

PRELIMINARY

Breaking Through the Zero Lower Bound

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May 9, 2013

I. Introduction

Under current monetary systems, paper currency (and coins) guarantee a zero nominal rate of return, apart from storage costs, which are relatively small. It is then difficult for central banks to reduce their target interest rates below the rate of return on paper currency storage, which is not far below zero. This limitation on central bank target interest rates is called the “zero lower bound.” Because the zero lower bound is a consequence of how monetary systems handle paper currency, it is possible to eliminate the zero lower bound by alternative paper currency policies. Though there are costs as well as benefits to any policy, there is nothing intrinsically difficult about paper currency policies that eliminate the zero lower bound. Eliminating the zero lower bound would give central banks a wider range of options for their target interest rates.

Because the zero lower bound is more likely to bind when the long-run inflation target is low, central banks have been concerned about setting the long-run inflation target too low. Indeed, some economists have advocated raising long-run inflation targets for this reason. (See for example Larry Ball, “The Case for Four Percent Inflation,” Johns Hopkins University working paper.) Moreover, the Bank of Japan has raised its inflation target because of concerns about the zero lower bound. By eliminating one of the costs of low inflation, eliminating the zero lower bound is likely to reduce the optimal level of the long-run inflation target. For countries such as Japan that are trying to raise their inflation rate *because of concerns about the zero lower bound*, studying ways to eliminate the zero lower bound (and their costs and benefits) is especially urgent, since increases in inflation are not easy to reverse.

Moreover, to the extent that raising the rate of inflation is difficult when a central bank is already up against the zero lower bound, eliminating the zero lower bound may be the most practical way to gain more freedom for monetary policy to maneuver. Freedom for monetary policy to maneuver, however obtained, can relieve some of the burden on short-run fiscal policy for stabilizing the economy at the natural level of output. To the extent that fiscal stimulus generates other concerns, such as increasing national debt or increasing the needed long-run level of tax rates, a wider range of options for monetary policy can be especially valuable.

¹ I have a shadow coauthor who has not yet received institutional clearance to be credited for his contribution to this paper.

II. Recent Trends in Policy Rates

Many central banks responded to the global financial crisis in 2008 by setting a substantially lower trajectory for policy rates. This was particularly true in advanced economies, where the initial effects of the financial crisis were felt strongest. Figure 1 shows the response of the four largest advanced economies to the financial crisis. While Japan already entered this period with close-to-zero rates, the Federal Reserve, ECB and the Bank of England, responded by cutting rates aggressively. By the end of 2012 all four central banks had interest rates below unity, with Japan and U.S. almost at zero.

Central banks in other advanced economies responded with similar aggressive cuts, with several central banks quickly reaching rates close to zero (figure 2). By the end of 2012, several central banks around the world—in both the advanced and emerging economies—had reached all-time low policy rates. As figure 3 illustrates, several central banks had an average policy rate below one percent, and a subset of those effectively reaching a rate of zero. Also, as the figure depicts, the sub-unity policy rates were not just a feature of the advanced economies, as several emerging economies have also engaged in aggressive rate cuts hitting the zero lower bound.

II. Why is There a Zero Lower Bound? Denmark Case Study

Zero lower bound refers to the notion that nominal interest rates are not expected to fall below zero. While there have been episodes in which some market interest rates become negative, these episodes are fairly isolated.

The basic argument for why the zero lower bound may hold is that the nominal interest rate offered by currency is always zero. Holding a dollar bill will have the same nominal value a year from now. On the other hand, investing the dollar in an account that offers an interest rate of negative five percent implies that one dollar of saving today will yield ninety five cents a year from now. Since everyone has the option to hold the currency, there is no incentive to invest in any account that offers a negative interest rate.

Denmark is part of ERM II and has thus pegged its currency to the euro. The krone can fluctuate between kr. 762.824 per 100 euro and kr. 728.252 per 100 euro. Following the ECB's 25 basis point rate cut in Summer 2012, the Danish central bank cut its lending rate—both the discount rate and the CD rate—by 25 basis points to 0.2 percent and minus 0.2 percent respectively (Figure 4 and 5). The rate cut was an attempt to end a long period of sharply rising demand for the Danish krone (DKK), which despite considerable intervention continued to strengthen versus the euro.

The CD rate is the Danish central bank's key monetary policy tool to maintain exchange rate stability versus the euro. The reason is that Danish banks and mortgage lenders deposit vast sums of money with the central bank due to massive excess liquidity in the money market. The banks can use either the CDs or the current account to deposit money at the central bank. However, due to a limit on the amount of money a bank can place in the current account, the CD rate is the effective return the financial institutions get on deposits at the central bank with maturity up to seven days. This also makes the CD rate effectively a peg for short-term money market rates in Denmark.

To ease the burden of the negative rates on the banks, the Danish central bank increased the limit on current account deposits from DKK 23 billion to DKK 70 billion. The zero percent return offered by the current account was relatively attractive to the negative return offered by the CD rate, and this led to increased holdings in the current account (Figure 7). Nevertheless, as Figure 7 shows, there was little evidence of substantial outflows from CDs in the months following the negative rates.

The Danish experiment illustrates that it is possible for central banks to implement negative policy rates in the current economic environment without creating outflow of resources from the banking system. Nevertheless, the lessons from optimal policy are somewhat limited since their main rationale was to stem the large inflows of money while maintaining the peg to the euro.

III. Possible Methods for Preventing Massive Paper Currency Storage at Negative Nominal Interest Rates.

A. History of Thought Because the relevant history of thought is not well-covered in most undergraduate or graduate economics courses, it is important to quote at some length from the history of thought on preventing massive paper currency storage at low interest rates.

1. Silvio Gesell's Stamped Currency. One of the earliest well-worked-out proposals for avoiding massive paper currency storage was Silvio Gesell's proposal for stamped currency. In Chapter 23, Section VI of *The General Theory of Employment, Interest and Money*, John Maynard Keynes gives this account of Silvio Gesell's proposal. (This chapter is available online at <http://www.marxists.org/reference/subject/economics/keynes/general-theory/ch23.htm>)

Gesell was a successful German merchant in Buenos Aires who was led to the study of monetary problems by the crisis of the late 'eighties, which was especially violent in the Argentine, his first work, *Die Reformation im Münzwesen als Brücke zum sozialen Staat*, being published in Buenos Aires in 1891. His fundamental ideas on money were published in Buenos Aires in the same year under the title *Nervus rerum*, and many books and pamphlets followed until he retired to Switzerland in 1906 as a man of some means,

able to devote the last decades of his life to the two most delightful occupations open to those who do not have to earn their living, authorship and experimental farming.

The first section of his standard work was published in 1906 at Les Hauts Geneveys, Switzerland, under the title *Die Verwirklichung des Rechtes auf dem vollen Arbeitsertrag*, and the second section in 1911 at Berlin under the title *Die neue Lehre vom Zins*. The two together were published in Berlin and in Switzerland during the war (1916) and reached a sixth edition during his lifetime under the title *Die natürliche Wirtschaftsordnung durch Freiland und Freigeld*, the English version (translated by Mr. Philip Pye) being called *The Natural Economic Order....*

The incompleteness of [Silvio Gesell's] theory is doubtless the explanation of his work having suffered neglect at the hands of the academic world. Nevertheless he had carried his theory far enough to lead him to a practical recommendation, which may carry with it the essence of what is needed, though it is not feasible in the form in which he proposed it. He argues that the growth of real capital is held back by the money-rate of interest, and that if this brake were removed the growth of real capital would be, in the modern world, so rapid that a zero money-rate of interest would probably be justified, not indeed forthwith, but within a comparatively short period of time. Thus the prime necessity is to reduce the money-rate of interest, and this, he pointed out, can be effected by causing money to incur carrying-costs just like other stocks of barren goods. This led him to the famous prescription of "stamped" money, with which his name is chiefly associated and which has received the blessing of Professor Irving Fisher. According to this proposal currency notes (though it would clearly need to apply as well to some forms at least of bank-money) would only retain their value by being stamped each month, like an insurance card, with stamps purchased at a post office. The cost of the stamps could, of course, be fixed at any appropriate figure. According to my theory it should be roughly equal to the excess of the money-rate of interest (apart from the stamps) over the marginal efficiency of capital corresponding to a rate of new investment compatible with full employment. The actual charge suggested by Gesell was 1 per mil. per month, equivalent to 5.4 per cent. per annum. This would be too high in existing conditions, but the correct figure, which would have to be changed from time to time, could only be reached by trial and error.

The idea behind stamped money is sound. It is, indeed, possible that means might be found to apply it in practice on a modest scale. But there are many difficulties which Gesell did not face. In particular, he was unaware that money was not unique in having a liquidity-premium attached to it, but differed only in degree from many other articles, deriving its importance from having a *greater* liquidity-premium than any other article. 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. As I have mentioned above, there have been times when it was probably the craving for the ownership of land, independently of its yield, which served to keep up the rate of interest; — though under Gesell's system this possibility would have been eliminated by land nationalisation.

A version of stamped money was briefly tried in the town of Woergl, in 1932. See <http://en.wikipedia.org/wiki/Wörgl> and "The Woergl Experiment with Depreciating Money" <http://www.reinventingmoney.com/worglExperiment.php>. The title "The Woergl Experiment with Depreciating Money" refers to the fact that unstamped paper money would gradually be valued less and less over time, relative to all other forms of money.

2. Robert Eisler's Depreciating Paper Currency. Robert Eisler's contribution was to propose a paper currency that gradually depreciated relative to other forms of money—in particular, "bank money"—without any attempt to have a system of stamps to keep the paper currency valued at par. Robert Eisler's key work on paper currency policy is Robert Eisler (1932), *Stable Money: the remedy for the economic world crisis: a programme of financial reconstruction for the international conference 1933* (with a preface by Vincent C. Vickers. London: The Search Publishing Co.) In Chapter XVII, pp. 234-235, Eisler writes about his system for an exchange rate between "bank money" and "current money":

Under the new system there would be two sorts of money: (1) legal tender, called a pound or a U.S. dollar of 'current money' [The term 'current money' is well known to legal practice and theory as the equivalent of 'legal tender' as opposed to divisionary money which need not be accepted in unlimited quantities.] or money proper (£ *cr.* or \$ *cr.*) and (2) bank or contract money of account, called a pound or dollar *banco* [The history of the term is told in W. F. Spalding's article 'Pound Banco' concerning the author's address to the Parliamentary Finance Committee in *The Times Trade and Engineering Supplement* of February 27th, 1932. The expression goes back to the twelfth century: the idea of a stable money is an ancient Roman invention (cp. Eisler, *Das Geld*, Munich, 1924, pp. 201 and 211f.)] (£ *bo.* or \$ *bo.*). Money *banco* would be obtained by concluding a contract about a future payment of money proper, or by depositing 'current money' with a bank or similar institution. Current money would be exclusively used for small transactions between persons not well know to each other or not in possession of a bank account, especially for the payment of wages, transport fares and occasional retail purchases. All other payments would be effected by means of bank-money, that is by cheques or transfers of money *banco*. All prices in catalogues of shops selling goods of which the price does not vary much (e.g. books, clothes, jewellery, cigars, tobacco, wines) would be marketed in money *banco*. The index multiplier of the week would be affixed to the

desk of the cashier, who would calculate by means of simple multiplication or conversion tables published in the Sunday papers the sums due in 'current money'. This is how retail business, inn and hotel-keeping was done in Germany at the height of the inflation in 1923, when the 'stable mark' was introduced as a money of account alongside the paper mark used as 'current money'. [This simple expedient was criticized as 'a nightmare' by Prof. Edwin Cannan in his review of the author's book, *This Money Maze* in the *Economic Journal* of 1932. We should like very much to put it to the vote of all shop assistants, however, whether they would object to this little extra work if they could thus be permanently freed from the menace of unemployment.] All bank and business accounts would, however, be calculated without any additional complication in money *banco*, current money being exchanged against bank-money by special tellers [Keeping special ledgers for 'cash bought and sold' as the money changing cashier of an English Cook's office or of a continental bank.] only in so far and as soon as a client wanted to pay in or draw out current money. In each country the external exchanges between the national and foreign bank-moneys would be pegged, [See above, Chap. xiv.] but a variable internal exchange rate between current and bank money would be determined by the cost-of-living index.

Eisler did not fully recognize that in such a system, to the extent possible, it is important to treat the units of the bank money as the unit of account for *all* purposes. From that point of view, it is confusing to talk about the exchange value of the bank money (which should be treated as the numeraire) as being determined in relation to the current money according to a cost-of-living index. But what this does make clear is that Robert Eisler intended inflation as stated in terms of the bank money to be zero, while there *would* be inflation as stated in terms of the current money. To the extent the bank money is treated as the unit of account, most of the costs of inflation could be avoided, as we will discuss carefully in the next section, but the most important *advantage* of higher inflation—a looser zero lower bound—is obtained by having inflation in terms of the paper currency.

One other aspect of Eisler's proposal was for a fixed exchange rate in the bank money. This aspect of the proposal is not surprising since he was writing in an era when the gold standard was still thought of as the norm, but fixed exchange rates are by no means necessary in order to have an exchange rate between bank money and paper currency with no system of stamps.

3. Marvin Goodfriend's Advocacy of Stamped Money. In Marvin Goodfriend's 2000 paper "Overcoming the Zero Bound on Interest Rate Policy" (*Journal of Money, Credit and Banking*, 32(4), pp. 1007-35, November), in addition to advocating the kinds of long-term and risky asset purchases that have come to be called "quantitative easing," Goodfriend advocated stamped money, writing on p. 1008:

Under my proposal, the floor on short-term nominal interest rates would be determined by the carry tax imposed by a central bank on electronic reserve balances. When interest rates are pressed against that floor, a monetary

policy committee could vary the carry tax in order to adjust its interest rate target. The carry tax would anchor the short end of the yield curve much as, say, the intended federal funds rate does today in the United States. To assure that the carry tax on electronic reserve balances sets the economy's nominal interest rate floor, a carry tax could also be imposed on currency and vault cash. I discuss how this might be done, too.

Goodfriend elaborates on p. 1016:

Modern payments system technology makes it possible to impose and vary a carry tax on electronic bank reserves at the central bank. With a system to do so in place, the zero bound would cease to be a technological constraint on interest rate policy. Whenever the intended target for the interbank interest rate reached zero, the policy committee could activate a daily tax on electronic reserve balances that would make the interbank rate negative. By calibrating the daily tax as a percent per annum, the policy committee could adjust the cost of carry so as to move the interbank rate in 25 basis point steps and continue to make interest rate policy exactly as it does today. 24

To supplement the carry tax on electronic reserves, a carry tax could be imposed on currency by imbedding a magnetic strip in each bill. The magnetic strip could visibly record when a bill was last withdrawn from the banking system. A carry tax could be deducted from each bill upon deposit according to how long the bill was in circulation since last withdrawn and how much carry tax was "past due." Likewise, a carry tax could be assessed on currency held as vault cash in banks.

In other words, Goodfriend argues that modern technology makes it easier to implement Silvio Gesell's stamped currency.

4. Marvin Goodfriend's Discussion of Suspension of Payment in Paper Currency. One of the most valuable contributions of Marvin Goodfriend's paper is his footnote 23 on the suspension of payment in physical currency. He writes:

23. In principle, as an alternative to imposing a carry tax on currency, banks could agree to suspend the payment of currency for deposits whenever a carry tax was imposed on electronic reserves at the central bank. Currency and deposits each have a comparative advantage in making payments. Currency is more efficient for small transactions made in person, and checkable deposits are useful for making larger payments at a distance. The respective demands for the two monies would be well-defined. The imposition of a negative nominal interest rate coupled with a suspension would cause the deposit price of currency to jump to the point that the expected negative deposit return to holding currency matched the negative nominal rate on deposits.

This mechanism is reminiscent of the temporary suspensions that occurred in the US prior to the establishment of the Federal Reserve. For instance,

currency went to a few percent premium over deposits for a few months during the suspension that occurred in the aftermath of the banking panic of 1907.

Suspending the payment of currency for deposits would avoid the cost of imposing a carry tax on currency. After the initial capital gain, however, currency would bear the same expected negative return as deposits. Moreover, the proposal would involve the inconvenience of dealing with a fluctuating deposit price of currency. Furthermore, the possibility of making a capital gain on currency relative to deposits when a suspension occurs would create destabilizing speculative runs on the banking system. Such attacks would be annoying and costly for banks. Effort invested in attacking banks would be a waste of resources from society's point of view.

In other words, Goodfriend argues there is a great deal of messiness to suspension of payment in physical currency as a way of breaking through the zero lower bound. Although the expected depreciation of paper currency after the initial, mostly unexpected *appreciation* can bring down the expected rate of return on paper currency, the attendant uncertainty could have a negative effect on the economy, he argues.

5. Willem Buiter's Discussion of a Wide Range of Mechanisms for Avoiding Massive Paper Currency Storage. In academic articles in 2004 and 2007,² and in two blog posts in May, 2009 "Negative interest rates: when are they coming to a central bank near you,"³ followed up by "The Wonderful World of Negative Nominal

² Buiter, Willem H. (2004) ,"Overcoming the Zero Bound: Gesell vs. Eisler; Discussion of Mitsuhiro Fukao's "The Effects of 'Gesell' (Currency) Taxes in Promoting Japan's Economic Recovery" . Discussion presented at the Conference on Macro/Financial Issues and International Economic Relations: Policy Options for Japan and the United States, October 22-23, 2004, Ann Arbor, MI, USA. *International Economics and Economic Policy*, Volume 2, Numbers 2-3, November 2005, pp. 189-200. Publisher: Springer-Verlag GmbH; ISSN: 1612-4804 (Paper) 1612-4812 (Online).

Buiter, Willem H. (2007), "Is Numéraireology the Future of Monetary Economics? Unbundling numéraire and medium of exchange through a virtual currency with a shadow exchange rate", *Open Economies Review*, Publisher Springer Netherlands; ISSN 0923-7992 (Print); 1573-708X (Online). Electronic publication date: Thursday, May 03, 2007. See "Springer Website".

³ <http://blogs.ft.com/maverecon/2009/05/negative-interest-rates-when-are-they-coming-to-a-central-bank-near-you/#axzz2CIT6Pm2V>

Interest Rates, Again”⁴ Willem Buiter lays out a wide range of mechanisms for avoiding massive paper currency storage. They are

- “Abolish currency.”
- “Tax currency and ‘stamp’ it to show it is ‘current on interest due.’”
- “Unbundle currency from the unit of account. This ideal goes back at least to Eisler (1932), was drawn to my attention by Stephen Davies in 2004 and has been formalized by me [Willem Buiter] in a couple of papers since then.”

6. Greg Mankiw’s Discussion of Random Invalidation by Serial Number.

Willem Buiter introduces his May 7, 2009 blog post pulling together his earlier work by referring to Greg Mankiw’s New York Times April 18, 2009 article “It May Be Time for the Fed to Go Negative,” saying

I agree with Greg Mankiw⁵ that it is time for central banks to stop pretending that zero is the floor for nominal interest rates. There is no theoretical or practical reason for not having the Federal Funds target rate and market rates at, say, minus five percent, if that is what your Taylor rule, or whatever heuristic guides your official policy rate, suggests.

Mankiw’s article is worth looking at more closely in its own right.

Here is Mankiw’s key passage:

So why shouldn’t the Fed just keep cutting interest rates? Why not lower the target interest rate to, say, negative 3 percent?

At that interest rate, you could borrow and spend \$100 and repay \$97 next year. This opportunity would surely generate more borrowing and aggregate demand.

The problem with negative interest rates, however, is quickly apparent: nobody would lend on those terms. Rather than giving your money to a borrower who promises a negative return, it would be better to stick the cash in your mattress. Because holding money promises a return of exactly zero, lenders cannot offer less.

Unless, that is, we figure out a way to make holding money less attractive.

At one of my recent Harvard seminars, a graduate student proposed a clever scheme to do exactly that. (I will let the student remain anonymous. In case he ever wants to pursue a career as a central banker, having his name

⁴ <http://blogs.ft.com/maverecon/2009/05/the-wonderful-world-of-negative-nominal-interest-rates-again/#axzz2HiltTlo2>

⁵ http://www.nytimes.com/2009/04/19/business/economy/19view.html?_r=2&

associated with this idea probably won't help.)

Imagine that the Fed were to announce that, a year from today, it would pick a digit from zero to 9 out of a hat. All currency with a serial number ending in that digit would no longer be legal tender. Suddenly, the expected return to holding currency would become negative 10 percent.

That move would free the Fed to cut interest rates below zero. People would be delighted to lend money at negative 3 percent, since losing 3 percent is better than losing 10.

7. Matthew Yglesias's Advocacy of the Abolition of Paper Currency. Because of the more prominent placement of Mankiw's article in the New York Times, some of the discussion in online publications proceeded based on an awareness of Mankiw's article, but no evident awareness of Willem Buiter's work. Matthew Yglesias's Slate article "How Eliminating Paper Money Could End Recessions"⁶ is a particularly important example. Yglesias's key passage is:

Why would a cashless society be a depression-less society? Starting about 40 years ago, it became clear that central banks had the power to end most recessions pretty easily, independent of fiscal stimulus....

But there is a problem with this simple recession-fighting formula. The number zero.

As Paul Krugman wrote in a [1999 *Slate* column about Japan's decadelong depression](#), "whereas U.S. interest rates in early 1982 were in double digits—and could therefore be sharply reduced—Japanese short-term interest rates have been below 1 percent for years, apparently leaving little room for further cuts." Japan couldn't reduce interest rates to spur economic activity, because interest rates couldn't fall below zero.

Today, the United States is in the same boat. That doesn't mean there's nothing a central bank can do to fight a recession, but it does mean the standard formula of simple rate cuts won't work.

Now we come to the miracle of the cashless society. Stop for a moment and ask yourself *why* the interest rate can't be reduced much below 1 percent. The trouble is cash. At any given time, relatively little paper currency circulates in the United States. Instead, most of the American money supply consists of bank accounts and other electronic stores of value. People prefer to keep money in bank accounts because it's convenient and because you get

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http://www.slate.com/articles/technology/technology/2011/12/how_eliminating_paper_money_could_end_recessions_.html

interest on it. If the rates were driven below zero—in effect a tax on holding cash in the bank—people would just withdraw money and store it in shoeboxes instead. But what if you *couldn't* withdraw cash? What if all transactions were electronic, so the only way to avoid keeping money in a negative-rate account was to go out and buy something with the money? Well, then, we would have solved our depression problem....

In addition to his proposal for abolishing currency, Yglesias has a useful discussion of *real* storage, arguing that real storage would not prevent negative nominal interest rates from having a stimulative effect:

Some people could, it's true, try to horde gold, diamonds, or other valuable primary commodities. But this would amount to a price boom, creating mining and exploration jobs. It would also increase the wealth of everyone who already owns jewelry, expanding their consumption. The savvy investor, meanwhile, will realize that the price of gold is sure to crash when the recession ends and interest rates go back up, which should put a break on hoarding.

Yglesias's proposal for abolishing paper currency generated an extensive discussion online (see below), including, for example, Stefan Karlsson's "Would electronic money end recessions?"⁷ in the *Christian Science Monitor* and Ryan Avent's "The Buck Shrinks Here"⁸ in the *Economist*.

8. Miles Kimball's Advocacy of a Crawling-Peg Exchange Rate Between Electronic Money and Paper Currency. In a November 5, 2012 article "E-Money: How paper currency is holding the US recovery back," in the online business magazine *Quartz*, Miles Kimball advocated a crawling-peg exchange rate between electronic money and paper currency, along the lines suggested by Robert Eisler and Willem Buiter. (This article was later updated and republished as the blog post "How Subordinating Paper Currency to Electronic Money Can End Recessions and End Inflation."⁹) Kimball subsequently pursued the advocacy and defense of the idea of a crawling peg exchange rate between electronic money and paper currency in many other online magazine articles, blog posts, and tweets. All the important links are collected in his "Breaking Through the Zero Lower Bound with Electronic Money" sub-blog <http://blog.supplysideliberal.com/tagged/emoney>

Like Eisler, Kimball emphasizes that eliminating the zero lower bound makes it possible to have monetary policy as stimulative as necessary even when the steady-state rate of inflation is zero:

⁷ <http://www.csmonitor.com/Business/Stefan-Karlsson/2012/0418/Would-electronic-money-end-recessions>

⁸ <http://www.economist.com/blogs/freeexchange/2012/04/monetary-policy-0>

⁹ <http://blog.supplysideliberal.com/post/46244331402/quartz-5-how-subordinating-paper-currency-to>

What the opponents of primacy for electronic money fail to realize is that making electronic money the economic yardstick is the key to eliminating inflation and finally having *honest money*. The European Central Bank, the Fed, and even the Bank of Japan increasingly talk about an inflation rate like 2% as their long-run target. Why have a 2% long-run target for inflation rather than zero—no inflation at all? Most things are better with inflation at zero than at 2%. The most important benefit of zero inflation is that anything but zero inflation is inherently confusing and deceptive for anyone but the handful of true masters at mentally correcting for inflation. *Eliminating inflation is first and foremost a victory for understanding, and a victory for truth.*

There are only two important things that economists talk about that are worse at zero inflation than at 2% inflation. One that has attracted some interest is that a little inflation makes it easier to cut the real buying power of workers who are performing badly. But by far the biggest reason major central banks set their long-run inflation targets at 2% is so that they have room to push interest rates at least 2% below the level of inflation. With electronic dollars or euros or yen as the units of account, there is no limit to how low short-term interest rates can go *regardless of how low inflation is*. So inflation at zero would be no barrier at all to effective monetary policy.

Below, we discuss the costs and benefits of inflation in a context of a crawling-peg exchanger rate between electronic money and paper currency in detail. Here, the most important point to emphasize is that Kimball's idea involves electronic money serving as the *unit of account*; he argues that a key benefit of zero inflation is that money (in this case, electronic money) serves as a better unit of account when inflation is as close to zero as possible. Kimball assumes that the government would encourage firms and households by various means to use electronic dollar, euro, yen, pound, etc. as the unit of account rather than the paper dollar, euro, yen pound, etc. Elaborating (using the electronic dollar as an example), the argument for the feasibility of getting to the equilibrium where the electronic money serves as the unit of account could have the following elements:

- Stating required tax payments, government transfers and all other transactions with the government in electronic dollars would do a lot to encourage the use of the electronic dollar as a yardstick.
- Governments have shown an ability to determine the equilibrium in regard to daylight's savings time.
- In the long run, if inflation is, indeed, kept close to zero in the electronic dollar, but is positive in paper currency, the electronic dollar would be a more convenient unit of account for households and firms.
- If necessary, the government could easily require that prices be stated in terms of electronic dollars. Firms would still have the option of changing the electronic dollar prices frequently in a way that tracked the value of paper dollars, but that would then be relatively less convenient.

- More generally, governments have shown themselves able to effectively encourage the use of the domestic currency over foreign currency, as long as the rate of inflation in the domestic currency is not too high. In this analogy, the electronic dollar is analogous to the domestic currency, and is intended to have a very low inflation rate.

One issue with a crawling-peg exchange rate between electronic money and paper currency is simply explaining it to people. Kimball gives this explanation of the background in a radio interview¹⁰ intended for a general audience (interviewer questions only transcribed when necessary for clarity)

I think the key thing I would like to emphasize is that we could keep the cash around and get a lot of the benefits, if we just said that the electronic dollars were the *real* dollars, and that paper dollars were just an ancillary thing—they were kind of a subordinate, subsidiary thing. And the thing you want to do is make it so that we can stimulate the economy with monetary policy. So a lot of people don't realize, that the reason we've had such a long recession, is because the Federal Reserve was not able to lower the interest rate, because of the way our system uses paper money....

Well, basically, if you tried to make the interest rate negative, so that the money would actually shrink over time, which is what is actually needed to stimulate the economy, then people will say "Well, I'll just keep a big pile of cash"--money under the mattress. And because of that, the Federal Reserve is not able to lower the interest rate low enough to get the economy moving again.... The Federal Reserve doesn't even try to lower the interest rates, because it knows that [people would store cash]....

It's a big deal: when economists talk about it, they have a name for it: the zero lower bound. And they actually talk about it a lot, because it is a big, big problem. People may not realize it, but it's not just recessions that are a result of this limitation on what the Fed can do, it's also inflation: because the Federal Reserve, because it's worried about its ability to make interest rates low enough, it feels it needs to have a little bit of inflation. If you took that away—if you took away that zero lower bound, so you can have negative interest rates, then we could also have an economy without inflation, and still be able to take care of recessions....

Interviewer Cynthia Canty: "When do you believe our country will be digital money?"

Well, it certainly gets easier with every passing year, as more and more of what we do is with electronic money, as it is. I think the key thing is, once one country does it, I think a lot of other countries will start doing it. I think

¹⁰ <http://blog.supplysideliberal.com/post/38300571420/miless-first-radio-interview-on-electronic-money>

actually, it's probably easier to do in some place like England, that has a parliamentary democracy, and they have one party controlling all the levers of power, than here in the United States. I think it's more likely that some other country will do it first. But once some other country does it, they'll get just such a big advantage—it'll mean their economy will hum along, and do great, and other countries will say "Now wait a minute, not only are people investing and consuming a lot in your economy, you are also exporting a lot." And they say "Well, you should go to making the electronic money the real thing, too."

Note that Kimball emphasizes that in an environment where many countries are up against the zero lower bound, the negative nominal interest rates possible with the crawling-peg depreciation of paper currency would tend to generate both more investment *and* capital outflows that would lead to an increase in net exports. In his *Quartz* article "Could the UK be the first country to adopt electronic money,"¹¹ Kimball writes:

What a negative interest rate *means* is that there is no way for someone saving money to stay even using a totally safe saving strategy, either in a bank account, or by saving currency. Negative interest rates help to fight recessions, and once the economy recovers, interest rates will soon return to normal. Indeed, even someone living off of interest income is likely to be helped more by the quick recovery of the economy, leading to interest rates above zero, than if interest rates had not been able to go negative, but had stayed at zero for a long time.

Negative interest rates stimulate investment when firms find that building a new factory or buying new equipment in even a wounded economy earns a better return than putting money in the bank or keeping paper money in a safe. Negative interest rates have another powerful effect as well. They cause savers to seek higher returns in foreign stocks, bonds and other assets. For the UK, the purchase of foreign assets would put pounds in the hands of people outside the UK whose only good use for those pounds is to either to buy UK products or to pass off the unwanted pounds to someone else until someone spends them on UK products. So negative interest rates stimulate exports.

Right now, most major economies are struggling to get enough aggregate demand stimulus for their economies. And one nation's exports—an addition to aggregate demand, are another nation's imports—a subtraction from aggregate demand. So the powerful effect of negative interest rates on

¹¹ <http://blog.supplysideliberal.com/post/47186138861/quartz-9-could-the-uk-be-the-first-country-to-adopt>

exports means that the first movers in the transition to electronic money gain aggregate demand at the expense of the laggards. But that should just spur the laggards to make the transition to electronic money as well; then the whole world will have all the aggregate demand stimulus it can possibly use (and more, if care isn't taken not to overdo the stimulus). Or if other nations stubbornly resist the transition to electronic money, the first movers could still come out ahead even if they invited other countries to do exchange rate interventions that would give them less of a boost in exports, but a bigger boost to investment in factories and equipment. (One reason the first movers would come out ahead is that such exchange rate interventions would involve the laggards lending to the first movers at even lower negative interest rates than would otherwise prevail. That means the laggards would, in effect, be paying the first movers an arm and a leg to take the funds.)

The fact that the transition to electronic money rewards the first movers and punishes the laggards makes it much more likely that this transition will actually happen in the near future. Once any major economy gets the ball rolling, others will soon follow. And nations should be vying to be the first.

As for the actual workings of the proposal, Kimball gives this explanation in a series of tweets, collected into a blog post:

1. Let me explain paper currency policy a little more. Our current paper currency policy is that 1 paper \$ = 1 electronic \$ always.
2. Let's treat the electronic \$ (e-\$) as our yardstick—the unit of account. We want to encourage people to state prices in terms of the e-\$.
3. With 1 paper \$ = 1 electronic \$ all the time, paper currency earns a zero rate of interest. So people won't lend at a worse negative rate.
4. So a paper currency policy of pegging paper currency at par (1 p-\$ = 1 e-\$) puts a floor of zero under interest rates.
5. Like other price floors, a floor of 0 on interest rates messes up markets big time when the equilibrium interest rate would otherwise be <0.
6. We see the messed up markets from the floor of 0 on interest rates all around us these days in the troubled world economy.
7. The alternative paper currency policy looks like this: In January 2013, 1 paper \$ = 1 e-\$. In January 2014, 1 paper \$ = .95 e-\$.
8. If 1 paper \$ = 1 e-\$ now, but 1 paper-\$ = .95 e-\$ a year from now (95 e-cents), then paper currency effectively earns a -5% interest rate.
9. Call our current paper currency policy "pegging at par." (Par: 1 p-\$=1 e-\$) The alternative paper currency policy is called a crawling peg
10. With a crawling peg that allows paper currency to depreciate relative to electronic money, paper money earns a negative interest rate.
11. If the crawling peg makes paper money earn -5%, there is no reason the Fed can't choose any interest rate above -5%.
12. Institutionally, the Fed should be given control of paper currency policy and have the target rate and ROR on paper money move together.

13. ROR = rate of return = effective interest rate in a case like this, when the ROR is a fixed, certain number.
14. The Fed should move the effective interest rate on paper money in tandem with the fed funds rate and the interest rate on excess reserves.

In regular text, Kimball describes the crawling peg in “Could the UK be the first country to adopt electronic money?” in this way:

The key is to allow for an *exchange rate* between paper currency and money that is recorded electronically in bank accounts. I am proposing that in times of economic emergency, the rate at which electronic money could be converted into paper currency would be allowed to vary over time. Let me use the pound as an example, and a 4% per year rate of depreciation of paper money. The exchange rate would start out at par: withdrawing £100 from a UK bank account would yield £100 of paper money, as usual. But after three months, if you withdrew £100 from a UK bank account, you would be handed about £101 in paper money. After six months, you would get about £102 in paper money, and so on. Of course, the exchange rate would apply for deposits as well: after six months, depositing £102 of paper money would add £100 to what was shown in your bank account. Retailers might accept paper money at par for longer than banks, but after a while, they too would ask for more in paper money than would be charged to a debit or credit card. But the extra paper money banks would give for withdrawals would make that a wash. The exchange rate between paper pounds and electronic pounds wouldn't directly change how far anyone's paycheck would go. What it *would* do is allow the Bank of England to set short-term interest rates anywhere above negative 4%. That is, since the value of paper pounds would be shrinking at the rate of 4% per year in relation to electronic pounds, the Bank of England could push interest rates so low that the number of electronic pounds in a bank account would gradually shrink at a somewhat slower rate.

That is, the crawling peg might look something like this:

Preannounced exchange rates for *withdrawals* of \$1.00 in paper money in 2014, after adoption of crawling peg system, effective January 1, 2014:

- January 1, 2014: \$1.00 paper = \$1.00 electronic
- April 1, 2014: \$1.00 paper = \$0.99 electronic
- July 1, 2014: \$1.00 paper = \$0.98 electronic
- October 1, 2014: \$1.00 paper = \$0.97 electronic
- January 1, 2015: \$1.00 paper = \$0.96 electronic

Preannounced exchange rates for *deposits* of \$1.00 in paper money in 2014, after adoption of crawling peg system, effective January 1, 2014:

- January 1, 2014: \$1.00 paper = \$1.00 electronic
- April 1, 2014: \$1.00 paper = \$0.99 electronic
- July 1, 2014: \$1.00 paper = \$0.98 electronic
- October 1, 2014: \$1.00 paper = \$0.97 electronic
- January 1, 2015: \$1.00 paper = \$0.96 electronic

In between these dates, the exchange rate would be interpolated. (Or it might be stated directly in terms of a daily decrement to the exchange rate—for example, having the value of a paper dollar decline decline \$.0001 electronic per day would be a round figure in the same ballpark-9.) Note that although announcing the exchange rate between paper dollars and electronic dollars a year in advance when possible could be helpful for public acceptance of the system, keeping commitments about this exchange rate made three months in advance is sufficient (though clearly not necessary) to allow three-month Treasury bills to have negative interest rates. Other interest rates would be influenced by predictions of future three-month Treasury bills. The effective interest rate on paper currency is itself an important interest rate. But as long as that effective interest rate on paper currency is set low enough, the overnight money market interest rate (fed funds rate in the US), rate of interest on excess reserves, and discount rate could be adjusted as desired on a different, more frequent schedule, even if the convenience of the public dictated infrequent announcements for the track of the exchange rate between paper dollars and electronic dollars.

Another element of the proposal is that in times when nominal interest rates on bank accounts are positive, paper money could be allowed to *appreciate* relative to electronic money, until it reached par again. Even with a steady state inflation rate of zero that makes real and nominal interest rates the same, it should be possible to return to par after a time as long as the long-term average real interest rate is positive (or bigger than the desired spread between the interest rate on electronic money and paper money.) Thus, for example, suppose that by January 1, 2016, the economy had recovered enough that the central bank's target interest rate was now 3%, and that by then \$1.00 paper had depreciated to be worth \$.94 electronic. Then the central bank could announce the following crawling peg with appreciating paper currency:

- January 1, 2016: \$1.00 paper = \$0.94 electronic
- April 1, 2016: \$1.00 paper = \$0.945 electronic
- July 1, 2016: \$1.00 paper = \$0.95 electronic
- October 1, 2016: \$1.00 paper = \$0.955 electronic
- January 1, 2017: \$1.00 paper = \$0.96 electronic

This makes the effective interest rate on paper currency approximately 2%/year, which is safely below the target rate of 3%/year. In following years, the paper dollar could be allowed to continue to appreciate back up to par.

9. The Urbanization Project’s Elucidation of a Crawling Peg Designed to Generate Substantial Seignorage Without Inflation. At a small working group of NYU’s Urbanization Project (billed originally as a meeting on the “Cashless Society,” and including Paul Romer and Miles Kimball, among other participants) that met on November 30, 2012, two variants of the crawling peg were discussed. The one above in which, assuming positive steady-state real rates, there is an eventual return to par between electronic money and paper money in normal times, and another variant for use in environments that have large underground economies that are difficult to tax. In such an environment, paper currency--which is advantageous for participants in the underground economy—would continually depreciate at a rate meant to generate substantial revenue but stop short of leading those in the underground economy to primarily use a foreign currency or some type of commodity money instead of the depreciating domestic paper currency. (There might be border controls on the importation of foreign paper currency, without any restrictions on well-documented electronic accounts in foreign money.) Since there is widespread use of domestic paper currencies even in countries with substantial inflation, it should be possible to generate quite a bit of seignorage revenue. The interesting thing about this kind of seignorage revenue is that it is at least theoretically consistent with zero inflation in the unit of account: electronic money. Although the temptation using monetary policy to push the economy above the natural level of output would continue to provide a temptation to raise inflation, in a system with a crawling-peg exchange rate, the desire for seignorage need not by itself create a temptation toward higher inflation.

10. Options for the Relationship Between International Exchange Rates and Domestic Exchange Rates Between Paper Currency and Electronic Money. The exchange rate between paper currency and electronic money could interact with international exchange rates in various ways. Robert Eisler imagined a fixed exchange rate between “bank money” (the early 20th century equivalent of electronic money) in different countries, with a flexible exchange rate between bank money and currency within each country. For the most part, Miles Kimball envisions flexible exchange rates between countries, but a pre-announced crawling peg between electronic money and paper money within a country. However, in “How the Electronic Deutsche Mark Can Save Europe,”¹² Kimball proposes the introduction of an electronic Deutsche mark for Germany, with the euro continuing to serve as the paper currency for Germany. At least to begin with, the electronic euro and the paper euro would remain at par relative to each other. In this setup, the crawling peg between the electronic Deutsche mark and the euro would serve two functions: adjusting international exchange rates *and* avoiding a tight zero lower bound for Germany. If the European Central Bank retained authority to issue both electronic Deutsche marks and euros, there would be no problem in defending the announced crawling peg. (That is, in a “one central bank, multiple fiat currencies” system, the

¹² <http://blog.supplysideliberal.com/post/46584993288/quartz-7-how-the-electronic-deutsche-mark-can-save>

announced exchange rate between the fiat currencies would be as easy to maintain as the 5 to 1 exchange rate between \$1 bills and \$5 bills. Financial firms would be allowed to freely exchange euros for electronic Deutsche marks or Deutsche marks for euros at the announced exchange rate.

Establishing a new electronic Deutsche mark as the unit of account within Germany would take some extra effort, but should be possible. If so, the crawling peg between the electronic Deutsche mark and the euro would allow smooth adjustment of relative prices between Germany and the rest of the eurozone. But in addition, if the one-central-bank, multiple-currencies system makes the crawling peg fully credible, anticipated changes in the exchange rate could have stimulative effects for Germany. Here is Kimball's description of those effects, and why they depend on the absence of a paper Deutsche mark at par with the electronic Deutsche mark:

While prices in Germany would be steady in terms of the electronic mark, they would be gradually increasing, according to plan, when measured in euros. The electronic mark would also tend to rise relative to other currencies, while the euro would tend to fall relative to other currencies. These exchange rate changes would do two things. First, goods in the rest of Europe gradually become more competitive as the German goods they are competing with rise in their euro-equivalent price, and as the euro fell relative to other currencies. Second, knowledge that German goods were rising in price would encourage buyers within the rest of the euro zone and around the world to buy German machine tools and other durable exports *now* instead of later when those goods would be more expensive. This desire by foreign buyers to accelerate their purchase of German machine tools and other durables due to the *upward trend* in the electronic mark's value would provide a powerful stimulus to the German economy that would counteract the short-run negative demand effects from the higher *level* of the electronic mark's value. But this buy-it-now effect would fall prey to higher interest rates if a reintroduced paper mark were there, pushing up interest rates.

11. Inhibiting Massive Paper Currency Storage without Changing the Rate of Return on Long-Term, Small-Scale Paper Currency Storage. A variety of methods could be used to inhibit massive paper currency storage, without fundamentally changing the rate of return on long-term, small-scale paper currency storage: paper currency withdrawal limits or charges, and taxes on commercial storage of paper currency and storage of paper currency by banks and other firms (as opposed to households). Issuing only small notes has also been suggested. (See Frances Coppola's blog post "The Problem of Cash"¹³ and the Twitter discussion at https://twitter.com/Frances_Coppola/status/290595551903375360.) This might be useful as a way to see whether methods that can more powerfully reduce the rate

¹³ <http://coppolacomment.blogspot.co.uk/2013/01/the-problem-of-cash.html>

of return on paper currency need to be put into effect to allow a low enough target interest rate. On this, see the discussion in Miles Kimball “Getting Leeway on the Lower Bound for Interest Rates by Giving the Central Bank Standby Paper Currency Policy.”¹⁴

B. Discussion of the Relative Merits of Various Ways of Eliminating the Zero Lower Bound.

Because of Keynes’s treatment of stamped currency in the *General Theory*, many economists have been aware of this option. One obvious difficulty is the cumbersomeness of charging the taxes on the paper currency. However, Marvin Goodfriend argues that modern technology would make this easier.

Modern technology also makes the abolition of paper currency thinkable in a way it wasn’t in earlier eras. People have raised privacy concerns here. There are some transactions for which people want to leave less of an electronic trail. Even to the extent that such transactions are illegal transactions one would want to suppress, the strong desire in certain circumstances for the secrecy that paper currency afford suggests that people would find some substitute if an attempt is made to abolish paper currency entirely.

A crawling peg exchange rate between paper currency and electronic money can be implemented with only an awareness of the date and the appropriate exchange rate for that date. The exchange rate between paper currency and electronic money should be able to return to par after a time and subsequently remain there as long as the central bank is targeting an interest rate above zero. Thus, for periods of time in between serious recessions, daily life under a system with an exchange rate between paper currency and electronic money could remain exactly as now. The exchange rate would only come into play when the central bank felt it needed a target rate below zero. In small recessions, that might not happen at all. In moderate recessions, the cumulative depreciation of paper money needed to sufficiently relax the zero lower bound could be quickly reversed in a return to par. In serious recessions, the longer period away from par would be justified by a quicker recovery.

IV. Reevaluating the Costs and Benefits of Inflation in the Absence of a Zero Lower Bound

It is useful to reconsider the costs and benefits of higher or lower long-run inflation targets in the absence of a zero lower bound (that is, with a lower bound that the central bank can always make lower than the target interest rate they want to set). A standard list of the costs of inflation (in this case from Greg Mankiw’s *Brief Principles of Macroeconomics, 6th edition*) provides a good starting place for

¹⁴ <http://blog.supplysideliberal.com/post/41696676783/getting-leeway-on-the-lower-bound-for-interest-rates-by>

organizing this discussion. We will pursue the discussion below as if the zero lower bound has been eliminated by an exchange rate between paper currency and electronic money, but some of what we say below will still hold true if the zero lower bound has been eliminated by one of the other methods discussed above.

A. Costs of Positive Inflation.

1. Causing People to (Falsely) Believe Their Real Wages are Lower than Their Real Wages Would Be in the Absence of Inflation. At one level, this is not obviously a cost, since it is a false belief, but it indicates some of the confusion that inflation causes. This cost of upsetting people falsely is to some extent the flip side of a benefit below—allowing employers to cut real wages while having part of the blame be directed at another target.

2. Shoeleather Costs—the Costs of Economizing on Money Balances. The costs of economizing on certain kinds of money actually arise from interest rate differentials. If the interest rate on paper currency is under the central banks control, if desired, it is actually possible to maintain quite small interest rate differentials between paper currency and electronic money in bank accounts. Negative interest rates on paper currency will not necessarily lead to low paper currency balances if interest rates on electronic money in bank accounts are almost as low as the interest rate on paper currency.

This is an important point. The Friedman rule of keeping shoeleather costs down by having the same interest rate on bank accounts and on paper currency is actually easier to maintain in a system in which the interest rate on paper currency is under the central banks control. If paper currency is always at par relative to electronic money, keeping the nominal interest rate at zero in a long-run steady-state with a positive real interest rate would require deflation, and any fall in the natural level of interest would make the zero lower bound an issue. But in principle, controlling the exchange rate between paper currency and electronic money allows positive nominal interest rates on electronic money to be matched by comparable, or nearly comparable, interest rates on paper money through anticipated appreciation. Thus, the Friedman rule is attainable without creating a zero-lower-bound problem. However, one cost of attaining the Friedman rule in this way would be the inability to go back to par. Over time, with a zero inflation rate and positive average real rate, matched by appreciation of paper currency, paper currency would appreciate so far above par, it would never return.

3. Menu Costs. Zero inflation keeps menu costs at a minimum. Higher or lower inflation leads to higher menu costs than zero inflation.

4. Relative-Price Variability and the Misallocation of Resources. Zero inflation keeps inflation-induced relative price variability at a minimum. Higher or lower inflation leads to some leapfrogging of prices by other prices, resulting in off-kilter relative prices, and consequent distortions.

5. Inflation Induced Tax Distortions. To the extent the tax system has been designed as if there were no inflation, it will function more nearly as intended if inflation is, in fact, zero. Higher or lower inflation will then lead to unintended effects, some of which are quite powerful, particularly in the area of capital taxation. Note that it is not just the tax code at issue here. Tax policy is also guided in part by income distribution calculations that often include the part of nominal returns that merely makes up for inflation.

6. Confusion and Inconvenience. Mankiw writes on p. 260 of *Brief Principles of Macroeconomics*:

Imagine that we took a poll and asked people the following question: “This year the yard is 36 inches. How long do you think it should be next year?” Assuming we could get people to take us seriously, they would tell us that the yard should stay the same length—36 inches. Anything else would complicate life needlessly.

Although it is traditional in economic models to assume that people are infinitely intelligent at making economic decisions, and that therefore anything that just takes a little of math to correct for is costless, in the real world, information processing is costly, and confusion engendered by inflation can be a serious cost, though one that is difficult to precisely quantify.

7. Arbitrary Redistribution. Any departure of inflation from its expected value can create arbitrary redistributions. Because zero is a focal point for inflation in a way that, in the absence of a zero lower bound is unlikely to be changed in the future, a long-run target of zero inflation should minimize unexpected inflation in the long run. That is the more true for countries that begin with a zero rate of inflation. For countries that start with, say, a 2% inflation target, any change from that 2% target to a lower long-run target may cause some arbitrary redistribution.

B. Benefits of Positive Inflation.

1. Avoiding the Zero Lower Bound. This is no longer an important reason for positive inflation if the zero lower bound has been eliminated or tamed.

2. Making it Easier for Firms to Adjust Real Wages Downward. As noted above, to the extent workers blame “inflation” for lower real wages rather than firms that allowed real wages to slip, positive inflation makes it easier for firms to adjust real wages downward. It has been argued that making wages more flexible downward can be helpful in bringing an efficient equilibrium to the labor market. To make this argument work requires not only worker confusion between nominal and real, but also a special worker resistance to reductions in the wage in nominal terms greater than their desire for increases in the wage in nominal terms.

To the extent that downward nominal wage rigidity does reduce economic welfare, eliminating the zero lower bound on nominal interest rates does not eliminate the benefits of positive inflation in “greasing the wheels of the labor market.” Because

all of the other costs of inflation are minimized at zero, the importance of downward nominal rigidity in gumming up the labor market would then be the single most important determinant (other than historical inflation rates) of which countries should have a positive long-run inflation target and which should have a long-run inflation target at zero, or very close. In the following section [NOT COMPLETED YET], we look at evidence about which countries might face higher levels of downward nominal rigidity in wages.

It should also be noted that the degree of downward nominal rigidity of wages may be influenced by policy. For example, tax policies could encourage having a significant portion of pay in the form of annual bonuses, which are easier to adjust downward than regular monthly wages. Martin Weitzman has proposed as much in his book *The Share Economy* (<http://www.amazon.com/The-Share-Economy-Conquering-Stagflation/dp/0674805836>).

V. Macroprudential Concerns

In addition to the usual concerns of creating asset bubble by monetary stimulus, negative nominal interest rates may disrupt current business models of financial firms. In standard models, only real returns should matter after the elimination of the zero lower bound. As Willem Buiter writes in “The Wonderful World of Negative Nominal Interest Rates, Again”¹⁵

It helps not to confuse nominal and real interest rates in this discussion. Real interest rates (inflation-corrected interest rates), on nominal instruments have been negative (ex-post) on many occasions in our inflationary past.

Moreover, in principle, financial firms should care about *spreads* between various interest rates, rather than absolute levels, customers may currently have expectations of receiving at least zero returns that financial firms can no longer meet without incurring negative profits. From this point of view, substantial negative interest rates that make it clear to everyone—firms and customers alike—that existing business models must be modified may actually cause less trouble than small negative rates that create a temptation for some financial firms to cling to ultimately untenable business models.

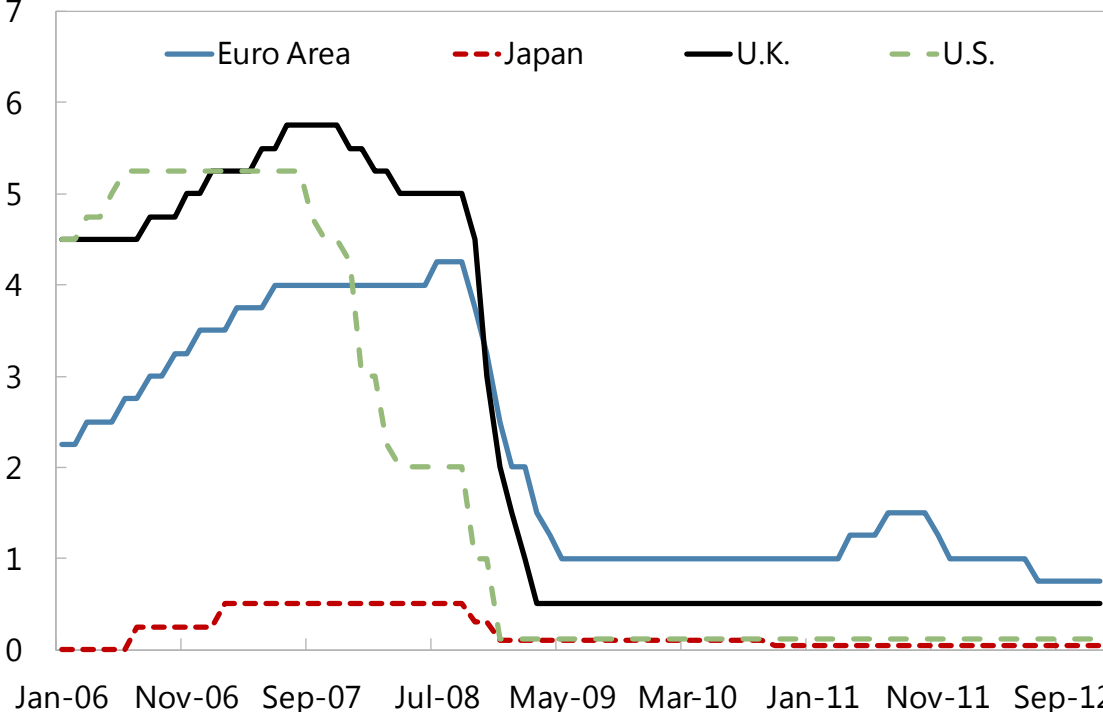
Regardless of the details of how financial firms react, it will be safer for the macroeconomy as a whole if financial firm requirements for equity financing on the liability side of their balance sheets (“capital requirements”) be sufficient to insure as much as possible that any mistakes made by financial firms in adapting to negative nominal interest rates come at the expense of shareholders rather than the economy more general. High equity requirements are also helpful in avoiding any serious harm from the side effects of stimulative monetary policy more generally.

¹⁵ <http://blogs.ft.com/maverecon/2009/05/the-wonderful-world-of-negative-nominal-interest-rates-again/#axzz2HiltTlo2>

It should be noted that, except for the effects of nominal illusions, negative nominal interest rates represent the use of the best-understood tool of monetary policy: cutting interest rates. By contrast, in the presence of a zero lower bound, large-scale purchases of long-term and risky assets—to the extent they work at all—operate on spreads in ways that have little-understood effects. Thus, any risks from negative nominal interest rates due to nominal illusion must be weighed against the side-effects that come from changing spreads as opposed to moving the entire term- and risk-structure of interest rates up and down in tandem, as cutting the short-term safe rate does in standard models when there is no zero lower bound.

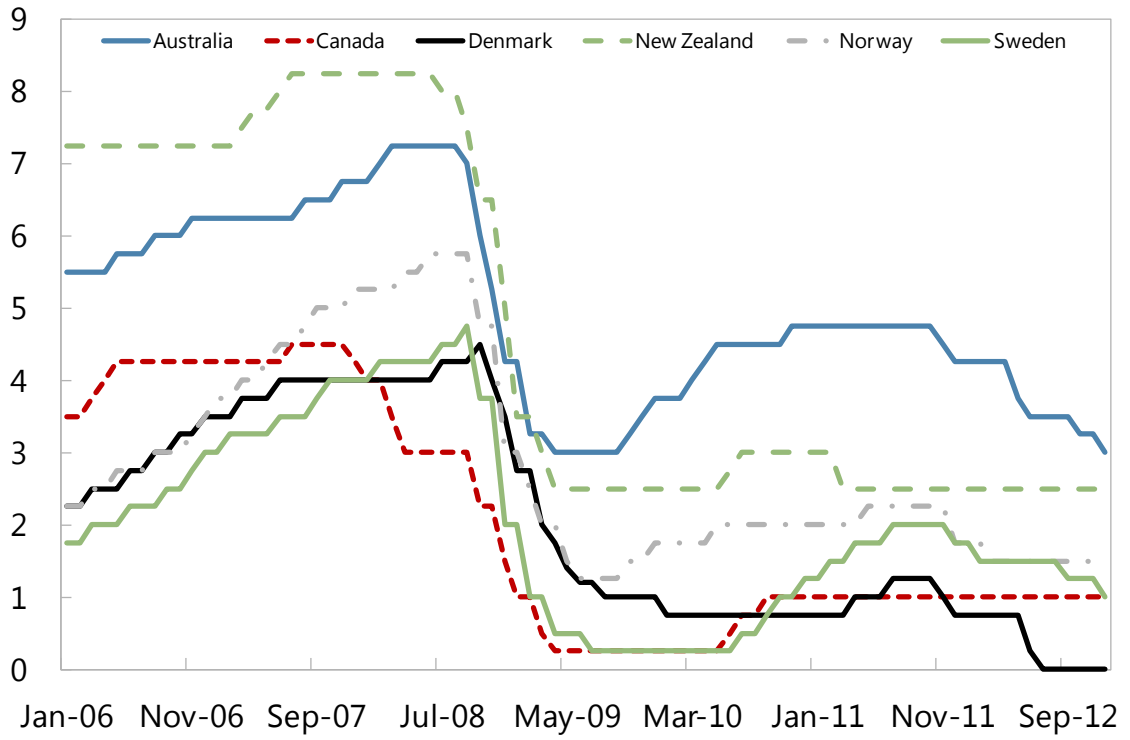
In addition to macroprudential concerns proper, there are no doubt some legal and regulatory details that need to be addressed because of current law or regulation assuming that interest rates will always be nonnegative. Since it is unlikely that the zero lower bound will be eliminated without at least a few months of deliberation, there should be adequate time to figure these details out. Nevertheless, it might be better to figure out these details sooner (even before it is clear that a new paper currency policy will, in fact, be adopted.) rather than later.

Figure 1: Policy Rates in Major Advanced Countries (2006-2012)



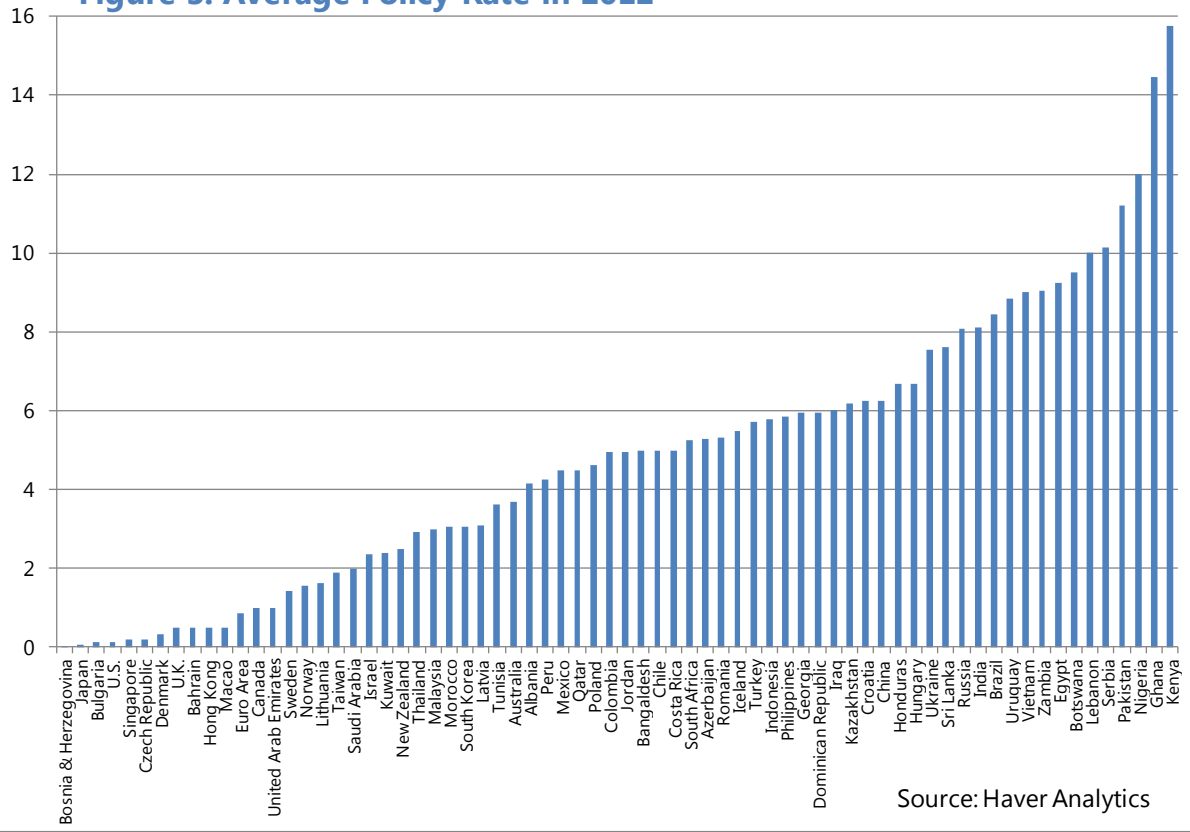
Sources: Haver Analytics

Figure 2: Policy Rates in Other Advanced Countries (2006-2012)



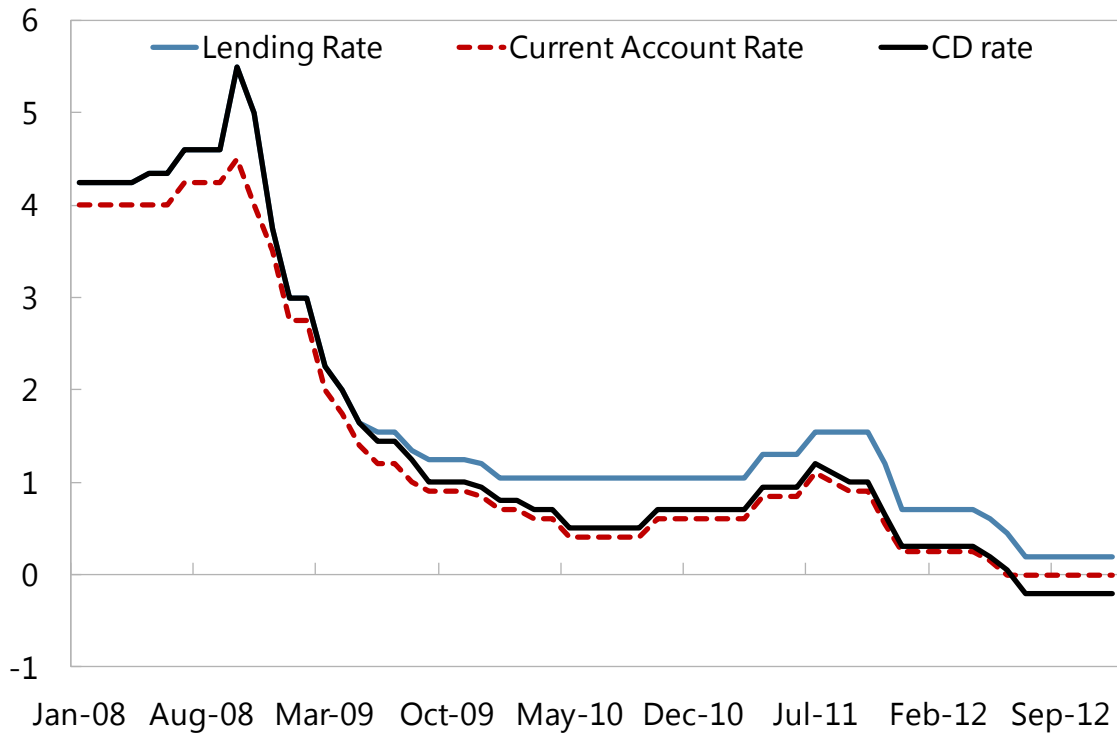
Sources: Haver Analytics

Figure 3: Average Policy Rate in 2012



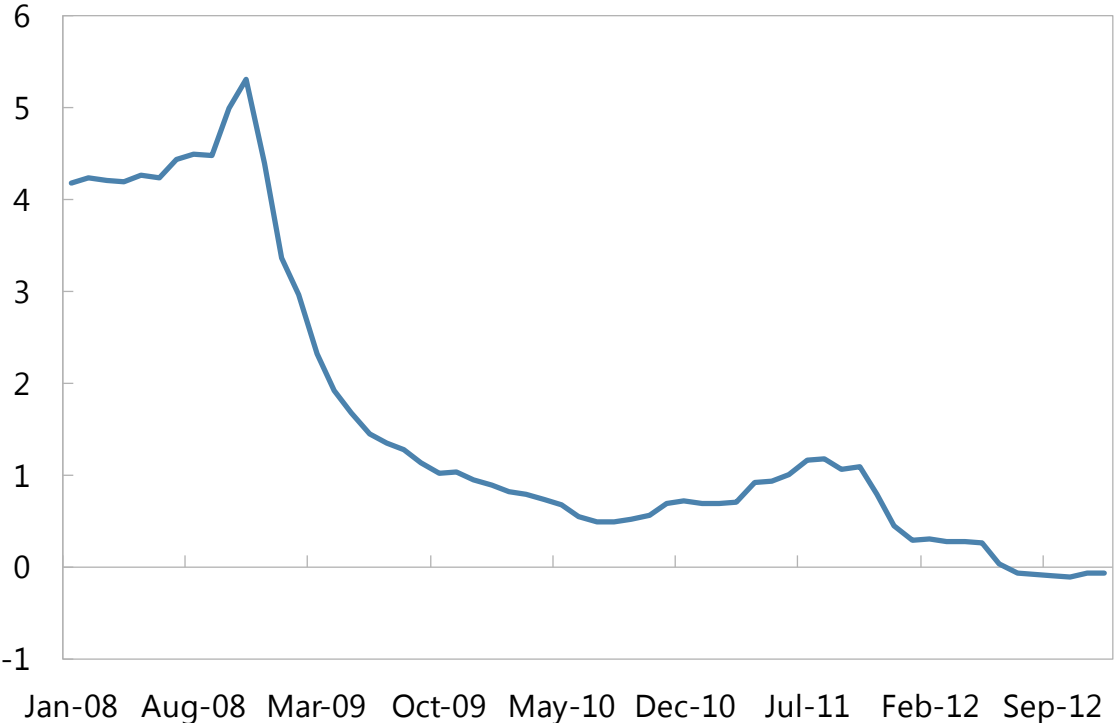
Source: Haver Analytics

Figure 4: Denmark Rates (End of Period, % per annum)



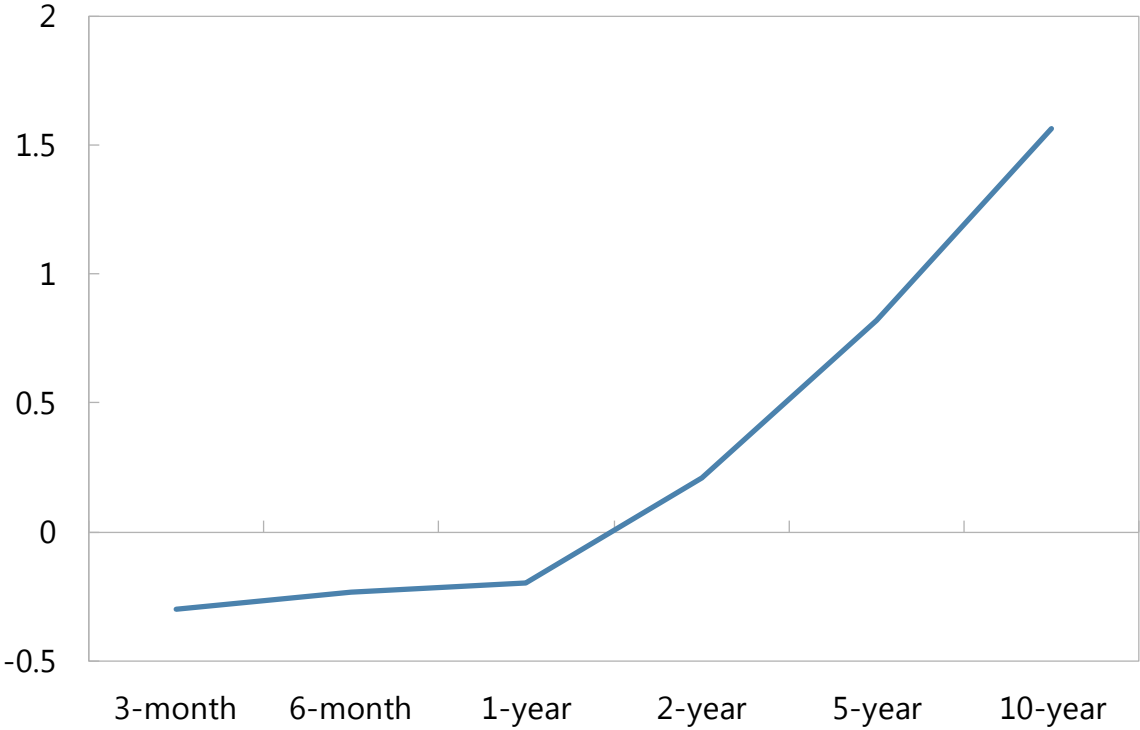
Sources: Danmarks Nationalbank

Figure 5: Denmark Interbank Interest Rates (next-day uncollateralized)



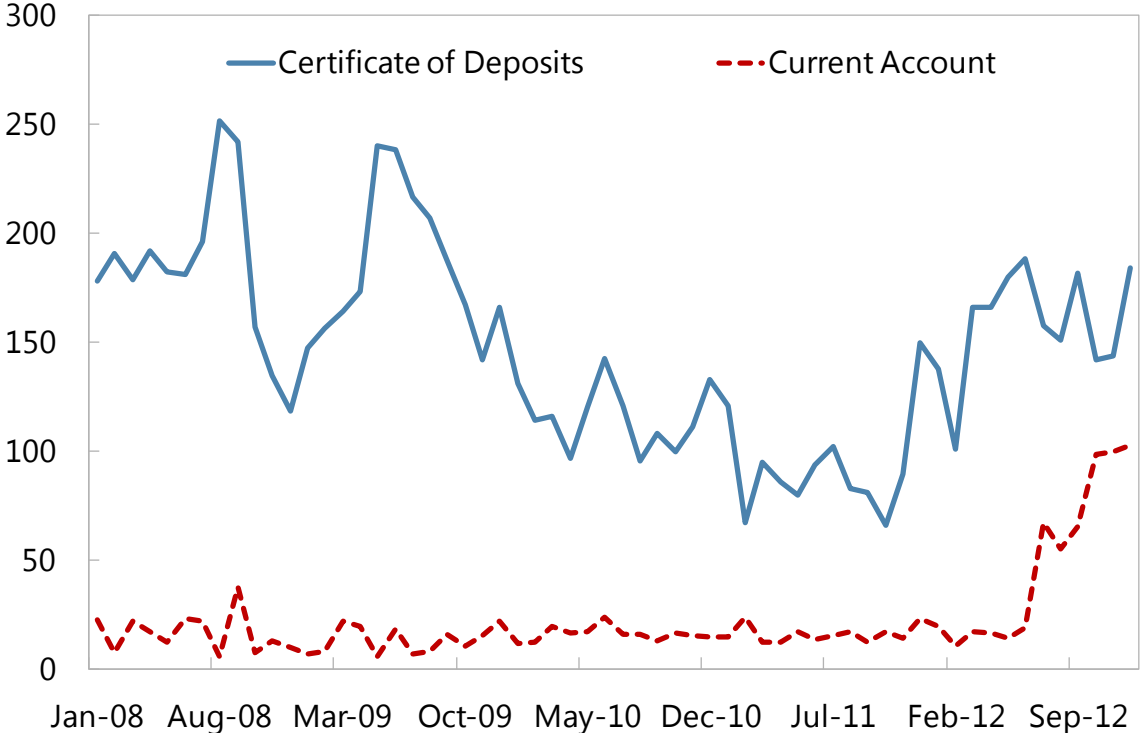
Sources: Danmarks Nationalbank

Figure 6: Government Yield Curve for Denmark (January 2013)



Sources: Bloomberg

Figure 7: Deposits of Commercial Banks at the Danmarks Nationalbank



Sources: Danmarks Nationalbank