it earns a higher return than base money (Buiter and Panigirtzoglou, 2003, p. 727). As long as the two components of the monetary base are perfect substitutes concerning the provision of liquidity, any deviation of their interest rates would cause the demand for the other to become infinite. Thus, any attempt to levy negative interest rates must necessarily involve the whole monetary base.

The zero bound exists because coins and currencies are bearer instruments as opposed to registered instruments such as bank accounts (Buiter, 2010, p. 214). In fact, levying a tax on commercial bank reserves and any form of registered account in order to make implicit interest on these assets negative would be as trivial as collecting positive interest (Buiter & Panigirtzoglou, 2003, p. 730). However, this cannot be done with coins and bank notes, because these are anonymous bearer bonds and their transfer is not registered but by delivery. Inducing the anonymous holders of coins and bills to pay the interest due is rather difficult since they lack the incentive to do so. Given the existence of coin and 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. This in turn sets a floor to market rates at the zero nominal interest rates of coin and currency. However, in reality this floor to market rates is a lot higher since the latter contain risk premium and administrative costs.[23] Once base rates are close to zero, conventional monetary policy is ineffective for reducing market interest rates any further. If one seeks to fully remove the zero bound, levying negative interest rates on the whole monetary base becomes inevitable, and because bank notes are

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22 At the time of writing (October 2010) the Federal Funds target rate is still between 0 and 0.25 per cent, the Bank of Japans target rate is at 0.1 per cent, the Bank of England's Rate is 0.5 per cent and the ECB main refinancing operation is 1 per cent.

23 van Suntum et al. (2010) propose long-term central bank lending as way for reducing the floor to market rates against zero.

bearer bonds with anonymous owners, paying the interest due would have to take place on the bills themselves.

The Proposals

Scholars have come up with various schemes for removing the zero bound via negative interest rates. Buiter (2010) proposes three different methods for removing the zero bound. One very interesting proposal is separating the means of payment function of currency and its unit of account role, was already suggested by Einaudi (1953) and Gaitskell (1969). Buiter (2005a) refers to Eisler (1932), who 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. Eisler himself was rather not concerned about the implications of the zero bound, but his motivation was to shield the economy 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; 2010).

According to Buiter's (2005a; 2010) scheme, the existing currency is withdrawn and replaced by a new government-issued currency. 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 a different unit of account. Since there are no coins or notes of the currency that serves as the unit of account, the monetary authorities may set a negative rate of interest on all registered accounts in the manner described above. In order to avoid a flight into the legal tender, it is constantly depreciated against the currency which serves as a unit of account. Covered interest parity demands that the rate of depreciation of the legal tender must equal the negative interest rate on the unit of account (Buiter, 2010, p. 230). Thus, the whole monetary base is subject to negative interest rates, although the nominal interest rates on coins and bank notes respectively remain zero. Indeed, Eisler-like schemes have been adopted in Latin America to fight inflation, most notably in Chile, but so far have not been used as a method for removing the zero bound.

Nonetheless, the most commonly thought method for removing the zero bound is taxing money. To begin with, the easiest way to implement such a scheme was to abolish coin and bank notes altogether. Buiter (2010, pp. 222-226) considers coins and bank notes to be redundant media of exchange, the larger part of it being held abroad for legitimate (store of value in countries with high inflation rates) and illegitimate (underground economy) reasons. In developed countries, its function of providing liquidity could easily be satisfied by bank

accounts. Roughly half of Dollar and Euro notes are held abroad and of the remainder only a small fraction is held for transaction purposes.[24] As stated above, without coins and currency, levying the tax on all non-bearer bonds is technically simple. . . If coins and currency are completely replaced by electronic transfers via registered accounts, in theory there is no limit to the domain over which the rate of interest can be set. In addition, there would be the additional advantage of hitting the underground economy as the absence of anonymous bearer bonds would make all economic transactions traceable.

Although abolishing coins and currency offers a seemingly simple solution to the zero bound and Buiter's argument about the redundancy of coins and notes is not easily refuted, there are various problems associated with this scheme. Buiter (2010, pp. 223-224) states the usefulness of currency as a means for payment and store of value for low-income households is a standard argument for keeping coins and currency. However, given that the majority of currency by value is held in large denominations which are hardly used for transaction purposes, he believes that the real reason behind the continued existence is the substantial seigniorage through the issuance of non-interest bearing and non-redeemable legal tender. We believe that there are more good reasons for keeping coins and currency. First, having a redundant system of payment besides complex electronic devices might be an additional backup in case that the sophisticated electronic system fails. Indeed, blackouts and computer bugs have in the past disturbed electronic payment systems and with cyber warfare becoming increasingly sophisticated, having a redundant medium of exchange might even become a question of national security. Second, with all transactions being done by registered accounts, all economic activity of the population becomes traceable. While this has potential benefits concerning the fight on crime, it will also raise the question of potential abuse and hence of adequate data protection. Finally, there is also a psychological factor, because people might not accept non-physical money, in particular in times of a crisis.

Thus, if one wishes to keep coins and currency as media of exchange, negative interest rates could never exceed the (storage) carrying charges of ready money; otherwise the demand for the latter would become indefinite. In the case of a sharp deflation, it might be insufficient to lower real interest only by the margin given by the carrying costs (Buiter, 2005b, p. 14). Therefore, if one seeks to fully remove the zero bound, taxing non-electronic money is inevitable. Because bank notes are bearer bonds with anonymous owners, taxing would have to take place on the bills themselves (Goodfriend, 2000, p. 1015, deems taxing coins to be

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24 Buiter (2010, p. 223) concludes therefore that 'the only domestic beneficiaries from the existence of anonymity-providing currency are the underground economy'.

unnecessary, since storing great quantities of small change would incur high costs). As we discussed above, Gesell advocated stamping ready money as a practical means of removing the zero bound. With modern technology, using stamps could be replaced by electronic devices (Goodfriend, 2000, pp. 1016-1017). With both components of the monetary base subject to this tax, simple arbitrage would ensure that all other components of the money supply will also yield negative nominal interest.

Model based evaluation

The modern treatment of negative nominal interest rates has not made halt at the verbal analysis of the zero bound problem and proposals how to overcome it, but constructed technical models to assess the effectiveness of negative interest rates to escape from liquidity traps. Buiter and Panigirtzoglou (1999) build a continuous time representative agent model where money is held despite of the existence of riskless bonds with positive yields because money holdings generate direct utility. They consider two versions: In the flexible price version of this Money-in-the-Utility-Function (MIU) model the Pareto-efficient monetary policy is the so-called Friedman rule where agents are satiated with money and the interest rate on bonds equals the interest on currency, $i=i_M$. In the absence of policy measures to overcome the zero-bound on nominal interest rates this interest rate of currency, i_M, is zero, the Pareto-efficient equilibrium coincides with the liquidity trap equilibrium. The only problem with the liquidity trap is that the lower bound on interest rates might prevent the economy to achieve the inflation target. By setting the interest rate on currency sufficiently negative, however, any inflation target can be achieved.

The more interesting case is the Keynesian version, where output is demand-determined and inflation adjusts to the gap between actual and potential output through an accelerationist Phillips curve. The dynamics of the economic system are determined by a system of 2 first-order differential equation in inflation and consumption, the latter one switching when the interest rate reaches its lower bound. The 2-dimensional phase diagram shows a saddle-point stable steady-state in the non-binding "normal" case ($i > i_M$) and a centre surrounded by closed integral curves in the binding "liquidity trap" case ($i=i_M$). The authors then show that there exists demand or supply shocks that can lead the economy from the "normal" saddle-point steady state to the liquidity trap equilibrium. A negative interest rate on currency shifts the liquidity trap steady state and the boundary between the two regimes to the left such that an economy caught in the liquidity trap can escape to the normal regime with sufficiently negative interest rates on currency. Moreover, since negative interest rates on

currency widen the distance between the two steady states the likelihood to end up in a liquidity trap is reduced as well.

These findings are upheld by Buiter and Panigirtzoglou (2003) and Buiter (2010) in New-Keynesian discrete time MIU models with price setting a la Calvo-Woodford (Calvo, 1983; Woodford, 2003) and forward looking Phillips-Curves. Buiter and Panigirtzoglou (2003) study the effects of a Gesell tax in the model of Benhabib et al. (2001). In that framework the lower bound on nominal interest rates becomes binding under sufficiently large negative shocks and the economy enters a liquidity trap and can end in a deflationary spiral. Buiter and Panigirtzoglou (2003) then show that the liquidity trap region can be completely eliminated by setting the Gesell tax such that the interest rate on currency i_M keeps a constant distance d to the short-term interest rate i on non-monetary assets, that means $i_M = i - d$, where $d \geq 0$, and i is determined by the Taylor rule. They also note that setting d to zero would correspond to the Friedman rule, that aims at eliminating the opportunity cost of holding money, and that this policy would still eliminate the liquidity trap. The same holds true in the model of Buiter (2010), where the author stresses that a Gesell tax would allow the authorities to target true price stability (zero inflation) without fear of hitting the lower bound on interest rates.

The common feature of these model based studies of the Gesell tax and negative interest rates is the focus on overcoming the zero bound and the corresponding liquidity trap and – apart from the ad-hoc model of Buiter and Panigirtzoglou (1999) - the use of Walrasian DSGE models. However, in all of these models, money has no essential role and is held only because it enters the utility function directly. Hence, these studies do not address important issues like the effects of Gesell taxes on efficiency of exchange or on the velocity of money. Moreover, as has been stated by Wallace (1998) the Friedman rule is efficient in all models where money is not essential, but there exist many models where money is essential and the Friedman rule ceases to be optimal. .This leads us to con-sider the efficiency effects of Gesell taxes in a model class with essential money in more detail.

Efficiency of monetary exchange

Independently of Gesell's ideas and the debate on the zero bound, a tax on money appeared in the literature on search-theoretic models of money. First, it was meant to be a proxy for inflation in first-generation search models that could not study the effects of money growth and inflation directly. Second, it was found that there was an efficiency enhancing role of these money taxes in models where the endogenous choice of search-intensity leads to an

inefficient size of the 'market' due to externalities in the search for trading partners. When modelling advancements made the proxy role of money taxes obsolete, since inflation could now be studied directly, the efficiency enhancing role was attributed only to inflation, and the policy tool money taxes was not recognized as such. Since the reader is probably not very familiar with the search-theoretic literature[25], we expose in the following the main deviations from the Walrasian paradigm and review the discussions and results with respect to taxes on money in the different generations of search models.

Monetary search models starting with Kiyotaki and Wright (1989, 1993) replace the centralized Walrasian goods market by decentralized bilateral exchange of differentiated goods among agents with heterogeneous tastes over these goods. In this environment money can ease bilateral trade by overcoming the problem of an `absence of double coincidence of wants'. Without money, the producer of say good A that likes good B would have to find a producer of good B that likes good A – a difficult task when there is a large number of different goods in the economy. A money holder, on the contrary, has just to search for a producer of the desired good that accepts money. The latter will only do so if he expects others to accept money in the future (in exchange for their products). Thus, if money is accepted across economy as the medium exchange, the resulting monetary equilibrium is characterized by a higher amount of transactions. Hence, money plays an essential role in the sense that some of the allocations achievable in a monetary equilibrium cannot be achieved in an equilibrium without money.[26] In terms of efficiency monetary equilibria improve on barter equilibria.

The literature distinguishes now three generations of search models of money, each of them dealing in a different way with the high degree of heterogeneity of agents that arises through the pairwise exchange of goods which is generating non-degenerate distributions of goods inventories and money holdings.[27] The early search literature assumed indivisible money and indivisible goods such that an agent could hold only 1 unit of money or 1 unit of goods and trade took place at a constant price 1. This simplified the analysis since the distribution of money was degenerate, each agent carrying either 0 or 1 units of money. A second generation of models based on Shi (1995) and Trejos and Wright (1995) kept the simplifying assumption of

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25 See for example Rupert et al. (2000, chapter 4) and Shi (2006) for an extensive overview over the literature based on the search-theoretic approach.

26 Kocherlakota (1998) establishes that necessary conditions for the essentiality of money are the lack of complete memory and of full commitment to future actions. The latter follows from the usual assumption of random-matching and rules out the use of credit, while the former inhibits the use of punishments to trigger gift-giving equilibria. See also Corbae, et.al. (2002) for models with directed search where money remains essential as long as agents are restricted to one bilateral trade per period.

27 The use of simulation methods to keep track of these distributions is very cumbersome. See Molico (2006) and Molico and Zhang (2006).

indivisible money holdings, but endogenized prices by allowing for divisible quantities of goods. Prices are determined in each match through Nash-Bargaining over the quantity of goods to be exchanged for one unit of money. Third generation search models abolish the restrictive assumption of indivisible money and allow therefore to study directly positive money growth and inflation. There are basically two competing approaches: the first one to appear was the representative agent formulation in Shi (1997, 1998, 1999), who assumes that the decision making unit - the household - is itself a continuum of agents and, hence, idiosyncratic risk is fully insured. In a symmetric equilibrium each household ends up with the same money and inventory holdings, capital stock and the same number of hired workers as the average firm. The alternative approach elaborates on models of alternating decentralized and centralized markets following Lagos and Wright (2005) and Arouba et al. (2006).

An interesting feature of these search models is that the exchange process can be inefficiently low because of too little search effort of buyers. In the following we review the literature on the effects of a tax on money on search-intensity or the number of buyers in the market and hence on aggregate transactions, consumption and output in first and second generation search models. Finally, we summarize the results of a recent study of the macro-economic effects of money taxes in a full-fledged business cycle model with capital formation.

First generation search models with endogenous search intensity

Li (1995) was the first to point out the externalities that can arise with endogenous search effort of buyers: Since search is costly, buyers compare their search costs with the private gains from search, rather than considering the social gains and costs of a higher search intensity. In sufficiently productive economies, there is a search externality that leads to a lower aggregate number of transactions relative to the social optimum. The author then proposes a tax on money to deal with this inefficiency. The welfare improving role for policies which tax money balances 'emanates directly from the ability of such policies to increase search efforts and the aggregate rate of transactions. That is, the search externality provides a role for government in subsidizing search activity through taxing 'nonsearch'', (Li (1995, p. 938)). This resembles Gesell's idea of taxing the hoarding of money to provide incentives for the spending or lending of money balances.[28] Li (1995) derives the welfare improving role of taxing money holdings in a first generation search model of money where goods and money

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28 Most monetary search models deal only with the spending aspect and do not treat the possibility of lending idle balances.

balances are indivisible.[29] The tax on money is modelled as a random expropriation of a unit of money.[30] It is then also interpreted as a 'proxy for inflation', which is generally thought to have the same consequences as the money tax in this model: increase in the cost of holding money, crowding out of real commodities through seigniorage revenue and reduction of real money balances. Finally, the author conjectures the optimality of inflation in more general models that would allow for positive money growth rates. In a follow-up paper Li (1996) examines the efficiency properties of money taxes in an extension of the model that allows for the storage of unsold goods inventories and finds similar results.

Second Generation Search Models with Bargaining over Prices

The modelling advance through the introduction of bargaining over quantities allowed researchers to study prices, but since it was still impossible to study positive money growth in these models issues like inflation and money taxes did not play a role. A recent exception is the treatment of a second generation search model in the paper of Liu, Wang and Wright (2008) that reviews in a similar way as the present chapter the first and second generation search models, but with respect to the effect of inflation on search-intensity.[31] Since the model with bargaining has either no monetary equilibrium or generically a pair of equilibria – one with low prices and another with high prices – the result that money taxes can increase search-intensity, velocity and sales depends on the type of the equilibrium and on parameter values. One can still find efficiency increasing effects of money taxes in some but not in all equilibria. Notably, in their treatment there is no mentioning of the tax on money as a policy proposal on its own or to engineer negative interest rates. Instead, they discuss money taxes only as a proxy for inflation.

Third Generation Search Models with divisible money

When extending their analysis to a third generation search model in the tradition of Lagos and Wright (2005), Liu et al. (2008) focus only on the effects of inflation, since their environment now allows to study positive money growth rates directly. Therefore, it is no exaggeration to claim that the two different literatures on money taxes – (1) as a proxy for inflation and a means to overcome inefficiencies in the monetary exchange process and (2) the Gesell tax proposal to remove the zero bound to nominal interest rates – have been totally unconnected up to the present. A study on the effects of money taxes in a theoretical model in

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29 See also Liu et al. (2008) as an excellent formal treatment of money taxes in the first generation model of Li (1995).

30 Note the resemblance to the proposal of Mankiw (2009) to induce a carrying cost on notes through the withdrawal of all notes of a special series or denomination.

31 Moreover, Liu et. al (2008) provide also a formal treatment of money taxes in a second generation search model.

the spirit of Lagos and Wright (2005) has still to be undertaken.[32] Menner (2010) studies the long-run and short-run effects of a Gesell tax in a full-fledged monetary business cycle model with capital accumulation that builds on Shi (1998) and was developed in Menner (2006).

Menner's (2010) long-run analysis characterizes the dependence of the steady states of various macroeconomic variables on the combination of money growth rates and Gesell taxes. The main finding is, first, that at moderate levels of inflation, a Gesell tax can increase the steady state levels output and capital and has positive effects on search-intensity, consumption, investment and employment. Second, a monetary equilibrium with negative interest rates can only be achieved by a positive Gesell Tax. Third, the Friedman rule, i.e. that money growth rates should equal the discount factor, is feasible in the considered model only if accompanied by a Gesell tax, which has to be quite heavy to achieve efficiency.

With respect to the short-run analysis, the focus is on the recovery path out of a recession under different policy scenarios. The recession is modelled as a sequence of negative shocks to time preference and investment efficiency that lower aggregate demand considerably, and hence leads to drops in output and employment comparable to the last "great recession" period in the US. The baseline scenario without policy intervention is then compared to 3 different policy scenarios: (a) a Gesell Tax of 6% (annualized) on money holdings, (b) a monetary expansion made possible through negative interest rates implied by the application of the Gesell Tax of scenario (a), and (c) a government spending profile that mimics the current US stimulus program established in the American Recovery and Reinvestment Act of 2009 (ARRA)[33]. The introduction of a Gesell tax shortens the period of recovery and brings back output and employment to its steady state level nearly as early as the extraordinarily expensive fiscal stimulus program. It fosters private consumption and investment, while the government spending package has negative (crowding-out) effects on private consumption and investment. Adding a monetary expansion to the Gesell tax scenario as in scenario (b) has dampening effects on impact on all variables, such that the recession is not that profound and not that long-lasting, but in the medium and long run the economy follows quite closely the economy of the pure Gesell tax scenario.

Summarizing, in the search-theoretic business cycle model of Menner (2010) that overcomes the limitations of first and second generation search models a tax on money as

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32 Note, however the various contributions to study the effects on inflation in these environments, e.g. Lagos-Rocheteau(2005), Rocheteau-Wright (2005), Ennis (2008), Nosal (2008), Liu et. al (2008,2009).
33 This is done following Cogan et. al. (2010) who study government spending multipliers in a New-Keynesian Macro-Model.

proposed initially by Gesell can have efficiency enhancing effects in the long run. Moreover, besides allowing for negative interest rates and expansionary monetary policy in a demand driven recession, it can have a role on its own as a policy instrument to speed up velocity and foster aggregate demand by making people spend their money more rapidly.

Practical considerations of Taxing Money

Altering the existing monetary regime is always controversial. However, from a historical perspective, the world's monetary system has been changing constantly. Although people tend to believe that the existing order is the only imaginable one, history teaches us that the institutional design of money is subject to rapid changes, even if the underlying purpose of facilitating exchange remains the idiosyncratic raison d'etre of money. For example, the last one hundred years saw the widespread advent of fiat money during the First World War, followed by a period of hyperinflation in many nations and a disastrous return to the gold standard that contributed to the worldwide spread of the Great Depression. After the Second World War, the Bretton Woods Dollar standard was the basis for the miraculous post war recovery, but run into trouble at the beginning of the 1970s. In fact, our modern monetary system of free floating fiat money is less than forty years old and is the outcome not of careful institutional design but rather of trial and error. Moreover, China and other nations are still pegging their currencies to the Dollar, thereby contributing to the gigantic trade imbalances of today. Thus, today's monetary regime is neither a natural system nor a carefully designed one. It is rather the path dependent outcome of political and economic events, which should be altered if the incentive to do so is compelling.

Cost and Benefits

If negative interest rates thus have a theoretical foundation beyond its anarchistic origins and are technically feasible, this in turn raises questions about the potential costs and benefits of such a policy scheme, because besides some local currencies, negative interests are so far an untested policy tool, and hence it is difficult to quantify its effects. Nevertheless, in the following we will attempt to sketch the possible implications of negative interest rates independent of the concrete method of its implementation.

To begin with the costs of such a scheme, Yates (2004, p. 445) argues that negative interest rates are similar to raising the inflation target, the costs being 'the shoe-leather costs of inflations in each case: […].' This is not an argument against negative interest rates, at least in the case of a deflationary shock. Indeed, raising expected inflation and thereby reducing real

interest rates is a commonly cited policy tool once the zero bound is hit. For example, Svensson (2001) devised a 'foolproof way for escaping the zero bound' by devaluating the exchange rate, thereby stimulating demand and inflation respectively. One frequently proposed alternative to avoid a binding zero-bound of nominal interest rates would be a higher target rate of inflation that raises nominal interest rates through the 'Fisher effect' of higher expected inflation. Jung et al. (2005) have argued that central banks should raise expected inflation by committing to a long term zero interest rate policy. However, while Svenssons's proposal will, in case of worldwide shock, only lead to beggar-thy-neighbour policies, the other proposal depends on the credibility of the central bank and must lead to inflation eventually.

Moreover, although inflation and Gesell taxes have the same 'shoe-leather costs' and effects on search-activity, they make a big difference in terms of the working of the price mechanism: while Gesell taxes are consistent with a zero inflation target, i.e. they do not move the price level so that movements of individual prices can always be identified as such, inflation moves the price level and we have Lucas's (1973) signal extraction problem where it is hard to distinguish movements of prices of individual goods and the aggregate price level. Zero inflation is also optimal in sticky price models, since it reduces the need for price adjustments and eliminates the distortion that arises through price dispersion[34]. In these respects price stability with Gesell taxes is preferable to moderate inflation. Moreover, it is probably easier to anchor expectations to a zero-inflation regime than to moderate inflation.

Another frequently citied objection is that providing the infrastructure for implementing negative interest rates will cause considerable costs and that such a policy theme has not been tested yet. Thus, Yates (2004, p. 446) argued there might be other more cost-effective methods for escaping the zero bound, such as quantitative or credit easing, and from a policy point of view, it might be wiser to use more thoroughly tried and tested methods. Admittedly, implementing negative interest rates will come at some costs but so does any policy scheme that tries to remove the zero bound.[35] Concerning the argument the negative interest rates are untested: The possible side effects of the current enormous quantitative and qualitative easing are equally unpredictable. On the contrary, not long ago the purchase of ailing securities, e. g. treasury bonds, by central banks was considered to be a capital sin. At the same time the

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34 See Woodford (2003) as an example of a large literature on optimal monetary policy with this view.
35 See for example Yates (2004, pp. 446-449) discussion on the merits on 'money rains' to overcome the zero bound.

effectiveness of this 'innovative' monetary policy remains doubtful, given stagnating growth rates the in the United States and elsewhere.

Concerning the benefits, the search-theoretical literature proposes a negative tax on money to be efficiency enhancing. A "hot potato" effect similar to the one caused by inflation increases velocity through higher search-effort of buyers trying to avoid the loss in value of their money balances. This results in a higher sum of overall transactions and increases aggregate activity. Moreover, it is undisputable that one of the benefits of negative interest rates would be that of avoiding the floor to rates in the case of a sharp deflationary shock. Thus, the argument concerning the cost-benefit ratio depends partly on the probability and the scale of a deflationary spiral. While this risk was previously considered to very small indeed (Yates, 2004, p. 464), the recent developments have reminded practitioners and economist alike that the likelihood of such an event is not that small after all. If unconventional monetary policy is not able to offset the asymmetry in the domain over which the official policy rate can be set in the event of large deflationary shock, the cost of the zero bound may be vast indeed (Buiter, 2010, p. 236). A Gesell tax combined with a low inflation target however can avoid the distortions of considerable inflation and can be used to escape from a liquidity trap while a higher inflation target cannot achieve this goal. Therefore, negative interest rates offer an additional short-term policy option in the event of a large deflationary shock, if even such a scheme may come with some costs.

Limitations

Obviously , the range over which negative rates could be set is not unlimited, as Buiter (2007, p. 129) points out: 'It goes without saying that for something to serve as a medium of exchange and means of payment, it will have to be willingly held between transactions and therefore will have to be a store of value.' In Buiter's view the storage of value complements money in its primary function as medium. On the first sight this contrasts Gesell's argument that the two functions of money are dichotomous. However, this disagreement might be just a matter of degree or of definition. What Gesell has in mind is the 'joker' position of money as an unerodable store of value that inflicts on its role as means of exchange. If the value of money does not erode too much it will very likely be accepted, as the experience of low-and medium inflation periods shows. In a search theoretical paper, Cuadras-Morató (1997, p. 120) showed that even a perishable good could serve as money because 'what determines which good appears as a medium of exchange are the extrinsic beliefs of agents about acceptability of goods, more than the intrinsic qualities of goods'.

In reality, there will be definitely a limit to the rate of depreciation that will be accepted by the public before the official currency will lose its status as commonly accepted medium of exchange. Setting a very high rate of depreciation may lead to a substitution of the official currency by other means of payment, as it is usually the case during periods of high inflation. Hence, too negative interest rates may risk the status of the official fiat currency as commonly accepted legal means of payment. These considerations Gesell had already in mind when he proposed a 5% annualized rate of depreciation that should just contrast the storage cost advantage of money against other goods and should not go further than that rate. The same line of arguments may also explain to some extent the failure of some experiments of the stamp scrip movement in the US in the 30's that tried a too high tax rate on money.

Finally, a comment on the long-run implications of a Gesell tax is in order. It is very unlikely that the imposition of Gesell taxes can lower real interest rates substantially in the long run, and that 'capital rents' finally disappear because of the elimination of basic interest - 'Urzins' as Gesell claims. According to the classical and neoclassical view, the long-run real interest rate is determined by thrift and productivity, i.e. by the levels of saving and investment and cannot be affected by monetary reform. For Austrians the interest rate is determined psychologically by the rate of time preference. Keynes' liquidity preference theory, however, shares with Gesell's theory that the interest rate is a monetary phenomenon: according to Gesell interest rates are high because of the low storage cost of money, while according to Keynes (1936, Ch.17) what matters is that money has among all assets the largest difference between liquidity premium and storage cost. Hence an increase in storage costs through a Gesell tax would, in principle, counteract the high liquidity premium of money, but would not affect the liquidity premium of other durable assets, such as gold. Consequently, their somewhat smaller liquidity premium would still set a minimum standard for the long-term interest rate. This view was already expressed by Keynes (1936, p. 358) himself: 'Thus if currency notes were to be deprived of their liquidity-premium by the stamping system, a long series of substitutes would step into their shoes – bank-money, debts at call, foreign money, jewellery and the precious metals generally, and so forth'. Hence, in the long run a tax on money will not lower real interest rates substantially and thereby succeed in abolishing the ills of capitalism completely, as many of Gesell's followers claim. Therefore   negative short term nominal interest rates are – from a Post Keynesian perspective – no remedy towards the effects of liquidity preference.

Conclusion

The aim of this paper was to give a concise review of the various theoretical origins of negative interest rates, which so far have been unconnected in the literature. Evidently, negative interest rates have come a long way from anarchistic to modern economic theory. Even if their origins are to be found in a rather simplistic economic theory, which nevertheless Keynes vividly embraced as being prophetic, various prominent economists have picked up the proposal and have shown its value as an additional monetary policy tool. Instead of being the fantasy of a monetary crank, negative interest rates draw on a variety of different modern theoretical backgrounds.

Our review of the various strands of research suggests that a moderate tax on money may be efficiency enhancing (in the absence of inflation) and implementing the infrastructure for setting negative nominal interest rates may give central banks an additional valuable policy tool in case of a large deflationary shock. A beneficial side effect could be that the velocity of circulation of coins and notes and probably demand deposits might be considerably more stable if subjected to the Gesell tax and this could render monetary control more efficient. Given that many developed economies have reached the lower zero bound, with central banks unable to combat unemployment and depression, we believe that there is a need for further extensive research, especially in models with more relevant specifications of production, investment, banking, and asset markets, and where money plays an essential role in exchange.

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