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### **ABSTRACT**

Modern technology provides the basis of an efficient low-cost electronic payments as an alternative to the current system where fiat money is the medium of exchange. This paper explores possible macro-economic implication, showing how such a financial system might enhance government's ability to control the level of aggregate demand. As in other arenas, in second-best situations with uncertainty, systems where there is an attempt to directly control quantities directly may perform better (e.g. have less volatility) than those using prices and other indirect control mechanisms. The paper identifies conditions under which in a system of electronic money, macroeconomic variability is lower when the level and direction of credit creation is directly controlled, through appropriately designed credit auctions, than in a system of indirect control of, say, investment via the interest rate. This is especially important since much macro-economic instability is associated with instability in credit creation and in the fraction allocated to newly produced goods and services. The paper also explains how, in an open economy, in a system of electronic money, credit auctions combined with trade chits might enable the control of net exports, again enhancing macro-stability. Finally, we explain how under a system of electronic money, the rents that are currently associated with credit creation and that arise from bank franchises—that constitute a form of appropriation of the returns from trust in the government and its ability and willingness to bail-out banks in the event of a crisis or bank run—could be appropriated by the government to a greater degree than at present.

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## Macro-economic Management in an Electronic Credit/Financial System

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There has been a long tradition in economics, dating at least back to Minsky (Minsky, 1992) tracing macro-instability to excessive volatility in credit creation and to volatility in the fraction of credit going to the purchase of pre-existing assets (like land) rather than to the purchase of newly produced goods and services (Stiglitz, 2016c).<sup>2</sup> In open economies, volatile cross-border flows of short-term capital have led to volatility in exchange rates and trade flows, again leading to macro-economic volatility.

Part of the problem is that policymakers have been relying on the use of price variables (interest rates) to control macro-economic aggregates (investment, consumption, net exports), in a world in which the relationship between those price variables and the variables of interest is uncertain and variable. Monetary authorities previously attempted to control another quantity variable (the quantity of money), which too was only weakly related to the variables of interest.<sup>3</sup>

Modern technology provides the basis of a new low-cost “medium of exchange”-- an electronic payments system. This paper explores a natural question that then arises: how might such a change in our monetary system affect macro-economic management. This paper describes new opportunities that a fully electronic system might provide for enhanced macro-stability through credit auctions and trade chits.<sup>4</sup> The remainder of

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<sup>2</sup> Similarly, there is an extensive literature explaining some of the volatility in credit creation, focusing, for instance, on banks as risk-averse firms, affected by shocks to their balance sheets and risk perceptions, which induce variations in their ability and willingness to supply credit. See Greenwald and Stiglitz (2003) and Stiglitz 2016b.

<sup>3</sup> See, for instance, Stiglitz (2016c).

<sup>4</sup> As has happened in many areas of business practices, computerization and electronic technology forces an often long overdue rethinking of practices. While credit auctions and trade chits could have been introduced even without e-money, the enhanced ability to monitor flows

this introduction describes the basic ingredients of the system, while Part I focuses on its credit creation mechanism in a closed economy. Part II then extends the analysis to an open economy.

### *Creating a 21st-Century Financial Transactions System*

Money serves multiple purposes. One of them is as a medium of exchange. The world has several times made a change in the prevailing medium of exchange. Gold was once used as a medium of exchange; then, at least in the United States, there was a move to the bimetallic standard, where gold and silver were used, and finally we moved to paper (or “fiat”) money.

For years, it has been recognized that a move away from currency to electronic money might enhance the efficiency of the payments mechanism. Our payments mechanism has already changed dramatically. We have gone a long way towards an electronic payments mechanism.<sup>5</sup> Electronic money is more convenient for people on both sides of the transaction, which is why it has become the dominant form of payment. It saves the costs of printing money, which has increased as the sophistication of counterfeiters has increased. Electronic money has a further advantage, especially in countries where small businesses predominate—it significantly curtails the extent of tax avoidance.<sup>6</sup>

This paper, though, focuses on the question of whether, in such a system, the ability of government to control the level of aggregate demand is enhanced, through enabling

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and to organize markets that e-money and digitalization provides increases the potential gains that might arise from these institutional innovations.

<sup>5</sup> One of the reasons that there has not been more use of the electronics payments has to do with market power. Electronic transfers are extraordinarily cheap, but banks and credit card companies charge prices for the service that are considerably in excess of marginal or even average costs. Regulators, legislatures, and courts in antitrust actions have begun intervening to curtail the fees and certain other abusive practices.

<sup>6</sup> Cyber security is one of the key problems faced in modern electronic payments mechanisms. The advantages of electronic transactions appear, nonetheless, to be significant, explaining why even with monopoly pricing, there has been a shift toward this system.

institutional innovations that might affect its ability to control the magnitude and direction of credit creation and the magnitude and volatility of the trade deficit.

The key move in going from a current *mostly electronic* payments system to a *fully electronic payments system* is the abolition of paper money. Today, an individual with money in his bank system “withdraws” money from his bank account by converting it into cash, into paper money. But what happens if there is no paper money? With a fully electronic monetary system, the money *inside* a country’s banking system is effectively “locked in.” It simply can’t be taken out of the country’s banking system.<sup>7</sup> But anybody can transfer the money in his bank account to that of anyone else. Thus everybody has, in effect, full use of his money.

Most individuals today have accounts; only the very poor are “unbanked,” and in recent years governments and NGOs, like the Gates Foundation, have made great efforts to bank the unbanked. In most countries, government pension payments are now transferred through bank accounts, partly to reduce the risk of stolen checks, partly to reduce the charges that are sometimes imposed by check-cashing services. Thus, implementing a fully electronic banking system today is clearly manageable.<sup>8</sup>

### **Part I: E-money in a Closed Economy**

To understand better the possible advantages of e-money, we have to review the current system of credit creation (section 1) and the limits of monetary policy under the current payments mechanism (section 2). Finally, section 3 describes the basics of credit creation in an economy with e-money, while section 4 elaborates on several critical details.

#### **1. Fiat money and fractional banking**

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<sup>7</sup> The major exception, for the purchase of goods and services from abroad, is discussed in Part II.

<sup>8</sup> The reluctance of merchants to take debit or credit cards for small purchases arises from the high fees charged, related to the market power of the credit and debit card companies, not to high real costs.

The invention of money, enabling more efficient exchange than simple barter, is viewed as one of the great advances of mankind.<sup>9</sup> Over the centuries, the medium of exchange evolved. For long periods, gold (including gold coins) was the main medium of exchange. A big advantage of the use of fiat money was that its supply did not seem quite as capricious as that of gold: When gold was used as the medium of exchange, when there was a large discovery of gold—or when the gold supply increased as Spain conquered the new world—there would be inflation, as the price of gold would rise relative to other goods; if there were few gold discoveries, then there would be deflation. Both caused problems. Deflation, for instance, when it was unanticipated, would redistribute income from debtors to creditors. The resulting inequality as well as balance sheet effects on firms, can depress aggregate demand.<sup>10</sup>

While the modern financial system based on fiat money doesn't suffer from the vagaries of gold discoveries, it has sometimes suffered from something else: volatility in the creation of money and credit by the banking system, giving rise to the booms and busts that have characterized the capitalist system. Minsky put the fluctuations in credit creation at the center of his theory of macro-economic fluctuations, and a large body of other work, earlier, contemporaneous, and later, has similarly done so.<sup>11</sup>

### *The bases of bank credit creation*

The traditional view of banking was based on a primitive agriculture economy. Farmers with excess seed—with harvests greater than they wanted to consume or plant the next

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<sup>9</sup> See Weatherford (1997) and Ferguson (2008).

<sup>10</sup> See Greenwald and Stiglitz (1993b). These effects can arise just from inflation being less than was anticipated. Recent attention on the risk of deflation in Europe and Japan highlights the widespread recognition of the adverse effects of deflation and disinflation. America's election of 1896 was fought on the issue of the money supply. The deflation of the period imposed significant hardships on farmers, and debtors wanted to increase the money supply by moving from gold alone to gold and silver, a bimetallic standard.

<sup>11</sup> See, e.g. Minsky (1992), Kalecki (1939). Beginning in the mid-1980s, this became a major focus of my own research with Bruce Greenwald. Greenwald and Stiglitz (1987, 1988a, 1988b, 1990, 1991, 1993a, 2003).

season—could bring the seed to the bank, which would lend, at interest, the seed to some farmer who wanted more seed than he had, either for consumption (say, because he had a bad harvest that year) or planting. The bank had to have seed deposits in order to lend. In this view, the bank was *intermediating* between savers, those who had more seed than they wanted, and borrowers, those who wanted to consume or invest more than they had.

The evolution of the banking system from the primitive corn economy toward its modern form is interesting and informative. Early banks were really based more on gold deposits than on corn deposits. Those with more gold than they wanted to spend put it in the bank, and the bank lent it out to others. Soon, banks discovered that they could create pieces of paper, claims on gold, that others would accept, and that they could produce more of such pieces of paper than they had gold, in the knowledge that not all holders of these pieces of paper would ask for their money simultaneously. As it gave gold to some who asked for it, it would receive gold from others.

Occasionally, there would be a panic when holders of these pieces of paper worried whether the bank could fulfill its promises, and, of course, when they panicked and all went to the bank to demand their gold, there was not enough to satisfy their demands. The banks would go bankrupt, and the economy could be thrown into a depression.

These problems became worse with the move to fiat money. Banks effectively increase the supply of money by increasing the supply of credit. From the perspective of any individual bank, deposits and loans simply represent two sides of the balance sheet. They can lend a fraction of whatever money is deposited in their bank. But that “money,” when spent, becomes a deposit in another bank, which in turn can lend a fraction of that amount. The result of this *fractional* banking system is that there is a money multiplier.

Deposit insurance was invented to prevent bank panics: the government explicitly stood behind the banks' promises.<sup>12</sup> This gave greater faith that the promises would be honored (so long as there was faith in the government), and this in turn reduced the likelihood of a panic. But if the government was to provide these guarantees, this insurance, it had to make sure that the bank was acting responsibly—for example, lending out money to people who could actually pay it back, not lending to the owners of the bank and his friends, and holding enough money in reserves.

One can understand government taking on this new role, partially as a result of the magnitude and frequency of the panics and downturns in the market economy in the 19th and early 20th centuries. Moreover, as advanced countries, like the United States, transformed themselves from agricultural economies to industrial economies, with an increasing fraction of the population dependent on manufacturing and other nonagricultural jobs, these economic fluctuations took an increasing toll. With the extension of the franchise and increasingly democratic engagement, it became increasingly difficult for government to ignore macro-economic volatility and its consequences.

### *Market intervention in banking*

Markets on their own equilibrate the demand and supply of seeds, so there was really little need for government intervention in the primitive agriculture economy. The interest rate provided the natural mechanism: if for some reason,—the supply of seeds—exceeded investment (the demand for seed), by lowering interest rates, the supply of seeds would fall and the demand for seeds would increase, until the two were equilibrated.

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<sup>12</sup> Gerry Caprio, with whom I worked at the World Bank and who studied government bank rescues around the world, was fond of saying that there are two kinds of countries—those who have deposit insurance and know it, and those who have deposit insurance and don't know it. Sweden, before its financial crisis in the 1990s, had no deposit insurance, but it rescued its banks nonetheless. In the 2008 crisis, suddenly deposit insurance was extended to accounts that had not been fully insured before.



But this reasoning misses the nature of credit in the 21st century. In a modern economy, banks don't intermediate between "savers" and "investors," as claimed in the standard textbook models. Banks effectively create credit out of thin air, backed by general confidence in government, including its ability and willingness to bail out the banks, which is based in part on its power to tax and borrow.<sup>13</sup> But the *maximum* amount of credit that they can create is controlled by the central bank, through its reserve requirements; and the central bank can also attempt to affect the magnitude of credit creation indirectly, by changing the opportunity cost of lending, the return on T-bills.<sup>14</sup>

## 2. The limits of monetary policy under current arrangements

In a modern economy, central banks regulate banks' creation of credit only indirectly. They are supposed to do it *in just the right amount*, so there is a Goldilocks economy, neither under- or overheated but "just right." It is apparent that they have often failed to do so. This has partly to do with the often noted "long and variable lags" associated with monetary policy, with monetary authorities having to base their actions on predictions concerning the future course of the economy; the central bank has to forecast what GDP will be over the next eighteen months or so, to know how much money to create. There is always error in such forecasts.

But more important, for our purpose, is "instrument uncertainty," the "noise" in the link between what monetary authorities do and GDP.<sup>15</sup> Particularly after the Great

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<sup>13</sup> See J. E. Stiglitz (2016b), Turner (2015).

<sup>14</sup> More broadly, all of the regulations affecting banks, e.g. capital adequacy and liquidity requirements, affect credit creation. See Greenwald and Stiglitz (2003).

<sup>15</sup> Lags are important, because in their absence, monetary authorities could observe the consequences of, say, a particular level of M or interest rate, and adjust policy in response. With long lags, the danger is that monetary policy will be tightened, just when it should be loosened. Longstanding critics of discretionary policy argued that that was typically the case, so that it would be preferable to stick to a simple rule, and not attempt countercyclical policy. The evidence, however, is that discretionary macro-economic policy has resulted in more economic stability in the period after World War II. (See Clarida, Gali and Gertler, 1998, and references therein.)

Recession, the link between standard monetary variables and economic activity seemed weak:

- (i) Standard monetary theory held that the demand for money,  $M$ , was a function of the (nominal) value of produced goods and the interest rate (the opportunity cost of holding funds.) Thus, except in certain limiting cases, an increase in the money supply (which would follow from an increase in base money, the assets of the central bank) led to lower interest rates, and lower interest rates led to more investment, and possibly consumption. But each of the underlying hypotheses of standard money theory was questionable—at least they have been for the past quarter century: Most money is interest bearing, so the interest rate was not the measure of opportunity cost; most transactions are not directly related to the purchases of newly produced goods and services but rather to buying and selling of pre-existing assets; and credit, not money, is required for the purchase of goods and services. With the central hypotheses of standard monetary theory no longer being true, there was little reason to have much faith in the conclusion that there was a direct and strong link between the money supply and economic activity.
- (ii) The theoretical doubts about the underpinnings of standard monetary theory had their counterpart in the empirics: In the recent crisis, increases in the monetary base did not translate into increased lending and especially, it did not translate into increased investment. More broadly, the relationship between  $M$  and economic activity has exhibited considerable instability over the past forty years, partly as a result of advances in technology and the banking sector, with “innovations” like money market funds. This led to a shift of focus by monetary authorities: in the belief that what mattered for

the determination of aggregate demand was the interest rate<sup>16</sup>, they decided to target that directly, rather than indirectly through controlling M.

(iii) The link between the interest rate and real economic activity has proven just as elusive as the link between money and real economic activity (see Stiglitz, 2016c). One reason, already noted, is that what matters is not just the interest rate, but the availability of credit<sup>17</sup> (credit is often rationed) and the terms at which credit is available (e.g. collateral requirements). A second reason is that the interest rate that matters is the lending rate (for borrowers with different risk characteristics), and the spread between that and the T-bill rate—upon which monetary authorities typically focus—is endogenous. (See Greenwald-Stiglitz, 2003.) Thirdly, even in the absence of credit rationing, there are several first order variables affecting, say, investment or consumption, including expectations of future sales and technology, changes in market power (so that the relationship between marginal and average returns may vary), and perceptions of risk. Some of these variables, such as perceptions of risk, may even be affected by how monetary policy is conducted.

Just as expanding the monetary base did not have the stimulative effect expected, or at least hoped, so too for lowering interest rates; and this has been true even as increasingly innovative monetary policies have been tried, including crashing through the zero lower bound barrier to negative interest rates.

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<sup>16</sup> Though it was presumably the real interest rate through which economic behavior was affected in standard models, so long as (expectations) of the real interest rate did not change too rapidly, controlling the nominal interest rate would suffice.

<sup>17</sup> Though, to be sure, that was also an older literature arguing that what mattered was the availability of credit (the Bank of England's availability doctrine (see Smith and Micksell, (1957))), those ideas had been put on sounder macro-economic footing by the development of the theory of credit rationing (Stiglitz-Weiss, 1981), and subsequently extended to macro-economic settings, sometimes on conjunction with equity-rationing as well. (See, e.g. Stiglitz-Weiss, 1992 and Greenwald and Stiglitz (2003) and the studies cited there.)

(16) But even the stability of the link between credit and macro-economic activity has come to be questioned: Increases in lending do not translate into increases in purchases of newly produced goods and services—and therefore into increases in the level of aggregate demand and economic activity. Credit creation also goes to the purchase of pre-existing assets, especially land, and to financing margin on futures and other speculative transactions.<sup>18</sup> This has a direct policy implication: If monetary authorities could do a better job at directing the uses to which credit is put, then they might be better able to control the economy.

(17) In the post-crisis period, seemingly there was a new form of liquidity trap, where monetary authorities expanded banks' ability to lend, but banks did not increase lending. The phenomenon, a kind of liquidity trap, had earlier been noted in the context of other financial crises.<sup>19</sup> It was unlike the standard Keynesian liquidity trap, where households' demand for money became infinitely elastic at some point, so that it was impossible to lower the interest rate below a critical threshold, and therefore impossible to increase investment; rather, this liquidity trap arose from banks' risk aversion, and their unwillingness to extend further credit even as their ability to do so was increased. The recognition of this naturally led to a renewed focus on banks and their role in credit creation.

These insights fundamentally undermined what had developed as a consensus among macro-economists in the latter part of the twentieth century—that monetary policy should be the basis for macro-economic stabilization, leaving fiscal policy the task of balancing longer run concerns between investment and consumption and public and private spending. They also raised questions about other aspects of the pre-crisis

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<sup>18</sup> See Stiglitz (2015b, 2016b) and Turner (2015). In an open economy, it can also go to the purchases of goods abroad. See Part II.

<sup>19</sup> E.g. by Stiglitz and Greenwald (2003) in their discussion of the East Asia crisis.

prevailing wisdom, which held that Central Banks should not intervene in the allocation of credit—that should be left to the market. That presumption was based on the premise that markets were efficient in allocating resources—the first fundamental theorem of welfare economics; but that conclusion had been shown not to be true whenever information was imperfect<sup>20</sup>—and gathering and processing information was at the heart of credit allocation.

At the very least, the stability of the relationship between money, interest rates, and economic activity was questionable, making the formulation of monetary policy difficult and making monetary policy an unreliable basis for macro-economic stabilization.<sup>21</sup>

In short, even with fiat money, monetary authorities are unable to control the supply of money in such a way as to stabilize the economy. For instance, there may still be a deficiency of domestic aggregate demand—a deficiency that could seemingly be easily corrected: there are individuals and firms who would like to spend but cannot get access to credit. A near-zero interest rate does not mean businesses can get access to credit at such a rate—or at any rate. Indeed, some critics of fiat money contend that the volatility in the economy with fiat money is even greater than that with gold, implying that it might be preferable to go back to the gold standard.

### **3. Restoring domestic control over credit creation**

The previous section identified the central problem in our current system: because the central bank's control mechanisms over the purchases of produced goods and services is typically very indirect, the economy is often over- or under heated. Sometimes there is too much credit creation, leading to an excess of aggregate demand, and prices rise; there is inflation. Sometimes there is too little credit creation and too much of what credit is created goes to the purchase of pre-existing assets; as a result, there is a lack of

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<sup>20</sup> Greenwald and Stiglitz (1986).

<sup>21</sup> See, in particular, the appendix to Stiglitz (2016c).

aggregate demand, and prices fall; there is disinflation, sometimes even deflation,<sup>22</sup> and unemployment. Thus, after the 2008 crisis, there was a massive increase in liquidity, as the Fed pumped money into the economy. But relatively little of this went to buy goods and services produced in the United States, so in spite of the huge expansion of the money supply as conventionally measured<sup>23</sup>, the economy remained weak.

The electronic payments mechanism holds out the possibility of allowing a country to assert control over the supply of credit and the uses to which it can be put.<sup>24</sup> (The conditions under which the control of credit issuance leads to less volatility in GDP than the control of the interest rate are described below.)

Think of this most directly as occurring through a Government Bank. The Bank can add “money” to the payments mechanism by lending money to a small enterprise with a proven reputation that wants to make an investment. The Government Bank simply puts more “money” into the bank account of the enterprise, which the enterprise can then use to pay contractors. Of course, in providing credit there is always a risk of non-repayment, and standards have to be established for evaluating the likelihood of repayment and charging an interest rate to compensate for that risk.

In recent decades, faith in government’s ability to make such evaluations has diminished, and confidence has been placed in the private financial system. The 2008 crisis, as well as other frequent crises that have marked the last third of a century, has undermined that confidence.<sup>25</sup> Arguably, not only didn’t the banks make good

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<sup>22</sup> Deflation refers to a fall in prices, disinflation to a decrease in the rate of deflation. Either can have adverse effects on debtors, at least when not expected. Though the US has not experienced deflation since the Great Depression, Japan has had mild deflation.

<sup>23</sup> The assets of the Federal Reserve increased from around \$850 billion in 2007 before the crisis to \$4.5 trillion in 2015. There were similar increases in Japan and by the ECB. M2 increased from \$7.4 trillion to \$12.3 trillion.

<sup>24</sup> Even if this cannot be done perfectly, it is possible that it might be done with greater precision than is the case under current arrangements.

<sup>25</sup> There have been numerous instances in which widespread judgments have been questioned, including at various times those associated with over-lending to fiber optics, to fracking, to housing in a third, to Latin America or East Asia. Of course, these mistakes do not in themselves

judgments—as evidenced by the massive, repeated bailouts—but they systematically failed to fulfill what they should have seen as their major responsibility, providing credit to create new jobs and expand enterprises. By some accounts, such “real” lending amounts to just 3 percent of their activities; by others, to some 15 percent. But by any account, the activities of banks, including bank finance, has been directed elsewhere.<sup>26</sup>

There were always obvious problems in delegating the power of credit creation, backed by government, to private institutions: they could use their power to benefit their owners. If they made bad loans, the government might have to engineer a bailout. Governments tried to circumscribe the most obvious “abuses,” for instance connected lending and excessively risky lending, through regulations and supervision. But these regulations didn’t address one of the key underlying problems: credit is scarce; giving private banks the right to create credit with government backing gave rise to the possibility of the capture of enormous “economic rents.” Russia provides the quintessential example: those with banking licenses could use that power to obtain loans that enabled them and their associates to buy enormously valuable state assets, especially in natural resources. It was through the banking system that the Russian oligarchs were largely created. In Western countries, there is a need for more subtlety, but critics allege that the consequences for the creation of wealth inequality are similar, if not as extreme: banks lend money to those whom they “trust” and judge creditworthy, with collateral that they value: in short, the bankers lend money to those who are similar to themselves.<sup>27</sup> In the current system much of the “value” of the

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establish that there were flaws in lending practices or that decisions concerning whether to obtain further information were themselves “unreasonable.” They show only that *ex post* judgments were wrong. But they do not establish that *ex ante* they were unreasonable on the basis of information available at the time. But at least in some cases, such as the excessive lending to Latin America in the 1970s and to housing in the years prior to the 2008 crisis, there is a considerable body of evidence that that is the case. See, for instance, Stiglitz (2010). Indeed, in the housing crisis, there have been several findings by Courts of fraudulent behavior on the part of key market participants. See Financial Crisis Inquiry Commission (2011).

<sup>26</sup> See, for example, Kay (2015); and Turner, (2015).

<sup>27</sup> Even if banker A can’t lend to himself or his relatives, banker A can lend to the relatives of banker B, and banker B can lend to the relatives of banker A.

underlying government credit guarantee is thus captured by the private sector.<sup>28 29</sup> In doing so, the financial sector has become one of the major sources of the increased inequality (Galbraith (2012)).<sup>30</sup>

### *Credit auctions*

The government may still want to delegate responsibility for making credit decisions to private enterprises. Credit auctions provide one way of doing so, while simultaneously addressing the issues discussed in the previous paragraphs (including making it more likely that the government captures a larger share of the rents associated with the value of its credibility and guarantees) and providing for greater economic stability.

The basic idea is straightforward: the central bank (government) auctions off the rights to issue new credit.<sup>31</sup> The amounts would be added to the “money” that is within the financial system. The magnitude of net credit that it allows to be added each month will be determined by the country’s central bank on the basis of its assessment of the macroeconomic situation—that is, if the economy is weaker, it will provide more credit to stimulate the economy. The winners of the credit auction then allocate this “money”

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<sup>28</sup> This is especially so, through the privatization of gains and the socialization of losses that has become a regular feature in economies with too-big-to-fail banks. (See Stiglitz (2010).)

<sup>29</sup> Critics suggest that they have been able to do so, without performing the societal functions that banks were supposed to perform e.g. lending to small and medium sized enterprises.

<sup>30</sup> There is an especial concern about the frequency of certain practices, such as predatory lending, market manipulation (Libor and ForEx), and abusive credit card practices, which have particularly deleterious effects on the poor. See the references in the previous footnote and Akerlof and Shiller (2015).

<sup>31</sup> There are many details about the design of the auction process, the analysis of which we leave for another occasion. To avoid the possibility of banks (the buyers of the right to issue credit) speculating, buying up credit now against the risk that its price will be higher at a later date—thereby adding uncertainty to the amount of new credit actually issued—the right to issue credit would be date-stamped, i.e. banks would have the right to issue new credit, but only for a specified period, e.g. three months, and under other conditions to be described below.



to borrowers, on the basis of *their* judgments about repayment capacity, within the constraints that the central bank may impose (described below).<sup>32</sup>

Note that in this system, banks cannot create credit out of thin air. The winners of the credit auction can only transfer money from their account to the borrowers' accounts. Accordingly, even with a system of delegated credit allocation, the Central Bank can control the magnitude of credit creation with some precision—and thereby the level of macro-economic activity.

### *A simple model*

In this subsection, we present a simple model providing conditions under which one can obtain greater macro-stability by controlling directly the amount of credit than by doing so indirectly, setting the real interest rate (assuming one could do that.) Assume that output (GDP) is a linear function of investment<sup>33</sup>:

$$1) \quad Q = a + b I + \epsilon_1$$

The monetary authority wishes to achieve full employment output,  $Q^*$ , with a quadratic loss function for deviations from that target (exceeding that output risks inflation):

$$2) \quad L = (Q^* - EQ)^2 + k \text{ var } Q$$

If  $\epsilon_1 = 0$ , and if the monetary authority could directly control  $I$ , this implies simply setting

$$3) \quad I = I^* = (Q^* - a)/b.$$

In the absence of instrument uncertainty,

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<sup>32</sup> The system is symmetric. The central bank may decide that there is too much money in the economic system—that is, the banks are lending too much, using “money” that they receive in repayment to make new loans. In that case, the government can buy back rights to issue credit: they buy back the money that they have allowed the banks to effectively manage on their behalf. Again, there can be an open auction for those most willing to give up rights to issue credit. This would literally drain money out of the banking system.

<sup>33</sup> It is easy to extend this model to include consumption, net exports, and government expenditures.

$$4) \text{ var } Q = \text{Var } \epsilon_1.$$

In fact, the monetary authorities do not control  $I$  directly. We have discussed two alternative ways of controlling  $I$  indirectly, one through monetary authorities' control of the interest rate, and the other through the control of credit,  $C$ . In the former case, we ignore instrument uncertainty (i.e. the government can precisely set  $r$ ), but assume that investment is a stochastic function of  $r$ , i.e.

$$5) I = (\mu + \epsilon_3) r + \epsilon_2,$$

where for simplicity we assume  $\epsilon_1$ ,  $\epsilon_2$ , and  $\epsilon_3$  are uncorrelated and have zero mean, so investment is a linear function of  $r$ , with variance

$$6) \text{Var } I = r^2 \text{ var } \epsilon_3 + \text{var } \epsilon_2.$$

Then

$$7) L = [Q^* - (a + b \mu r)]^2 + k [b^2 r^2 \text{ var } \epsilon_3 + b^2 \text{ var } \epsilon_2 + \text{var } \epsilon_1],$$

so the optimal interest rate is

$$8) r^* = \mu(Q^* - a) / (b(\mu^2 + k \text{Var } \epsilon_3))$$

Alternatively, there is conventional monetary policy, where government tries to regulate investment (and thus GDP) *indirectly* through the regulation of credit creation by the banking system. Now, investment is assumed to be a function of credit creation,  $C$ ,

$$9) I = \alpha C + \epsilon_4$$

And credit creation itself is a function of the money supply

$$10) C = \beta M + \epsilon_5$$

So

$$11) I = \alpha \beta M + \alpha \epsilon_5 + \epsilon_4,$$

And assuming again that  $\epsilon_1$ ,  $\epsilon_4$ , and  $\epsilon_5$  are uncorrelated and have zero mean,

$$12) \text{ var } I = \alpha^2 \text{ var } \epsilon_5 + \text{ var } \epsilon_4$$

It should be apparent that if

$$13) \alpha^2 \text{ var } \epsilon_5 + \text{ var } \epsilon_4 < r^{*2} \text{ var } \epsilon_3 + \text{ var } \epsilon_2 =$$

$$[\mu(Q^*-a)/b(\mu^2 + k\text{Var } \epsilon_3)]^2 \text{ var } \epsilon_3 + \text{ var } \epsilon_2,$$

then controlling credit creation through the money supply is preferable to controlling investment through the interest rate. The more precisely the government controls credit creation and the closer the link between credit creation and investment (the smaller is  $\text{var } \epsilon_4$ ), the more likely is the inequality in (13) satisfied. Our credit auctions provide a more precise way of controlling credit creation (effectively reducing  $\text{var } \epsilon_5$ ), and therefore reducing the variability in GDP. If one could reduce the uncertainty in the link between credit creation and investment, economic stability would increase still more. The next section shows how this might be done.

#### **4. Elaborating on a System of Credit Creation in an e-Economy**

This section elaborates on the basic idea of how credit auctions in an e-Economy can increase macro-stability.

##### *4.1. Ensuring that credit creation is directed at produced goods and services*

It is straightforward for monetary authorities to attach conditions (beyond the usual ones, e.g. concerning connected lending and excessive risk taking) in selling the “rights to lend” to the banks. It could, for instance, proscribe the extension of credit for margin on speculative loans or for real estate or other existing assets. Of course, funds are fungible, and restricting the use of *new* credit does not restrict the use of other funds. But the Central Bank could impose broader restrictions on lending “banks,” those institutions eligible to participate in credit auctions. Credit bubbles are associated with

the excessive creation of credit for particular purposes, e.g. real estate, and our restricted credit auctions might enable monetary authorities to prevent such excesses.<sup>34</sup>

If it wished, the monetary authority could target credit even more narrowly, to be used to purchase goods which are in excess supply, or which use labor of types which confront high levels of unemployment. There is always a trade-off: such targeted lending may be subject to political pressure, in ways that more broad based measures may not be.

#### 4.2. *Bank licenses*

In this 21st-century banking system, a bank's ability to lend is given only temporarily. It is conditional on compliance with the rules and standards established.<sup>35</sup> The government could allow for entry into the banking system.<sup>36</sup> Indeed, separating the depository and lending functions<sup>37</sup> and the open auction of rights to issue credit could

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<sup>34</sup> Monetary authorities have often said that it is difficult if not impossible for them to prevent the growth of bubbles—monetary policy is a blunt instrument, and raising interest rates to dampen bubbles would at the same time force down the level of *real* economic activity. Such claims of impotence are, I believe, exaggerated: Macro-prudential regulations can be an effective instrument. Still, the *direct* control of the uses to which credit can be put is likely to be more effective.

<sup>35</sup> Thus, to avoid the kinds of practices described earlier in the previous section (such as predatory lending), the government might find it desirable or necessary to impose regulations attempting to proscribe such activities. There is a large literature on the design of such regulatory measures and their effectiveness.

<sup>36</sup> Even with well-designed auctions with a limited number of banks, returns might exceed the normal risk adjusted level. Firms might wish to enter until *the after tax* return to capital (measured over the business cycle) would be equal to the normal return to capital. But since lending is an information-based activity, and the gathering of information is a fixed cost, the government might like stability in the new banking system, and this will require that banks not live on the edge; entry would be allowed only to the point where there was *some* excess return, to encourage prudential behavior. (See Hellman, Murdoch, and Stiglitz (2000)).

<sup>37</sup> In the banking model presented in the previous section, banks still could accept deposits: a deposit is simply a (temporary) transfer of the right to spend money from an individual to the bank. The bank then has the right to allocate this spending power to another individual or firm. The bank operates much as the “seed bank” described earlier in this paper. As we have noted, banks could not, in this system, create money effectively out of thin air.

make entry easier, and thus competition more vigorous than under current arrangements. At the same time, the system of auctioning of credit might ensure that banks not earn excessive returns; most of the value of the public's backing to the creation of money/credit could be captured by the public, rather than as now by the bankers.

### *Whence bank capital?*

The beauty of this modern credit system is it doesn't really require the same kind of capital as required by banking systems of the past. Recapitalizing a destroyed banking system would not require gold or borrowing to buy seeds as it did in the old days. As we have seen, the government itself can simply create credit.<sup>38</sup>

The fact that the money created by the government can be used to pay the taxes that are owed to the government, and that the government has the power to levy taxes, ensures the value of the credit it has created. Indeed, because the credit that has been created is electronic money, the movement of which can easily be monitored, the government has not only the ability to levy taxes; it also has an enhanced ability to collect taxes.

The only reason for bank capital in this world is as a partial guarantee that the bank has the capacity to repay the credit—the bank's "purchases" from the government of the right to issue credit are only temporary, and the credit thus created has to be repaid to the government. (The fact that the bank will lose its own capital has, in addition, strong incentive effects, incentivizing the bank to make good decisions about to whom to give credit and to monitor loans well.) But if the government is doing an adequate job of

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The depository and lending functions could be further separated by having the government assume the role of the depository institution (like postal savings banks), with commercial banks being licensed to act as agents on its behalf. The government would then have more precise information about the amount of money not being spent; such information would be critical in determining the amount of credit to be created. Virtually the entire credit allocation could be managed through the auction process described in the previous section. (Of course, individuals might still lend directly to other individuals.)

<sup>38</sup> Either through a government bank or through the auction mechanism just described.

bank supervision and has imposed appropriate regulations (for example, on connected and excessively risky lending), the amount of capital required will be limited. And that fact alone should, as we have noted, lead to more competition in the market for the provision of credit—reducing the likelihood of excessive returns.

#### *4.4. Macro-stability and income (state) contingent loans*

To achieve full employment may entail an auction of credit in sufficiently large amount that the price is negative, i.e. the only terms at which potential lenders are willing to “accept” the temporary use of funds, to be repaid later, entail a negative interest rate. The auction may entail a provision where a negative “bank rate” has to be passed on, at least partially, to borrowers, in the form of a negative lending rate. Presumably there is some negative rate at which the desired credit creation—that viewed as necessary to ensure full employment—related to new spending, either investment or consumption, is achieved. (This can be viewed as a *partial* “money rain.”) But it may be a very negative rate, and the distributive and even allocative consequences of that negative rate may be adverse.

Accordingly, it makes sense to look for alternative and perhaps more effective and efficient ways of stimulating the economy. One such way—ensuring a trade surplus or limiting the trade deficit—is discussed in the next section. Here we consider another way—state contingent loans, whereby the amount the borrower has to repay depends on the state of the economy.

There is a widespread consensus that one of the reasons that consumption and investment are depressed in a deep economic downturn is “lack of confidence,” or slightly more precisely, uncertainty about the future. Consumers are not sure of their future wages; retirees of the future return on their savings; and producers of the returns on their investment. They worry that if the downturn persists, unemployment may be high, wages low, interest rates low, and sales poor. Traditional monetary policy has tried to compensate for the absence of insurance markets by which individuals might mitigate these risks by changing the intertemporal price. It is, to say the least, a peculiar

response: it makes far more sense to try to address the market failure directly than to increase one distortion in response to another.<sup>39</sup> As we noted in Stiglitz (2016c), it is not even clear that lowering the interest rate is even an *effective* response, not just because of the distributive and distortionary effects, but because as the interest rate is lowered, risk perceptions may increase, and the adverse risk-perception effects could overwhelm the intertemporal price effects.

State-contingent credit auctions, where the amount the bank would have to repay the government would depend on the state of the economy during the period of the loan, provide a direct way of public risk absorption. By reducing the amount to be repaid in the event of a serious economic downturn, the risk of lending is reduced, and thus the supply of lending increased.<sup>40</sup>

#### *4.5. Concluding Remarks*

One of the major contributors to macroeconomic instability is the instability in credit supply. The 2008 crisis suggested that all the advances in markets, including financial markets, and in our understanding of markets has *not* lead to greater macro-economic stability—in fact, quite the opposite. The electronic banking system described here, together with credit auctions, may, under certain conditions, enhance stability in the equilibrium provision of credit for productive purposes, and thus enhance macro-economic stability. This may be especially so if repayments are made state-contingent as described in the previous sub-section. It thus may provide the basis of a virtuous circle, leading to an increase in overall stability of the economy. One of the most

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<sup>39</sup> It should be clear that the generalized Ricardian equivalence theorem (which holds that government financial risk has no effect (Stiglitz, (1988)) does not hold in general, and that there are real benefits to this socialization of risk. In particular, the firms and consumers who are effectively “buying” this state-contingent insurance are engaging in bets which increase their expected wealth more than the losses in expected wealth of the rest of society which assumes these losses, so that there is a positive pseudo-wealth effect. There is also a “substitution” effect. Both increase investment, consumption, and production. (For a discussion of the concept of pseudo-wealth, see Guzman and Stiglitz 2016a, 2016b.)

<sup>40</sup> In other contexts, such income contingent loans have been shown to be welfare enhancing, increasing GDP as well as individuals’ expected utility. See Stiglitz and Yun (2016).

important reasons that small businesses don't repay loans is macroeconomic fluctuation: loans simply can't be repaid when an economy is in depression.<sup>41</sup> Ensuring greater macro-stability than under the current regime would do as much as anything else to ensure the viability of the banking system, and increase the willingness of banks to lend and firms to invest. We have explained how this system could in fact also lead to a more competitive banking system.

## **Part II. Monetary Policy in an Open Economy with e-Money**

The analysis so far has been for a closed economy. Extending the analysis to an open economy is at least conceptually easy. When a firm exports some good, say a widget, it receives dollars. The dollars could be kept out of the country, say in a dollar account in New York. But the exporter may want to bring the dollars home, depositing them into the country's electronic banking system. The number of, say, euro's that the exporter would receive in return for the dollars would be market determined. Importers may want dollars to buy goods from the US. Exporters thus transfer money in their bank account to that of the importer. By the same token, an individual in the country wanting to make an investment abroad, say in the US, might want dollars, and be willing to transfer euros in his electronic banking system to someone who is willing to sell him dollars in exchange for euros.

These capital flows may, however, be very destabilizing—leading to large fluctuations in exports and imports as the exchange rate changes, leading in turn to macro-economic instability. The central bank can attempt to offset these effects through the system of credit creation (auctions) described earlier. But there is another

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<sup>41</sup> There are thus significant macro-economic externalities, providing part of the explanation for why there may be an undersupply of such lending privately. (See Korinek (2011).)



way of enhancing macro-stability, by regulating trade flows, in ways that may be more efficient and effective.<sup>42</sup>

### **5. Managing the Current Account Deficit through Trade Chits**

Government could provide to any exporter a chit, a “token” (in this case, electronically recorded) (alternatively called trade chits or Buffett chits<sup>43</sup>), the number in proportion to the value of what was exported; to import a euro worth of goods, there would be a requirement to pay, in addition to the cash price, a euro’s worth of chits or “trade tokens.” There would be a free market in chits, so the demand and supply of chits would be equal; and by equating the demand and supply of chits, one would automatically balance the current account.

In practice, the value of the chit might normally be very small, at least for a country currently with a small trade deficit.

This system would be a way of managing the high level of volatility in market economies associated with short term capital flows. With the free flow of capital, the exchange rate is determined by the vagaries of the market. And those changes in exchange rate then drive exports, imports, the trade deficit, and borrowing, and in doing so, give rise to macroeconomic instability. With the system of trading chits, the trade deficit can be controlled, enhancing overall stability.<sup>44</sup>

In the analysis above, where every import needs a chit, there is neither a trade surplus or trade balance. The government could use this system to limit the size of the deficit or

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<sup>42</sup> If there are costs of adjustment, e.g. to investment, then there may be significant costs associated with putting the burden of adjustment on investment and other activities that are sensitive to the supply of credit. See Kraemer (2015).

<sup>43</sup> See Buffet (2003).

<sup>44</sup> To prevent the buildup of chits—speculators might buy them on the bet that a chit is more valuable some years into the future—the chits should be date-stamped; they would have to be used, for example, within a period of one year. (It’s possible that some international rules, such as those currently stipulated by the WTO, might need to be changed to accommodate the system of chits, which could be viewed as a system of multiple exchange rates.)

surplus within any desired bounds. For instance, if it wants to limit imports to be no more than 20 percent greater than exports, it can issue 1.2 import chits for every euro of exports. By contrast, when there would be an excessive surplus in the absence of trade-chits, every import would be granted an “export” chit. Then every export would require a chit. This would automatically bring exports down to the level of imports.

The fact that the country could thus stabilize the size of the trade deficit or surplus has an enormous macroeconomic advantage: it facilitates macroeconomic stabilization itself. It means, for instance, that a small country doesn’t have to suffer from the vagaries of its “external balance,” its net export position. These fluctuations impose enormous costs on society, of which the market, in generating them, takes no account.<sup>45</sup>

But ensuring stability in the trade deficit also engenders longer-term stability, for national indebtedness, built up over many years, can suddenly become unsustainable. The market sees the world through very myopic lenses. It is willing to lend year after year—until it suddenly changes its mind.<sup>46</sup> By limiting the trade deficit, a country is in effect limiting national borrowing; this framework thus reduces a key source of instability in open economies.<sup>47</sup>

Moreover, this system helps stabilize exchange rates. In the absence of the chit system, an increase in the demand for imports (that is, for, say, dollars to buy American cars) would lead to a fall in the price of the euro. But now, with imports discouraged by the necessity of also paying to purchase a chit, the increased demand for imports would be

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<sup>45</sup> These are an example of macro-economic externalities, such as discussed by Anton Korinek (2011) and Jeanne and Korinek (2010), themselves a generalization of the pervasive pecuniary externalities to which Greenwald and Stiglitz (1986) called attention.

<sup>46</sup> See Calvo (1998) for a discussion of sudden stops.

<sup>47</sup> The experience of Europe and elsewhere has shown that it is not so much government borrowing that gives rise to crises, but national borrowing (including both private and public debt). In some cases, the national borrowing was government borrowing (Greece), but in many other cases (Ireland and Spain) it was private borrowing. When a crisis hits, the debt quickly moves from the private balance sheet to that of the public.

reflected in an increased price of a chit, rather than a decrease in the value of the euro. The euro will be stronger than it otherwise would be.

### Concluding Remarks

In the Arrow Debreu world with perfect markets, prices play a critical role in ensuring economic efficiency. But in the real world in which we live, as Marty Weitzman (1974) explained long ago, it is often better not to just rely on prices—to try, as this framework does, to control the *quantity* of credit and net exports, and to regulate the uses to which credit is put. There is a large literature showing under a variety of conditions when there is a departure from the first best world that such quantity controls are a better way of regulating the economy.<sup>48</sup>

The management of the economy in the electronic monetary framework analyzed in this paper relies, however, heavily on the use of prices and market mechanisms, but not fully so; there is no micro-management, but more macro-management than exists today. There are credit auctions and fully developed markets for trade-chits, though the amount of credit to be auctioned and the rules governing trade chits (how many export or import chits are granted per dollar of exports or imports) are determined by the government. But, of course, under *any* monetary system there is extensive intervention: In some, it attempts to set interest rates, in others, the money supply.

Decades ago, we learned that one could not let a market economy manage itself. That is why, for instance, every country has a central bank determining interest rates and/or the money supply, and regulatory authorities overseeing banking.

Anyone observing macroeconomic performance in recent years will see that things have not gone well in many countries around the world, even in advanced countries, with supposedly well-functioning markets and institutions and individuals who are supposedly well-informed about economics and presumably know how to manage the economy.

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<sup>48</sup> See also Dasgupta and Stiglitz (1977).

Advances in technology in recent years has made construction of a fully electronic monetary system feasible. This paper has addressed the question: in such a fully electronic system, are there new ways in which monetary policy could be conducted? And what might be the effects of these alternatives?

This paper has analyzed the effects of three institutional innovations, credit auctions, state-contingent loans, and trade chits. We have shown that credit auctions in particular may increase the fraction of rents associated with public guarantees that are captured by the government. State-contingent loans might reduce the limitations confronting monetary policy in deep recession, facilitating the return of the economy to full employment when faced with a liquidity trap, such as associated with a zero lower bound. The efficiency of capital markets might increase, by directly addressing the problems posed by perceptions of excessive risk, rather than attempting to address such problems indirectly by changing intertemporal prices.

But the most important impacts of the electronic payments system and the new mechanisms for macro-management that they may enable may be on macro-economic stability. We have analyzed conditions under which credit auctions may reduce the volatility in investment; and our analysis suggests that trade chits may enable the reduction in the volatility of net exports. Together these new instruments may provide additional tools that, at least under certain conditions, may enable the enhancement of macro-stability.

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