THE ROLE OF GOVERNMENT IN THE CREDIT MARKET

by

Benjamin Eden

Working Paper No. 09-W07

September 2009

DEPARTMENT OF ECONOMICS
VANDERBILT UNIVERSITY
NASHVILLE, TN 37235

www.vanderbilt.edu/econ

THE ROLE OF GOVERNMENT IN THE CONSUMER LOANS MARKET

Benjamin Eden*
Vanderbilt University
September 2009

The paper analyzes a government loan program that complements money. The focus is on administrative costs and the difference between the collection technologies available to the public and the private sectors. Among the questions addressed are: the optimal monetary and credit policy and the desirability of money substitutes. The paper describes the loan program as an integral part of the tax system and comments on some tax reform ideas.

Key words: Government loans, Tax reform, Tax Evasion, Collection Technology, Friedman Rule, Samuelson Rule, Money Substitutes

JEL codes: E42, E52, E51, E58, H20, H21, H26

* I would like to thank Robert Driskill, Maya Eden, Boyan Jovanovic and Ayse Sapci for useful comments and discussions on an earlier draft of this paper.

1. INTRODUCTION

The recent crisis has led to government intervention in the consumer loans market. For example, the Home Affordable Modification Program is aimed at helping about 9 millions Americans stay in their homes by using government funds to lower their monthly payments to less than 31% of income.[1] To evaluate this program we need to understand why the parties to the lending contract did not write a clause that limits the payment to 31% of income, ex ante.

More generally, to evaluate government intervention in the credit market, we may want to understand the "collection technology" that is available to each sector. We may start from the observation that the government collects income contingent payments that are not backed by collaterals, as in the case of income tax. Private lenders typically collect payments on loans that are not contingent on income and are backed by collaterals. There thus seems to be a difference in the "collection technology" between the two sectors.

This difference in "collection technologies" is discussed in Friedman (1960) celebrated book on Capitalism and Freedom. Friedman starts from the observed difference between the rate of return on an investment in human and physical capital. He ends with a proposal of a government loan program as a remedy to this "market failure". In page 105 in the 40th anniversary edition Friedman says:

"A governmental body could offer to finance or help finance the training of any individual who could meet minimum quality standards. It would make available a limited sum per year for a specified number of years, provided the funds were spent on securing training at a recognized institution. The individual in return would agree to pay to the

[1] http://www.ustreas.gov/press/releases/reports/modification_program_guidelines.pdf

government in each future year a specified percentage of his earnings in excess of a specified sum for each $1000 that he received from the government. This payment could easily be combined with payment of income tax and so involve a minimum of additional administrative expense".

The argument that led to this proposal is of particular relevance to our question. Friedman stresses the high costs of administering income contingent loans by the private sector "given the freedom of individuals to move from one place to another, the need to get accurate income statements and the long period over which the contracts would run". He then continues to say that: "These costs would presumably be particularly high for investment on a small scale with a wide geographical spread of the individuals financed. Such costs may well be the primary reason that this type of investment has never developed under private auspices" (page 103). He concludes that: "Government intervention might therefore be rationalized on grounds both of "technical monopoly" insofar as the obstacle to the development of such investment has been administrative costs, and of improving the operation of the market, insofar as it has been simply market frictions and rigidities".

Friedman (1960) focuses on the failure of the private sector to finance investment in human capital. Apparently, Friedman did not see any problem in the operation of the market for investment in forms of capital that can be used as a collateral. The recent crisis puts a question mark on this assumption. Indeed one of the argument in support of the Home Affordable Modification Program mentioned above is that getting people out of their homes is inefficient because evicted homes may loose as much as 30% of their

value.[2] In general, there are bankruptcy costs that arise in part because of the mismanagement of the collateral by the bank.

Moreover, there is a perfectly legitimate demand for uncollateralized loans to smooth consumption. The credit card type loans are not a satisfactory solution to this problem given the very high rates of interest on such loans.

In general, if there is a difference in "collection technology" between the two sectors there may be room for both sectors to operate and utilize their relative advantages. I consider here a proposal to create a government body that will make income contingent loans for any purpose without the need to check collaterals or to check whether the borrower satisfies "minimum quality standards" and use the loan to attend a "recognized institution".

I now turn to the question of whether Friedman's argument for a limited involvement in the credit market applies to the larger role I have in mind. I start with the "technical monopoly" argument. Friedman says that the private sector has a problem in collecting uncollateralized obligations because of the freedom of individuals to move. The advantage of the government here is that people have an incentive to report their location to the government in order to get various benefits like social security, medicare and unemployment benefits. Indeed the government can make these benefits contingent on paying the income contingent obligations. In addition admission of children to public school requires proof of residence in the school district. Thus, I see no special education aspect to this argument and it seems to justify a larger role for the government.

Friedman (1960) also mentions the need to get accurate income statement as a reason for the absence of private income contingent loans. Presumably, the suggested

---

[2] "Vacant properties are routinely vandalized and broken into by thieves who will scavenge whatever was left behind, especially copper wiring and pipes to sell as scrap. In the first seven weeks of this year, the Providence police took reports of at least 57 thefts or attempted thefts of copper." Mark Arsenault, Rhode Island News, May 25 2008.

government body will have access to the IRS records. A private lender on the other hand does not have an easy access to these records. Again, this argument applies to uncollateralized loans in general.

The advantage of the government in making consumer loans is particularly strong when considering intergenerational loans from old to young people. To see this point consider the case in which agents in an overlapping generations (OG) economy live for two periods and are endowed with a unit of the consumption good in the second period of their life. In such an economy trade between generations is not possible even if we introduce money into the system because the young have nothing to give to the old. I show that this is a problem in more realistic settings in which the young wants to borrow rather than lend (as in the standard OG model).

The paper is organized as follows. I start with a discussion of the Hall-Rabushka flat tax proposal and use it to outline my own proposal. I then use a finite horizon economy to better understand the government's advantage in collecting income contingent payments and intermediating between people of the same age. The main part of the paper follows. This is an overlapping generations model that is used to address questions about the optimal interest rate(s) and the way a government loan program can be integrated into the tax system.

2. THE HALL-RABUSHKA FLAT TAX PROPOSAL

Hall and Rabushka (HR, 1995) propose to simplify the tax system by having two marginal tax rates: zero up to the "family allowance" level and then 19% for all income above this level.[3] They say that a consumption tax or a value added tax will be simpler but they reject it because it is not progressive.

---

[3] Altig et al. simulated the effects of the flat tax proposal and other proposals.

A variation on the HR proposal is to have a value added tax with a rebate for low-income households. Alternatively, the government may extend loans to young individuals and allow households with low income to partially default on their loan payments. This form of rebate is better than standard rebate for two reasons. First, it solves a problem in the credit market. Second, it seems more "fair" because the present value of the rebates depends on the individual's earnings during his entire life.

Since the value added tax is a tax on all wages (including the family allowance) its base is larger than the flat-tax base. According to the numbers in HR Table 3.1 the value added tax base is larger than the flat rate tax base by 52%. The government may therefore impose a 19% value added tax and use a third of its revenues to finance loans defaults by households with low permanent income. For example, the government may require a loan payment of 31% of income if income is less than a critical level ψ and a full payment if income is above the critical level. (Thus, $payment = \max\{0.31(income), 0.31(\psi)\}$). We may think of the amount $0.31(\psi)$ as a full payment and of any amount less than that as partial payment. The ceiling and the amount of the loans should be set in a way that the total default level is not greater than a third of the VAT tax revenues.

Note that agents that consistently pay their loan in full will pay their entire debt before agents that pay only partial amounts and only agents that consistently earn low income will die with debt to the government.

There are several practical problems that need to be addressed.

Outmigration: I assume that the government loan program will be extended only to US citizens. What should we do about citizens who take the loan and immigrate? This is not a new problem. An individual can get the benefits of public education and then choose to immigrate without letting the country that made the investment reap the benefits. This "brain drain" problem is severe for some countries but not for the US that does not suffer

from outmigration. But we should keep this problem in mind so as not to make the initial loan too high.

Design of the loan limits: Practical consideration may want to limit the amount of loan payment to say 31% of income (as in the current policy proposal). This implies a limit on the amount of the loan and as we shall see, a tension with the Friedman (1969) objective of satiating the economy with liquidity.

Business loans: The proposed loan program does not impose restrictions on the use of the funds. The loan may thus be used to finance current consumption, education, investment in housing, or to start a business.

Evans and Jovanovic (1989) found that wealthier people are more likely to become entrepreneurs because they are less liquidity constrained. This is the apparent rationale used by the U.S. Small Business Administration to provide loans and loan guarantees to small business for start-up and expansion. Similar programs are present in other countries. Our loan program relaxes liquidity constraints and may allow for poor people to become entrepreneurs. It may also incorporate or substitute existing programs aimed at facilitating start-ups. The possibility of using part of the government loan for a business project rather than for consumption smoothing, is likely to mitigate moral hazard and adverse selection problems.

Self control issues: Traditional economics assumes that once agents become adults they gain self-control. Behavioral economics argues that some people never become adults in this sense.

Behavior that looks like lack of self-control is endogenous to some degree. For example, in the present system a young adult who drives an expensive car may do it in an attempt to transmit a signal about the wealth of his parents or his own ability to make money. Once everyone gets a loan, such a behavior may signal the lack of self-control.

In any case, self-control is likely to be a problem and the loan program should address it by making loans in various stages (say, a certain amount at age 20, an

additional amount at age 30 and so on) and by offering options to buy annuities and other commitment devices.

3. INTERMEDIATION BETWEEN PEOPLE OF THE SAME AGE

Enforcing income contingent loan contracts requires the verification of income. Townsend (1979), Williamson (1987) and Bernanke and Gertler (1989) studied loan contracts under the assumption that income verification is costly. Here I depart from this literature in assuming that instead of running an audit directly, a lender who wants to verify income obtains a costly court order that allows access to the borrower's internal revenue service (IRS) records. The government has an advantage because it has costless access to its own IRS records.

The use of the IRS records in bankruptcy court cases leads to a negative external effect imposed by private lenders on the IRS: A borrower who plan on going bankrupt may choose to underreport his income to the IRS as a way of sheltering some income from the lender. This makes the IRS job of collecting taxes more difficult relative to the case in which IRS records cannot be used in bankruptcy cases.[4] The government may mitigate this external effect and economize on bankruptcy costs if it uses its advantage to lower the borrowing rate without changing the amount of the loan.

To illustrate, I assume a two periods $(t = 1,2)$ single good endowment economy. There are two types of agents: Borrowers (indexed b) and Lenders (indexed l). The

---

[4] Here I assume that the lender bears the cost of going to court but in reality both the lender and the borrower bears some costs. The borrower often seeks the protection of the court and may be required to present IRS records to support his case. The external effect occurs in many other instances. An individual who plans to get divorce may choose to underreport his income to cut on alimony and child support. An individual who applies for a tuition reduction in private school is often required to present his IRS records. The IRS will release the records if the individual explicitly ask for it. A law that prohibits the use of IRS records may make the IRS job easier but is not consistent with the broader objective of supplying a public good.

number of borrowers is the same as the number of lenders and is normalized to 1. Borrowers get no endowment in the first period. In the second period they participate in a lottery: A fraction θ of the borrowers get 1 unit of the consumption good and a fraction $1-\theta$ get zero. Lenders get an endowment of 1 unit in the first period. They also participate in a lottery that determines their second period income: A fraction $1-\theta$ of the lenders receives an endowment of 1 unit and a fraction θ receives zero. Thus the aggregate endowment in each period is 1 unit.

The realization of the endowment is costlessly observable only to the agent that receives it. Each agent reports his income to the government (IRS). The agent may report an income of 1 or zero and the report may be different from his true income. The government uses the reports to redistributes income. The (after tax) income in period t is α_t for an agent that reports 1 and γ_t for an agent that reports zero, where $0 < \gamma_t < \alpha_t < 1$. The government spends v_t units on verification of income and we assume that this amount is sufficiently high so that all agents choose to report their true endowment. The determination of the government's expenditures on endowment verification will be discussed shortly.

I start with the case of private intermediation. There are banks that, at $t = 1$, take deposits and make loans. The gross interest rates are R^l on deposits and R^b on loans. The bank can verify income by obtaining a costly court order that gives access to the individual's IRS records.

The bank offers the following loan contract. The borrower gets b units at $t = 1$. At $t = 2$, the borrower may choose to declare bankruptcy. If he does not declare bankruptcy he pays to the bank $bR^b \leq \alpha_2$ units. If he declares bankruptcy the bank get a court order and verifies his reported income. If the bank finds out that the reported endowment is zero, the borrower pays $\omega bR^b \leq \gamma_2$ units where $0 < \omega < 1$ is the fraction of the debt paid by the truly bankrupt borrower. If the bank finds out that the reported endowment is one, the borrower pays the full debt of bR^b units. Since only borrowers who realize low

income will benefit from declaring bankruptcy, I assume that only low income borrowers declare bankruptcy.

There are costs to the bank for verifying income (getting a court order) and therefore the bank does not recover the full amount paid by the bankrupt borrower. It is assumed that the bank recovers only λbR^b units where $0 < \lambda < \omega$. The difference $(\omega - \lambda)bR^b$ is the bankruptcy costs paid by the bank.

The bank makes zero profits and therefore:

(1) $$R^b\left(\theta + (1-\theta)\lambda\right) = R^l$$

Note that since $\lambda < 1,\ R^b > R^l$. Thus, the bank charges a higher borrowing rate to cover the losses from bad loans.

I now turn to the "truth telling" constraints that determine the amount spent by the government on income verification. I assume that the agent can report to the IRS either 1 or 0. Avoiding detection when under-reporting (i.e., reporting 0 when true income is 1) is possible but costly. The cost of avoiding detection is given by the strictly increasing and continuous function $e(v_t)$ where v_t is the amount spent by the government on income verification. Furthermore, I assume that the fines when getting caught are high and therefore agents either report truthfully or underreport and perfectly conceal income.[5]

In the first period only lenders have a reason to conceal their income. A lender who conceals gets $1 + \gamma_1 - e(v_1)$ units. If he reports truthfully he gets α_1 units. He will report his endowment truthfully if $1 + \gamma_1 - e(v_1) \le \alpha_1$ or:

(2) $$e(v_1) \ge 1 + \gamma_1 - \alpha_1$$

---

[5] The tax enforcement literature seems to focus on the optimal way of spending the IRS resources on enforcement. For example, Scotchmer (1987) focus on the audit decision and Reinganum and Wilde (1988) focus on the enforcement decision when an audit has already been conducted. I did not find papers that focus on the ways that tax payers spend resources on avoiding auditing and minimizing the enforcement probability when an audit takes place. In the real world this can be done by hiring lawyers and accountants and by spending income in a way that cannot be easily observed.

In the second period borrowers who get an endowment of 1 have the strongest incentive to conceal and therefore I focus on their cost-benefit calculation. If the high income borrower chooses to conceal, he will have $1+\gamma_2-\omega bR^b-e(v_2)$ units. If he reports truthfully he will have α_2-bR^b. He will report truthfully if:

$1+\gamma_2-b\omega R^b-e(v_2)\le\alpha_2-bR^b$ or:

(3) $$e(v_2)\ge 1+\gamma_2-\alpha_2+(1-\omega)bR^b$$

I assume that the government spends the minimum amount of resources that will make agents report truthfully and therefore (2) and (3) hold with equality. Under this assumption we can solve for the verification costs:

(4) $$v_1=e^{-1}(1+\gamma_1-\alpha_1)=f(1+\gamma_1-\alpha_1)\ ,\qquad v_2=f\left(1+\gamma_2-\alpha_2+(1-\omega)bR^b\right),$$

where the inverse function f is strictly increasing. This ties the amount spent by the government to the incentives to conceal income. Note that the government needs to spend more resources on verification in the second period if the debt payment bR^b is larger, because the bank uses the information collected by the IRS in the case of bankruptcy. This is the external effect of the bank on the IRS mentioned earlier.

I will not attempt a full description of the economy here and treat (ω,λ) as exogenous variables. Our model is similar to Williamson (1987) who shows that the optimal contract offered by the bank is a special case of what I assume here (with $\omega=\gamma_2/bR^b$). Williamson shows that in his model there are two types of equilibrium: With credit rationing and without credit rationing. For the point that I want to make it does not matter whether the loan market clears or not and I will allow for both cases.

I assume that lenders and borrowers have the same expected utility function $u(C_1)+\beta u(C_2)$ where C_t is consumption at time t, u is monotone and strictly concave and $0<\beta<1$ is a discount factor. I use b^s and b^d to denote the supply and demand for bonds and define equilibrium as a vector $(\hat\alpha_1,\hat\alpha_2,\hat\gamma_1,\hat\gamma_2,\hat v_1,\hat v_2,\hat R^l,\hat R^b,\hat b^d,\hat b^s,\hat b)$ such that (1) and (4) are satisfied and (a) $\hat b^s$ solves the lender's problem:

$\max_{b^s}\ u(\hat\alpha_1-b^s)+\beta\left\{(1-\theta)u\left(\hat\alpha_2+b^s\hat R^l\right)+\theta u\left(\hat\gamma_2+b^s\hat R^l\right)\right\}$;

(b) $\hat{b}^d$ solves the borrowers problem:
$\max_{b^d} u(\hat{\gamma}_1 + b^d) + \beta\{(1-\theta)u(\hat{\gamma}_2 - \omega b^d \hat{R}^b) + \theta u(\hat{\alpha}_2 - b^d \hat{R}^b)\}$;

(c) The equilibrium amount of loans is: $\hat{b} = \min\{\hat{b}^s, \hat{b}^d\}$;

(d) Markets for goods are cleared: $\hat{\alpha}_1 + \hat{\gamma}_1 = 1 - \hat{v}_1$, $\hat{\alpha}_2 + \hat{\gamma}_2 = 1 - \hat{v}_2$.

Government loans program: I start from an equilibrium interest rates $(\hat{R}^l, \hat{R}^b)$ and assume that the government creates a bank that keeps the lending rate at the initial level $\hat{R}^l$ but reduces the borrowing rate to $\overline{R}^b < \hat{R}^b$. I assume that the demand for bonds at the lower rate $\overline{R}^b$ is: $\overline{b}^d \geq \hat{b}^d$. I also assume that the government offers the same size loan of $\hat{b}$ units. (This is likely to result in additional rationing because $\min\{\hat{b}^s, \hat{b}^d\} \leq \min\{\hat{b}^s, \overline{b}^d\}$).

In the second period, the government collects the full payment from borrowers who report an endowment of one and a fraction ω of the loan from borrowers who report an endowment of zero. I assume that the loan program is self-financing:

(5) $$\overline{R}^b(\theta + (1-\theta)\omega) = \hat{R}^l$$

Comparing (1) to (5) and using $\omega > \lambda$, leads to: $\overline{R}^b < \hat{R}^b$ as we have assumed. Note that the government program completely crowds out private lending because private banks cannot make money at the lower borrowing rate.

Since the borrowing rate is now lower the incentive to underreport is lower and therefore the amount spent on endowment verification is lower. Formally, since $\overline{R}^b < \hat{R}^b$ we get:

(6) $$\overline{v}_2 = f\left(1 + \hat{\beta}_2 - \hat{\alpha}_2 + (1-\omega)b\overline{R}^b\right) < \hat{v}_2 = f\left(1 + \hat{\beta}_2 - \hat{\alpha}_2 + (1-\omega)b\hat{R}^b\right)$$

To see that a Pareto improvement is possible note that if the government does not change the amount of resources spent on income verification, it will improve the welfare of borrowers who now pay less interest for the same amount of loan. This is possible because of the elimination of bankruptcy costs ($[\lambda - \omega]\hat{b}\hat{R}^b$). Lowering the income

verification effort to $\bar{v}_2$ will free additional resources and will allow for further improvement in welfare.

In this example, the government can improve matters because it has better access to its own IRS records. I now turn to intermediation between generations that may be possible only in the presence of a government loan program.

4. INTERMEDIATION BETWEEN PEOPLE OF DIFFERENT AGES

I consider an overlapping generations economy in which the government may have an advantage even if income can be costlessly observed. This advantage will arise in a steady state in which young agents want to borrow from old agents. This is not the case in the standard overlapping generations (OG) model.

In the standard model, agents live for two periods and get income only in the first. In this setting trade between generations is not possible in the absence of government intervention, but the required intervention is minimal. Samuelson (1958) has shown that money can solve the problem: When every young generation wants to save and is willing to accept money, the old may use the money they saved in the first period of their life to buy goods from the young.

The money solution will not work when agents get income only in the second period of their life, because the young have nothing to give to the old. More generally, it will not work in any (realistic) setting in which agents live for a finite number of periods and want to borrow at the beginning of the life cycle. What will work in these cases is a government loan program (or "negative money").

To illustrate, I assume a single non-storable good OG economy in which agents get an endowment of 1 unit in each of the two periods of their life. As in the previous section, the utility function of the representative agent is: $u(C_1)+\beta u(C_2)$, where C_t is consumption at age t, $\beta \geq 0$ is a discount factor and u is a single period utility function with the standard properties $(u'>0, u''<0)$.

I start from the problem of a planner who wants to maximize welfare in the steady state. Since at each period there is 1 unit per agent and there are two representative agents (young and old) the resource constraint is:

(9) $$C_1 + C_2 = 2$$

where C_1 is the (steady state) consumption of the young and C_2 is the steady state consumption of the old. The planner's problem is:

(10) $$\max_{C_1,C_2} u(C_1) + \beta u(C_2) \quad \text{s.t. } C_1 + C_2 = 2$$

The first order condition that an interior solution to this problem must satisfy is:

(11) $$u'(C_1) = \beta u'(C_2).$$

Figure 1 illustrates the planner's solution. The endowment (autarky point) is at point A while consumption is at point B. The intuition is as follows. From the planner's point of view the shadow price of consumption to the young in terms of consumption to the old is 1: If he wants to give an additional unit to the young he must take it from the old. In the steady state this is also the shadow price of consumption in the first period of the representative agent's life in terms of consumption in the second period of his life.

Decentralization: The planner can implement the allocation by making an offer to lend and borrow at a zero interest rate. The debt of the old agents to the government is $\tilde{C}_1 - 1$, where $(\tilde{C}_1, \tilde{C}_2)$ is the solution to the planner's problem. In the steady state the government collects this debt and transfer it to the young as a loan. The debt of the old generation is positive if $\tilde{C}_1 > 1$ as in Figure 1B and is negative otherwise, as in Figure 1A.

Using money: Money can play a role if the young want to save when the interest rate is zero. To see this point, assume that the government promises to buy and sell any amount of the good for 1 dollar per unit. In this case, a young agent may sell $1 - C_1 \geq 0$ units for $M = 1 - C_1 \geq 0$ dollars. Consumption in the next period is equal to the amount of money accumulated in the first period plus the second period endowment: $C_2 = M + 1$.

Substituting $M = 1 - C_1$ in the last equation leads to: $C_1 + C_2 = 2$. The consumer can therefore choose any consumption pair (C_1, C_2) that satisfies:

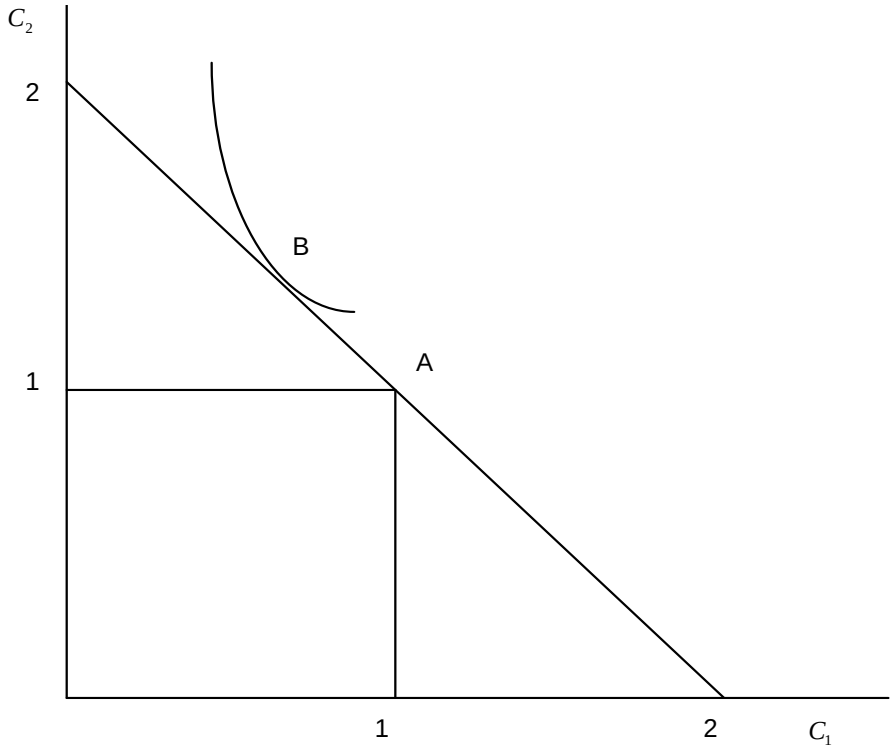
(12) $$C_1 + C_2 = 2 \text{ and } 1 - C_1 \geq 0.$$

When the non-negativity constraint is not binding, as Figure 1A, the consumer will choose the planner's solution $(\tilde{C}_1, \tilde{C}_2)$. Money works in this case.

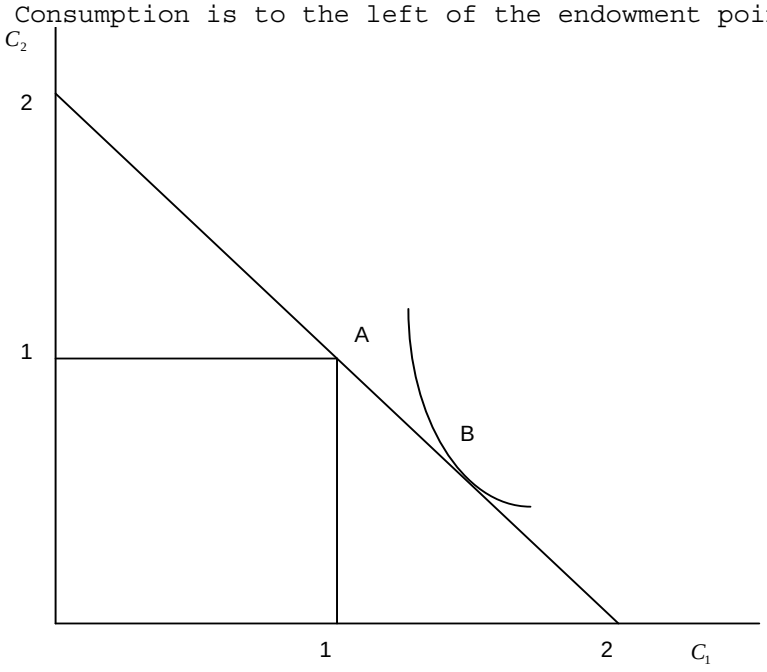
But when the consumer wants to choose a point to the right of the endowment point, as in Figure 1B, the non-negativity constraint is binding and introducing money will not help. In this case a Government lending program is required.

Negative money: We may think of government loans as negative money. From a mathematical point of view, there is little difference between the positive money holdings that occur when $\tilde{C}_1 \leq 1$ and the negative money holdings that occur when $\tilde{C}_1 > 1$. But the involvement of the government is different. In the first case we need the government only for the initial step of introducing money: In the steady state, the old will simply give the dollar bills (which says that "the government owes the owner of this bill, 1 unit of consumption") directly to the young in exchange for goods. To make negative money work we need the government involvement in all periods: The government must collect the debt from the old and transfer it to the young as a loan (because the young will not directly accept pieces of paper that say "The owner of this paper owe the government 1 unit of consumption") in exchange for goods.

We may conclude that if the society wants to maximize welfare in the steady state it must have a government loan program. The case for such a program is much weaker if we consider the transition to the steady state. When the economy starts at $t = 0$ at the autarkic point A, the only way of getting to point B in Figure 1B is to tax the generation born at $t = -1$. A Pareto improvement is not possible unless the government has an advantage in collecting income contingent payments and people who belong to the same generation are different, as in the previous section.



A: Consumption is to the left of the endowment point



B: Consumption is to the right of the endowment point

Figure 1

5. THE MODEL

I now attempt to integrate and expand on the special cases that we have discussed. The previous section made an analogy between money and the government loans program and argued that a loan program may be necessary for trade between generations. Here I intend to further explore the monetary connection asking whether the interest on government loans should be higher than the rate on government bonds and the rate of return on holding money. A related question is whether the government loan program should be self-financing. (As is apparent from equation (5), the self-financing requirement may lead to a difference between the lending and the borrowing rate).

As in the discussion of the Hall-Rabushka proposal, I model the loan program as part of the tax system and similar to section 3, I focus on income verification issues. Similar to Sargent and Wallace (1982), I use legal restrictions to distinguish between government bonds and money and as in their seminal paper, I find that efficiency is achieved when all interest rates are the same. But unlike their paper, here I assume that the government must use distortive taxes to raise revenue. The results here are also in line with the literature on the Friedman rule. But unlike this literature, here I focus on enforcement issues rather than on labor market distortions.

I consider a single good overlapping generations model. There are N types of agents. One agent from each type is born every period and lives for T periods ($1 < T < \infty$). I focus on a steady state in which age matters but the calendar date of birth does not. I will therefore talk about agent (of type) h without specifying his date of birth. Types have different income and may have different utility function. Type h agent receives at age t an endowment (income) of Y_t^h units of the good. His (strictly quasi concave and differential) utility function is: $U^h(c_1^h,...,c_T^h)$, where c_t^h is his age t consumption.

There are two government-backed assets: indexed money (real balances) and indexed bonds. A unit of indexed money represents an obligation of the government to

exchange it for a unit of consumption. In equilibrium the government will not exchange money for goods. Our money is therefore like fiat money and the promise to exchange it for goods is a way of committing to a real rate of return on money (or the inflation rate).

An indexed bond represents an obligation to exchange it for a unit of real balances.

There is a government owned bank that provides loans and accepts deposits. (There are no private banks.) The government bank offers two types of accounts: Checking and savings. Agents keep indexed money in their checking account and indexed bonds in their savings accounts. The government makes the distinction between bonds and money by prohibiting the writing of checks on savings accounts and requiring a trip to the bank to change the evolution of balances in these accounts. This is similar to regulation Q that prohibits paying interest on many checking accounts.

The (real) interest rate on loans is r. The interest rate on saving accounts is r_b and the interest rate on checking accounts is r_m, where $r_m \le r_b \le r$. The government can choose the real interest rates: r, r_b, r_m.

I distinguish between reported and actual income: Y_t^h is actual income and $Y_t^h - \varepsilon_t^h$ is reported income at age t, where ε_t^h is the misreporting magnitude. Under-reporting occurs when $\varepsilon_t^h > 0$. There are also reasons for over-reporting income (choosing $\varepsilon_t^h < 0$) in our model. I use $y_t^h = (Y_1^h - \varepsilon_1^h, ..., Y_t^h - \varepsilon_t^h)$ to denote reported income up to age t.

At age $t = 0$, the agent gets a loan of L_0 units that is directly deposited to his checking account. The agent may choose to take additional loans during his life. At age $t \ge 1$ he can get a loan of L_t^h units subject to the constraint:

(13) $$0 \le L_t^h \le LL_t(d_{t-1}^h, y_t^h) \text{ for } 1 \le t < T \text{ and } L_T^h = 0,$$

where the loan limits LL_t depend on the debt to the government at age $t-1$ (end of period debt = d_{t-1}^h) and on reported income history.

A trip to the bank is required whenever the agent does not elect the "default option". In the case of loans, the default option is $L_t^h = LL_t$: If the agent does not go to the bank, the amount $L_t^h = LL_t$ will be automatically deposited in his checking account.

There is also a default option in the contract that governs the savings account: If the agent does not go to the bank the amount in his savings account will be $b_t = (1+r_b)b_{t-1}$, where b_t is the end of period amount. The agent may choose $b_t^h \neq (1+r_b)b_{t-1}^h$ if he goes to the bank.[6] As in the Baumol-Tobin model, there is a fixed cost α_t^h, for a trip to the bank. At age t the agent pays the cost:

(14) $$tc_t^h(L_t^h, LL_t, b_t^h, b_{t-1}^h) = \alpha_t^h \quad \text{if } L_t^h \neq LL_t \text{ or } b_t^h \neq (1+r_b)b_{t-1}^h \text{ and}$$
$$tc_t^h(L_t^h, L_t, b_t^h, b_{t-1}^h) = 0 \quad \text{otherwise.}$$

The loan payments are contingent on the accumulated debt and reported income history. A t years old consumer who owes the government $(1+r)d_{t-1}^h$ units (at the beginning of the period) and reported y_t^h will pay:

(15) $$LP_t(d_{t-1}^h, y_t^h) \leq (1+r)d_{t-1}^h.$$

The loan payments (LP) are an automatic deduction from the individual's checking account. In what follows I assume a special case of (15):

(16) $$LP_t(d_{t-1}^h, y_t^h) = \min\left\{ rd_{t-1}^h + \frac{d_{t-1}^h}{T-t+1}, \psi(Y_t^h - \varepsilon_t^h) \right\}.$$

Under (16), the agent pays the interest and a fraction of the principle if this payment is less than a fraction $0 < \psi < 1$ of his (reported) current income. Otherwise the agent pays a fraction ψ of his current income. As was said in the introduction, the home affordable modification program chose $\psi = 0.31$.

The debt to the government evolves according to:

(17) $$d_0^h = L_0; \quad d_t^h = (1+r)d_{t-1}^h - LP_t(d_{t-1}^h, y_t^h) + L_t^h$$

---

[6] We may view the savings account contract as an incomplete long-term contract that allows for renegotiation as in Hart and Moore (1988). Balances accumulate interest automatically until a trip to the bank is made and the renegotiation option is exercised.

The government imposes income and consumption taxes. The consumption tax rate is $\kappa \geq 0$. The income tax payment (TP) depends on reported history and is given by the weakly increasing function:

(18) $$TP_t(y_t^h).$$

The government keeps tab on the accumulated value of the tax payments:

(19) $$J_0^h = 0 \ ; \ J_t^h = (1+r)J_{t-1}^h + TP_t(y_t^h) \leq \bar{J}$$

Note that under (19) the government does not collect taxes from people whose accumulated income tax payments have reached a ceiling $\bar{J}$.

Following Alt (1983) I abstract from the cost of collecting consumption taxes and focus on the cost of collecting income contingent (taxes and loan) payments from individuals, due to the cost of auditing income, reporting income and underreporting income discussed in Mayshar (1991) and Slemrod and Yitzhaki (2002).

As before, I assume that the government spends v per period for auditing income but here I allow for equilibrium in which misreporting occurs. The amount that the consumer has to spend to avoid detection depends on the magnitude of misreporting and on the government verification efforts and is given by the function $e_t^h(\varepsilon_t^h, v)$. Avoiding detection when under-reporting is costly: $\frac{\partial e_t^h}{\partial \varepsilon_t^h} > 0$ for all $\varepsilon_t^h > 0$. But over-reporting is not costly: $e_t^h(\varepsilon_t^h, v) = 0$ for all $\varepsilon_t^h \leq 0$. The penalty when cheating and getting caught is prohibitive so that all agents choose to spend the amount required to avoid detection. In some cases we may view underreporting as analogous to working less than what the agent will choose to work in the absence of taxes. But this analogy is not complete because here the incentives to underreport do not increase with the consumption tax rate.

There is also a fixed cost, $z_t^h > 0$, that occurs even if income is reported truthfully, because of the need to complete the required forms and to keep records. Agents may avoid this cost by not filing the tax forms. When agents do not report income they are treated as if they reported the highest income in their age group: $\overline{Y_t} = \max_h \{Y_t^h\}$. In this

case the misreporting magnitude is: $\varepsilon_t^h = Y_t^h - \overline{Y_t} \le 0$. The amount spent on reporting and underreporting income is therefore:

(20) $$X_t^h(d_{t-1}^h, J_{t-1}^h, \varepsilon_t^h, v) = 0 \text{ if } Y_t^h - \varepsilon_t^h = \overline{Y_t} \ ;$$

$$X_t^h(d_{t-1}^h, J_{t-1}^h, \varepsilon_t^h, v) = e_t^h(\varepsilon_t^h, v) + z_t^h \text{ otherwise.}$$

I now turn to describe the evolution of assets. At $t = 0$, agent h has:

(21) $$m_0^h = d_0^h; \quad b_0^h = 0$$

The total value of assets evolves according to:

(22) $$b_t^h + m_t^h =$$

$$Y_t^h + (1+r_m)m_{t-1}^h + (1+r_b)b_{t-1}^h + L_t^h - LP_t(d_{t-1}^h, y_t^h) - TP_t(y_t^h) - (1+\kappa)c_t^h - tc_t^h - X_t^h$$

The consumer's problem is:

(23) $$\max_{L_t^h, c_t^h, m_t^h, b_t^h, \varepsilon_t^h \ge 0} U^h(c_1^h, ..., c_T^h) \quad \text{s.t. (13)-(22).}$$

Note that a consumer that wants to consume along a path that is different from his net income path may choose to hold money to economize on trips to the bank.

I use g to denote government spending on items other than income verification and $G = g + v$ to denote total government spending.

The market clearing condition is:

(24) $$G + \sum_{h=1}^{N}\sum_{t=1}^{T} c_t^h = \sum_{h=1}^{N}\sum_{t=1}^{T}\{Y_t^h - tc_t^h - X_t^h\},$$

The government budget constraint is:

(25) $$G + \sum_{h=1}^{N}\sum_{t=0}^{T} L_t^h = \sum_{h=1}^{N}\sum_{t=1}^{T}\{TP_t(y_t^h) + LP_t(d_{t-1}^h, y_t^h) + \kappa c_t^h\}$$

Note that we allow for deficit in the loan program: The total amount of loans granted, $\sum_{h=1}^{N}\sum_{t=0}^{T} L_t^h$, may be different from the total amount of loan payments, $\sum_{h=1}^{N}\sum_{t=1}^{T} LP_t$.

In equilibrium, consumers solve (23) and (24) - (25) are satisfied. To define equilibrium in detail, note that government policy is a choice of interest rates, (r, r_b, r_m), loans limits (LL_t), a ceiling on lifetime income tax payments ($\overline{J}$), a verification effort (v), and payment functions (LP_t, TP_t). I denote the government policy by

$\Gamma = (r, r_b, r_m, LL_0, ..., LL_{T-1}, \bar{J}, v, LP_1, ..., LP_T, TP_1, ..., TP_T)$. Consumers choose $\mathrm{H} = (L_t^h, c_t^h, m_t^h, b_t^h, \varepsilon_t^h; t = 1, ..., T, h = 1, ..., N)$. Equilibrium is thus a vector (Γ, H) such that (a) given Γ, $(L_t^h, c_t^h, m_t^h, b_t^h, \varepsilon_t^h)$ solves (23) for all h, (b) the market clearing condition (24) and the government budget constraint (25) are satisfied.

I now focus on equilibrium in which there is enough liquidity and all interest rates are equal to zero. The equality between the interest rates is the Friedman rule. The level of zero is the optimal interest rate in Samuelson (1958), Diamond (1965) and Cass and Yaari (1966) that is obtained when restricting attention to the steady state. Diamond (1965) shows that the social planner will set the steady state interest rate at a level equal to the rate of population growth (n) even when the marginal product of capital is different from n. Here we have the special case: $n = 0$.

I evaluate the allocation of consumption by the following planner's problem:

$$V(x) = \max_{c_t^h} \sum_{h=1}^{N} \omega^h U^h(c_1^h, ..., c_T^h) \qquad \text{s.t. } \sum_{h=1}^{N} \sum_{t=1}^{T} c_t^h = x, \tag{26}$$

where $\omega^h > 0$ are the weights that the planner assigns to type h and x is the amount that the planner can allocate to consumption. The first order conditions for an interior solution to (26) require:

$$\frac{U_t^h}{U_1^h} = 1, \text{ for all } t \text{ and } h, \text{ where } U_t^h = \frac{\partial U^h(c_1^h, ..., c_T^h)}{\partial c_t^h}. \tag{27}$$

Condition (27) insures that a planner cannot increase welfare if he takes a unit from age 1 type h agent and transfers it to age t type h agent. Similarly, a type h agent who can lend and borrow at a zero interest rate will choose a consumption path such that (27) will be satisfied and it is not possible to increase utility by reducing consumption in age 1 and saving it until age t. It follows that under (27) it is not possible to increase the welfare of an individual agent by changing the allocation of consumption over his lifetime without changing the present value of his consumption. This is the condition for intertemporal efficiency.

I now turn to characterize a Friedman-Samuelson equilibrium defined as follows. A Friedman-Samuelson (FS) equilibrium is an equilibrium in which the loan limits LL_t are large (and not binding) and $r_m = r_b = r = 0$.

Proposition 1: A FS equilibrium has the following properties:

(a) The consumer cannot do better than elect $L_t^h = LL_t$ and $b_t^h = 0$;

(b) We can write the consumer's budget constraint in the following present value form:

(28) $$(1+\kappa)\sum_{t=1}^{T} c_t^h = d_T^h - J_T^h + \sum_{t=1}^{T}(Y_t^h - X_t^h);$$

(c) We can write (25) as:

(29) $$G = \sum_{h=1}^{N}(J_T^h - d_T^h) + \sum_{h=1}^{N}\sum_{t=1}^{T}\kappa c_t^h$$

(d) Either (24) or (25) is redundant $\{(26)+(24)\rightarrow(25)$ and $(28)+(25)\rightarrow(24)\}$;

(e) A change in the payment functions (LP_t, TP_t) that does not change the total payments $J_T^h - d_T^h$, is neutral.

(f) The condition for intertemporal efficiency (27) is satisfied and there are weights $\omega^h > 0$ such that welfare in equilibrium is: $V\left(-G + \sum_{h=1}^{N}\sum_{t=1}^{T}(Y_t^h - X_t^h)\right)$.

The proof is in the Appendix. Part (a) says that the agents can do no better than choosing the default option and using the checking account only. This is because there is no reason to go to the bank when $r_m = r_b = r$. The following two parts says that once we adopt the Friedman rule, the economy looks like a standard non-monetary economy with a perfect market for borrowing and lending: Part (b) says that when there is enough liquidity, the consumer can choose out of a single budget constraint that limits the present value of expenditures and part (c) says that from the government budget point of view, only the total net payment made by each type ($J_T^h - d_T^h$) is relevant. Part (d) says that either the market clearing condition or the government budget constraint is redundant. Part (e) combines the results in (28) and (29) to show equivalence of alternative policies

with the same net payments. Part (f) says that the allocation of resources devoted to consumption is efficient.

I now turn to show some additional claims about the equilibria in Proposition 1 that highlight the role of the option not to report income and the ceiling on lifetime taxes.

Proposition 2: A FS equilibrium has the following additional properties:
(a) An individual who pays his loan in full and reaches the maximum lifetime tax payments ($d_T^h = 0$ and $J_T^h = \bar{J}$) will not report his income (choose the option of not filing and having his income recorded as $\overline{Y_t} = \max_h \{Y_t^h\}$);
(b) A Pareto improvement is possible if no one reaches the ceiling $\bar{J}$ and the type with the highest lifetime tax payments, $h^* = \arg\max_h \left\{J_T^h\right\}$, under-reports income and pays his loan in full ($d_T^{h^*} = 0$).

Part (a) says that an individual who reaches the ceiling and pays his loan in full will not report income. To see this claim note that an individual who invests resources in underreporting or even true reporting and reaches the tax ceiling can increase his consumption by choosing the no reporting option and taking a loan that is large enough to finance the high tax payments when young.

Part (b) is a direct consequence of (a). It says that a Pareto improvement is possible if h^* chooses to under-report income. To show this claim, note that when the highest paying type chooses to under-report income, it must be the case that no one reaches the ceiling $\bar{J} > J_T^{h^*}$. The government can improve matters by lowering the ceiling and setting: $\bar{J} = J_T^{h^*}$. In this case h^* will choose not to report his income and increase the present value of his consumption by the amount he spent on avoiding detection and filing reports. The increase in consumption of type h^* agents implies an increase in

consumption tax revenues that permits a decrease in the consumption tax rate and increase in the welfare of all types.[7] [8]

Individuals who reach the ceiling face a zero marginal tax rate. Proposition 2 is therefore related to the result in Mirrlees (1971) and Stiglitz (1981). They considered a single period economy and show that in the "normal case" efficiency requires zero marginal tax rate on the high ability individuals. Their model focus on the labor supply choice while here I focus on collection costs.

6. DEVIATIONS FROM THE FRIEDMAN RULE

The FS equilibrium requires that all interest rates are the same and are equal to zero. We may distinguish between two "rules": (a) The Samuelson rule that requires an interest rate equal to the rate of population growth (zero in our case) and (b) The Friedman rule that requires zero nominal interest rate or more generally equality among the various interest rates $(r = r_b = r_m)$. The Samuelson rule was discussed in section 4. Here I discuss the Friedman rule asking whether $r_m < r = r_b = 0$ can improve matters.

We showed that the allocation in the FS equilibrium is intertemporally efficient. It may still be possible to increase welfare by taxing real balances provided that the tax on real balances reduces administrative costs without having an adverse effect on the distribution of income. I now argue that this is not likely to be the case.

I follow da Costa and Werning (2008) who use the mechanism design approach to argue that inflation tax makes sense only if it aids the redistribution of income from the

---

[7] Other high-income types may also choose not to report their income and pay more (income and consumption) taxes. This reinforces the argument.

[8] Having a ceiling on lifetime tax payments may lead to a large improvement in some countries. In Israel for example, residents must pay tax on their worldwide income while nonresidents pay only on income generated in Israel. As a result some people who want to live in Israel are very careful not to spend more that 180 days per year and satisfy some other "non residency" requirements. A ceiling on lifetime income may solve the problem for these people who will be able to choose residency without tax considerations.

more to the less productive. They study a direct mechanism in which each individual reports his type and the tax he pays (or the transfer he gets) is determined by his report. Formally, they study the problem of a planner who faces incentive compatibility constraints in addition to the resource constraint. The incentive compatibility constraints insure that individuals will not have an incentive to misreport their type. In this context, taxing real balances can help if it makes misreporting more difficult. That is, if the more productive individual who pretends to be less productive and reports a lower income will want to hold more money than the individual he pretends to be. But in their model the opposite is true. da Costa and Werning therefore concludes that zero nominal interest rate is optimal. This result holds in a variety of models. A partial list includes, Kimbrough (1986), Correia and Teles (1996) and Chari, Christiano and Kehoe (1996).

I now turn to apply this line of reasoning. I show in the Appendix the following Claim.

Claim 1: When the average (per period) demand for real balances is proportional to average consumption, a tax on real balances is not optimal: It is possible to make a Pareto improvement by replacing the tax on real balances with a tax on consumption.

The intuition is as follows. When real balances are proportional to consumption a tax on real balances can be viewed as a tax on consumption that has the undesirable effect of inducing trips to the bank. Replacing the tax on real balances with an additional tax on consumption will therefore free resources and allow each individual to increase his consumption by the amount he spends on trips to the bank.

In our model, income tax is used to change the distribution of income from the distribution that will prevail if only consumption tax is used. A tax on real balances can aid in the distribution of income if it is progressive. This is not the case in a Baumol-Tobin type model in which the elasticity of the demand for money with respect to

consumption is less than unity. Since a tax on money is regressive, we may achieve a Pareto improvement by eliminating it, increasing the revenues from consumption tax and reducing the revenues from income tax.[9]

7. THE OPTIMAL VERIFICATION EFFORT: AN EXAMPLE

I now consider an example that illustrates the determination of the verification effort v. I assume the special case: $N=1,\ Y_t=1,\ T=10$. I assume that there are no costs of reporting true income ($z_t=0$) and therefore the representative agent will never over report his income.

There is a standard proportional income tax. The income tax rate is $0\le\tau\le 1$ and the tax payments at age t are: $\tau(1-\varepsilon_t)$. The cost of underreporting for the representative consumer is: $e=v\varepsilon^2$. The agent chooses ε to minimize the sum of underreporting efforts and tax payments. He thus solves: $\min_{\varepsilon} e+\theta=v\varepsilon^2+\tau(1-\varepsilon)$. The first order condition for this problem requires:

(30) $$\varepsilon=\frac{\tau}{2v}$$

The government takes (30) as given and seeks to minimize the amount of resources spent on tax collection subject to its budget constraint. It thus solves:

$\min_{v,\tau} e+v=v\varepsilon^2+v$ s.t. $\tau(1-\varepsilon)T=g+v$ and (30).

---

[9] The assumption that the cross sectional elasticity of the average holding of real balances with respect to consumption is less than unity is thus critical for our argument. To build some intuition, it may be useful to consider two individuals who face the same cost of going to the bank. Individual 2 consumes in each period twice the amount that individual 1 consumes. Individual 2 can go to the bank exactly the same number of times as individual 1 and draw twice the amount of money in each visit. If he does this he will hold on average twice the amount of money and will pay twice the amount of "inflation tax" (or more accurately "nominal interest rate tax"). But since the cost of going to the bank is fixed individual 2 will choose to go to the bank more often than individual 1 and therefore his holding of money will be less than twice the amount held by individual 1.

Using $x = \frac{\tau}{v}$ and λ for the Lagrangian multiplier, we can write the first order conditions for the government's problem as follows.

(31) $$1 + \lambda\left(1 - (½)x^2T\right) = (¼)x^2$$

(32) $$\lambda = \frac{(½)x}{T(1-x)}$$

(33) $$\tau = \frac{gx}{Tx - (½)x^2T - 1}$$

From (31) and (32) we get the following quadratic equation:

(34) $$x^2T + (4T-2)x - 4T = 0$$

The positive solution to this equation is: x = 1.025.

Note that (30) implies that $\varepsilon(T) = (½)x(T)$ does not depend on g and (33) implies that $v = \frac{\tau}{x} = \frac{g}{Tx - (½)x^2T - 1}$ is proportional to g. Furthermore, $e = v\varepsilon^2 = \frac{(¼)x^2 g}{Tx - (½)x^2T - 1}$ is proportional to g.

Table 1 illustrates, assuming three levels of government spending. The level of underreporting remains at 0.51 regardless of the tax rate. A higher tax rate (induced by higher g) leads to higher verification efforts and higher underreporting efforts. The fraction of income spent on tax collection $(v + Te)/T$ increases with g.

Table 1: A numerical example

g	τ	v	ε	e	$(Te+v)/T$
1	0.26	0.25	0.51	0.066	0.09
2	0.51	0.50	0.51	0.131	0.18
3	0.77	0.75	0.51	0.197	0.27

This example illustrates the difference between the standard analysis of tax distortion and the analysis here that focus on administrative costs. Here higher taxes do not change reported income and may actually lead to an increase in measured GDP.

8. A BROADER PERSPECTIVE

In economies that last forever, we may have private Ponzi schemes that compete with the government money creation activities (that can also be described as a Ponzi scheme). For example, one can establish a firm that owns virtually nothing and offer to sell it to the public. If the public believes that the stocks of the firm will have the same rate of return as the money offered by the government, agents will be willing to exchange the stocks for money or for goods and the stocks will indeed earn the expected rate of return. (See Karaken and Wallace [1981] for a similar argument in an international setting.)

Should we allow the private sector to compete with the government by creating money substitutes, or should we impose regulations aimed at discouraging money substitutes? This is an old question that at least in my mind, has not been resolved. But as the current crisis illustrates, it is still highly relevant. I now offer a discussion of this important policy issue, in an attempt to put the proposal to institute a government loan program in the broader context of capital market regulations.

I start with the difference between the social and the private value of financial innovations. To illustrate this difference, I consider an economy in which gold is the only asset and gold has no intrinsic value. A financial innovator comes up with the idea of a bank. He issues claims on 10 ounces of gold for each ounce of gold that he has in his safe. The claim says that the holder of the claim can exchange it for one ounce of gold at a certain location (bank) at any time. Of course, there is a well known problem of bank runs that arises because there are more claims than gold in the safe, but for some reason people discount the possibility of bank runs and they treat the claims on gold as perfect substitutes for gold. The financial innovator sells the claims for a castle worth 10 times the amount of gold he has and retires. The idea catches on and as a result the money supply is increased by a factor of 10. The original innovators make seigniorage type

revenues. They certainly gain from the financial innovation. The society as a whole also gains from it because eventually the price of gold (in terms of goods) goes down and as a result less resources are devoted to the digging of gold.

Run now the same story after replacing gold with fiat money. The original innovators gain from the creation of banks because they get some real estate for the seigniorage revenue they made. The society as a whole does not gain from it. The money supply went up and the price level is up. Some resources (real estate) were transferred from the public at large to the financial innovators.

Suppose now that after many years there is a bank run. For some reasons people stop to believe in checks and want to receive cash only. As a result the money supply (M1) is now 10% of the pre run level. In the presence of price rigidity, a reasonable response on the part of the FED will be to print (high powered) money and distribute it to the agents in the economy so that M1 remains constant. At the same time the government should impose a 100% reserve requirement on the banks. Otherwise, when the crisis is over and the faith in checks is restored the government will have to levy more (distortive) taxes to absorb the increase in the base that occur during the crisis or let the money supply increase and suffer the consequences of inflation.

Let us move now to the present crisis and view it as a bank run episode as in Gorton (2009). Instead of banks we now have “shadow banks” and instead of the injection of cash we now have “bailouts” of financial institutions. Instead of the 100% reserve requirement we need now a broader set of regulations that will limit the ability of the “shadow banking” sector to create substitutes for money and artificial wealth. Otherwise, we will suffer from inflation or the distortive effects of higher taxes.

In addition to this fiscal argument, there are of-course other reasons to prohibit privately created Ponzi schemes. Any privately created Ponzi scheme has the same economic consequences as counterfeiting money and therefore has adverse wealth distribution effects and may lead to financial instability.

A prohibition on private Ponzi scheme is in line with the controlling the money supply, broadly defined. A narrow definition of money focuses on the medium of exchange characteristic. But recently, Woodford (2003) and others have argued that in a technological advanced society all assets can be used as medium of exchange. Woodford assumes that the prices of all assets are based on fundamentals. But in an overlapping generations model there may be government and private assets that have value but no fundamentals. We may thus define all assets with no fundamentals as money and view a prohibition on private assets with no fundamentals as a way of controlling the money supply.

How do we know if an asset has fundamentals? The following hypothetical stress test may help. We assume that the government prohibits trade in a given asset and offers to buy the asset from individuals at the date in which the prohibition on trade is imposed. We then ask at what price can the government get the asset. In the case of fiat money, the answer is zero. In the case of a house that is rented or lived in the answer is not much less than the pre-prohibition market value and may even be equal to it if the Friedman rule is implemented and agents are satiated with liquidity. The same hold for stocks that their price is based on fundamentals because the owner of the stocks will still get a stream of dividends. But this is not the case for assets that are grossly overvalued.

An actual stress test along these lines may be used to "burst bubbles" but it requires too much judgment on the part of the government.[10] One alternative is to wait for the bubble to burst and then employ "unconventional monetary policy" in which the

---

[10] This can be done in the following way. The government may impose a ban on trade in a suspected asset for say 10 years and offer to buy it at a low price. Agents will not sell the asset to the government, if the government made a mistake and the asset has reasonable fundamentals. In this case, the owners of the assets will just get a stream of dividends for the next 10 years. (Again, this may not be a problem if the Friedman rule is implemented). Otherwise, if the government is correct, agents will sell the asset to the government. The government may then get the small stream of dividends for 10 years and then sell the asset.

central bank directly intermediate between lenders and borrowers as in Gertler and Karadi (2009).

Another alternative is to think of a system that is not conducive to the creation of bubbles. Here we view money as the primary vehicle for allocating consumption over time (trading in goods that will be delivered at different dates) and argue that the government should dominate this aspect of the capital market. What is left to the private market is the allocation of risk (trading in goods that will be delivered in different states of nature). One possible guideline for regulations is therefore the discouraging of private assets that are not necessary for achieving efficient allocation of risk. For example, we may consider a financial system that is based on four components: (a) classical banks regulated by the government, (b) a stock exchange that is restricted to its original meaning, namely trade in shares of public companies (c) the government loan program described above and (d) classical insurance companies restricted to the elimination of individual idiosyncratic risk such as the risk of car accidents, death and health. The insurance companies should not be allowed to sell contracts that insure financial assets or investment projects.

This structure will be sufficient to allow individuals to allocate consumption over time by using the government loan program and, to a lesser extent, private banks. An entrepreneur can use the government loan program and the banks to get seed money and start a business. An established publicly traded company can finance a new project by selling stocks or using the banks. An individual can choose any combination of the riskless asset provided by the government and stocks. Of course, there are many unresolved issues. For example, should we allow trade in derivatives? The question is whether the benefit of reducing transaction costs is larger than the cost of the added complexity that can be misused to create bubble assets of the type that we want to discourage. Bank regulation is another issue. One argument for the 100% reserve

requirement is the fiscal considerations described above: get the seigniorage revenues to pay for the bailouts.

The approach to regulations here is in the spirit of Hume and Henry Simons. Hume (1752, p. 35) expressed “a doubt concerning the benefit of banks and paper-credit, which are so generally esteemed advantageous to every nation”. He seems to favor regulations against paper (inside) money and argue (on page 36) for a government run bank. Simons (1948, p. 79-80) argued for “Financial reform (banking reform primarily) aiming at sharp differentiation between money and private obligations” and for “Increasing concentration on the hands of the central government of the power to create money and effective money substitutes”.

It is also in the spirit of some of the recommendation of the Group of Thirty released on January 15, 2009. In general they see a role for the central bank in “promoting and maintaining financial stability” (page 36). They recommend that “Money market mutual funds wishing to continue to offer bank-like services, such as transaction account services, withdrawals on demand at par, and assurances of maintaining a stable net asset value (NAV) at par, should be required to reorganize as special-purpose banks, with appropriate prudential regulation and supervision”. (page 29).

The report consider the possibility of setting “Some form of broad-based collateral requirements or margin-setting authority, including authority to set minimum initial and maintenance margin requirements across a broad range of financial asset markets and instruments in which leverage is typically employed” (page 36). And their recommendation 7a is: “Where not already the case, central banks should accept a role in promoting and maintaining financial stability. The expectations should be that concerns for financial stability are relevant not just in times of financial crisis, but also in times of rapid credit expansion and increased used of leverage that may lead to crises.”

The suggested limits on leverage will force companies to rely more on stock financing and is a limitation on the ability of the private sector to create bonds that are a closer substitute to money.

The approach to regulations here is not in the spirit of Friedman (1967). In this article, Friedman reviews Simons proposals and argues against them. In page 3 he asks rhetorically: “Why should we not have variety and diversity in the market for borrowing and lending as in other markets? Is it not desirable that borrowers tailor their obligations to the demands of lenders? Is it not a sign of the ingenuity and efficiency of the free market that financial intermediaries develop which reconcile the needs of borrowers and lenders-providing funds on terms desired by borrowers and borrowing on terms desired by lenders?” It is hard to reconcile Friedman’s criticism of Simons with the analysis in his 1969 celebrated Optimum Quantity of Money article. In his 1969 article Friedman argues that from the social point of view there is no cost for creating liquidity. Why should we invest resources in creating substitutes for something that can be costlessly created? Ingenuity is a scarce resource and we should find a better use for it than creating money substitutes.

9. CONCLUDING REMARKS

The paper describes a government loan program that complements money. It focuses on administrative costs and the difference between the collection technologies available to the public and the private sectors.

The first part of the paper uses a finite horizon economy to spell out the government’s advantage in collecting income contingent payments and intermediating between people of the same age. It is shown that a government loan program that reduces the borrowing rate can actually reduce the cost of collecting taxes. This is because private banks impose a negative externality on the IRS: Agents know that in the case of bankruptcy they will have to reveal their report to the IRS and therefore their incentive to

conceal income increases with the size of their debt. Since the government can costlessly observe its own IRS records, it can lower the borrowing rate, reduce the debt and the incentive to conceal income.

Next we used an overlapping generations economy to argue that "negative money" or a government loan program is required for trade between generations in the realistic case in which the young want to borrow. This is an extreme case of a government advantage in collecting payments: the old cannot collect payments from the young because by the time the young are ready to pay the old are already dead.

We then turned to implementation issues asking whether the interest rate on loans should be higher than the interest rate on government bonds and the rate of return on money. It was shown that when the Samuelson and the Friedman rules are implemented, the resources devoted to consumption are allocated optimally over generations and over the lifetime of individuals: The allocation is intertemporally efficient.

It may still be possible to increase welfare by deviating from the Friedman rule and taxing real balances provided that the tax on real balances reduces administrative costs without having an adverse effect on the distribution of income. I argue that this is not likely to be the case because: (a) a tax on money is regressive and (b) collecting value added taxes is easier than collecting income tax. It follows that a steady state with a tax on money cannot be efficient: The government can make a Pareto improvement by eliminating the tax on money, reducing income tax and increasing consumption (value added) tax.

The government should also charge the same rate for borrowing and lending even if this leads to a loan program that runs a deficit. This is because loans defaults are transfers to the relatively poor and only the government total budget must be balanced. Efficiency can therefore be achieved if the government uses a single interest rate: $r = r_b = r_m$. The optimal level of the interest rate is governed by a Samuelson type rule: It should equal the rate of population growth.

A government loan program that reduces the importance of "liquidity constraints" may inspire some suggestions for improving the tax system itself. It may facilitate a change in the tax base from current to permanent income. It may also increase the benefits of putting an effective ceiling on lifetime tax payments. These suggestions are consistent with Mirrlees (1971) and Stiglitz (1981) who consider a single period economy in which taxes distorts the labor leisure choice.

Finally, the tax distortion here is different from the standard labor market distortion. I show by an example that here an increase in the income tax rate may lead to an increase in collection costs without affecting the level of reported income. But the main reasoning behind a government loan program is not likely to change if we make labor an endogenous variable.

APPENDIX

Proof of Proposition 1: Under (17) and $r = r_m$, a policy of maximizing debt at each age is optimal. To show this claim (part [a]), I assume that the consumer chooses at age t, $\Delta_t^h < L_t$ and pays α^h to go to the loan office. An alternative choice is to choose the default option and increase consumption at age t by the cost of the trip to the bank α^h without changing consumption in all other periods. To see that this is possible assume that we keep a separate account for the additional loan of $x_t = L_t - \Delta_t^h$ units and assume that the consumer's reported income is sufficiently high so that the payment (10) is $rx_\tau + \frac{x_\tau}{T-\tau+1}$ for $\tau = t+1,...,T$. Since $r = r_m$ the evolution of debt balances in this account is: $x_{\tau+1} = x_\tau - rx_\tau - \frac{x_\tau}{T-\tau+1} + r_m x_\tau = x_\tau - \frac{x_\tau}{T-\tau+1}$ and at age T the balances will be exactly zero. If the reported income is not high, the consumer may pay less and have some debt left at the end of his life ($x_T > 0$). This means that the special account will create some money that can be used to increase consumption at some other dates. Therefore, $\Delta_t^h < L_t$ cannot be optimal.

To show that private bonds will not be used (the second part of [a]), I consider a plan $\{L_t, c_t, m_t, b_t, \varepsilon_t\}$ that satisfies the constraint (13)-(22) and uses costly credit that leads to $tc_t > 0$ for some t. Under the Friedman rule the plan $\{L_t^* = LL, c_t^* = c_t + tc_t, b_t^* = 0, m_t^* = m_t + b_t, \varepsilon_t\}$ is also feasible. Since the "star" alternative has more consumption at each date the original plan cannot be optimal. We have thus shown that trading in the bonds market cannot be optimal under the Friedman rule.

To show (b) I use (a) to write (22) as:

$$m_t^h = Y_t^h + m_{t-1}^h + L_t^h - LP_t - TP_t - (1+\kappa)c_t^h - X_t^h \tag{A1}$$

I now proceed with forward substitution.

$$m_0^h = L_0^h$$

$$m_1^h = Y_1^h + L_0^h + L_1^h - LP_1 - TP_1 - (1+\kappa)c_1^h - X_1^h = Y_1^h + d_1^h - TP_1 - (1+\kappa)c_1^h - X_1^h$$

$$m_2^h = Y_2^h + m_1^h + L_2^h - LP_2 - TP_2 - (1+\kappa)c_2^h - X_2^h$$

$$= Y_2^h + Y_1^h + d_1^h + L_2^h - LP_2 - TP_1 - TP_2 - (1+\kappa)c_1^h - (1+\kappa)c_2^h - X_1^h - X_2^h$$

$$= Y_2^h + Y_1^h + d_2^h - TP_1 - TP_2 - (1+\kappa)c_1^h - (1+\kappa)c_2^h - X_1^h - X_2^h$$

Proceeding in this way leads to:

$$m_T^h = d_T^h + \sum_{t=1}^{T}\left(Y_t^h - TP_t - (1+\kappa)c_t^h - X_t^h\right)$$

Since the consumer has no bequest motive, we may set $m_T^h = 0$ which leads to (28).

To show (c) note that

$$\sum_{h=1}^{N}(J_T^h - d_T^h) = \sum_{h=1}^{N}\sum_{t=0}^{T}\left(\theta_t(y_t^h) + LP_t(d_{t-1}^h, y_t^h) - L_t^h\right) \tag{A2}$$

leads to (29). To show (d), I sum (28) over h. This leads to:

$$\kappa\sum_{h=1}^{N}\sum_{t=1}^{T}c_t^h - \sum_{h=1}^{N}(d_T^h - J_T^h) = \sum_{h=1}^{N}\sum_{t=1}^{T}(Y_t^h - X_t^h - c_t^h) \tag{A3}$$

Substituting (29) in (A3) leads to:

$$G = \sum_{h=1}^{N}\sum_{t=1}^{T}(Y_t^h - X_t^h - c_t^h). \tag{A4}$$

Thus, $(28) + [(29) = (25)] \rightarrow (24)$. We can also substitute (24) in (A3) to get (29).

The equivalence result in (e) follows directly from (b)-(d).

I now turn to show (f). I start with the problem of choosing consumption given the underreporting decision:

(A5) $$\max_{c_t^h} U^h(c_1^h,...,c_T^h) \quad \text{s.t.} \quad (1+\kappa)\sum_{t=1}^{T} c_t^h = d_T^h - J_T^h + \sum_{t=1}^{T}(Y_t^h - X_t^h)$$

The first order conditions for (A5) require:

(A6) $$\frac{U_t^h}{U_1^h} = 1, \text{ for all } t, \text{ where } U_t^h = \frac{\partial U^h(c_1^h,...,c_T^h)}{\partial c_t^h}.$$

The first order conditions to the planner's problem (26) require that (A6) holds for all h and

(A7) $$\omega^h U_t^h(c_1^h,...,c_T^h) = \omega^1 U_t^1(c_1^1,...,c_T^1).$$

To show part (f) note that the equilibrium allocation satisfies (A6) and we can choose weights ω^h such that (A7) is satisfied. □

Assumptions that leads to Claim 1:

I assume that there is no cost for filing income tax forms ($z_t = 0$) and therefore individuals will never over report their income. I assume that the present value of the tax payments depends on the present value of reported income and is given by the monotone and differentiable function: $\theta\left(\sum_{t=1}^{T} Y_t^h - \varepsilon_t^h\right)$. The individual agent chooses the amount of underreporting income by minimizing the present value of the tax payments and the tax evasion costs: $\min_{\varepsilon_t^h} \theta\left(\sum_{t=1}^{T}(Y_t^h - \varepsilon_t^h)\right) + \sum_{t=1}^{T} e^h(\varepsilon_t^h, v)$. The first order conditions for this problem require: $\frac{\partial e^h(\varepsilon_t^h, v)}{\partial \varepsilon_t^h} = \theta'$ for all t. Thus agents equate the marginal cost of underreporting to the marginal tax rate and since the marginal tax rate does not change over his lifetime, the underreporting magnitude does not change with age. I use $\varepsilon^h(\theta, v)$ to denote the solution to the agent's problem. The total amount spent on underreporting income is thus: $Te^h\left(\varepsilon^h(\theta,v), v\right)$. This amount depends on the function θ and on the amount spent on income verification.

I now turn to discuss the consumer's demand for money using the familiar Baumol-Tobin approach. I use $tc^h = \sum_{t=1}^{T} tc_t^h$ to denote the total amount spent on trips to the bank and $m^h = \sum_{t=1}^{T} m_{t-1}^h$ to denote the total amount of real balances held. I assume that the average amount spent on trips to the bank depends on the average amount of real balances held: $tc^h = tc^h(m^h)$. The consumer chooses the amount of real balances by solving: $\min_{m^h} tc^h(m^h) - r_m m^h$. I use $m^h(r_m)$ to denote the solution to this problem.

Proof of Claim 1: Total consumption of type h is:

(A8)
$$(1+\kappa)c^h = (1+\kappa)\sum_{t=1}^{T} c_t^h$$
$$= r_m m^h(r_m) - tc^h\left(m^h(r_m)\right) - Te^h\left(\varepsilon^h(\theta,v),v\right) - \theta\left(\sum_{t=1}^{T}[Y_t^h - \varepsilon^h(\theta,v)]\right) + \sum_{t=1}^{T} Y_t^h$$

When $m^h = \mu(1+\kappa)c^h$ is proportional to total consumption, we can write (A8) as:

(A9)
$$(1+\kappa)(1-r_m\mu)c^h$$
$$= -tc^h\left(m^h(r_m)\right) - Te^h\left(\varepsilon^h(\theta,v),v\right) - \theta\left(\sum_{t=1}^{T}[Y_t^h - \varepsilon^h(\theta,v)]\right) + \sum_{t=1}^{T} Y_t^h$$

where $(1+\kappa)(1-r_m\mu)-1$ is the "effective" consumption tax rate. We can now replace the tax on real balances by an additional tax on consumption. This can be done by setting a zero nominal interest rate ($\hat{r}_m = 0$) and raising the explicit consumption tax rate to its "effective" level: $\hat{k} = (1+\kappa)(1-r_m\mu) - 1$. This will eliminate the trips to the bank and increase both total consumption for each type and the revenues from the consumption tax. To see this, note that total consumption is now determined by:

(A10)
$$(1+\hat{\kappa})\hat{c}^h = -Te^h\left(\varepsilon^h(\theta,v),v\right) - \theta\left(\sum_{t=1}^{T}[Y_t^h - \varepsilon^h(\theta,v)]\right) + \sum_{t=1}^{T} Y_t^h$$

Comparing (A10) and (A9) and using $\hat{k} = (1+\kappa)(1-r_m\mu) - 1$ implies: $\hat{c}^h > c^h$. Since replacing the tax on real balances by an increase in the consumption tax rate leads to an increase in tax revenues, the government can reduce tax rates and increase net total income even further. The increase in net income leads to an increase in welfare because agents are free to lend and borrow at a zero interest rate. □

REFERENCES

Alt, James. "The Evolution of Tax Structures." Public Choice, Vol. 41, No. 1 (1983), pp. 181-222.

Altig David, Alan J. Auerbach, Laurence J. Kotlikoff, Kent A. Smetters and Jan Walliser. "Simulating Fundamental Tax Reform in the United States" The American Economic Review, June 2001, Vol. 91, No. 3, 574-595.

Baumol, W.J., 1952: "The Transaction Demand for Cash: An Inventory Theoretic Approach," Quarterly Journal of Economics, 66, 545–56.

Bernanke Ben and Mark Gertler., "Agency Costs, Net Worth, and Business Fluctuations" American Economic Review, March 1989, 79(1), pp. 14-31.

Cass, David and Yaari Menahem E., 1966: "A Re-examination of the Pure Consumption Loans Model," Journal of Political Economy, 74 (4), 353–67.

Chari, V.V., Lawrence J. Christiano, and Patrick J. Kehoe, 1996: "Optimality of the Friedman Rule in Economies With Distorting Taxes," Journal of Monetary Economics, 37 (2), 203–23.

Correia, Isabel and Teles Pedro, 1996: "Is the Friedman Rule Optimal When Money Is an Intermediate Good?," Journal of Monetary Economics, 38, 223–44.

da Costa, Carlos E. and Ivan Werning, 2008: "On the Optimality of the Friedman Rule with Heterogeneous Agents and Non-Linear Income Taxation" The Journal of Political Economy, Vol. 116, No. 1, 82-112.

Diamond, Peter, A., 1965: "National Debt in a Neoclassical Growth Model" The American Economic Review, Vol. 55, No. 5, Part 1, 1126-1150.

Evans, David S. and Boyan Jovanovic. "An Estimated Model of Entrepreneurial Choice Under Liquidity Constraints" Journal of Political Economy, August 1989, Vol. 97, No. 41, 808-827.

Friedman Milton, Capitalism and Freedom, Fortieth Anniversary Edition, The University of Chicago Press.

——, 1967: "The Monetary Theory and Policy of Henry Simons," *Journal of Law and Economics*, 1967, 10. Reprinted in *The Optimum Quantity of Money and Other Essays*. Chicago: Aldine, pp. 1–50.

——, 1969: "The Optimum Quantity of Money." In *The Optimum Quantity of Money and Other Essays*. Chicago: Aldine, pp. 1–50.

Gary Gorton., “Slapped in the Face by the Invisible Hand: Banking and the Panic of 2007”, Prepared for the Federal Reserve Bank of Atlanta’s 2009 Financial Markets Conference: Financial Innovation and Crisis, May 11-13, 2009.

Gertler Mark and Peter Karadi., “A Model of Unconventional Monetary Policy”, mimeo, April 2009, NYU.

Group of Thirty, Financial Reform: A framework for financial stability, January 15, 2009.

Hall, Robert E. and Rabushka, Alvin. The Flat Tax, 2nd Ed. Stanford, CA: Hoover Institution Press, *1995*.

Hart Oliver and John Moore., "Incomplete Contracts and Renegotiation" Econometrica, Vol. 56, No.4 (July 1988), 755-785.

Hume, David, 1970: Writing on Economics, ed. Eugene Rotwein. Madison: University of Wisconsin Press.

Karaken, John and Neil Wallace, 1981: “The Indeterminacy of Equilibrium Exchange Rates,” Quarterly Journal of Economics, 96 (May), 207–22.

Kimbrough Kent, P., 1986: “The Optimum Quantity of Money Rule in the Theory of Public Finance,” Journal of Monetary Economics, 18, 277– 84.

Mayshar Joram. "Taxation with Costly Administration" Scandinavian Journal of Economics, Vol. 93, No. 1 (1991), pp. 75-88.

Mirrlees, J., 1971, “An exploration in the theory of optimum income taxation”, Review of Economic Studies 38, 175-208.

Reinganum Jennifer F. and Louis L. Wilde., “A note on Enforcement Uncertainty and Taxpayer Compliance” The Quarterly Journal of Economics, November 1988, 793-798.

Samuelson, Paul A., 1958: “An Exact Consumption-Loan Model of Interest with or without the Social Contrivance of Money,” Journal of Political Economy, 66 (6), 467–82.

Sargent, Thomas J. and Wallace, Neil, 1982: “The Real-Bills Doctrine versus the Quantity Theory: A Reconsideration,” Journal of Political Economy, 90 (6), 1212–36.

Scotchmer Suzanne., “Audit Classes and Tax Enforcement Policy” The American Economic Review, Vol. 77, No. 2, Papers and Proceedings of the Ninety- Ninth Annual Meeting of the American Economic Association (May, 1987), pp. 229-233.

Simons, Henry, 1948: Economic Policy for a Free Society. Chicago, Ill.: University of Chicago Press.

Slemrod Joel and Shlomo Yitzhaki "Tax Avoidance, Evasion and Administration" NBER Working paper 7473, January 2000. Also in Alan Auerbach and Martin Feldstein eds. Vol. 3 of Handbook of Public Economics, 2002 - North Holland.

Stiglitz Joseph E., “Self Selection and Pareto Efficient Taxation” Journal of Public Economics 17 (1982) 213-240.

Tobin, James, 1956: “The Interest Elasticity of the Transactions Demand for Cash,” Review of Economics and Statistics, 38 (3), 241–7.

Townsend, Robert M. “Optimal Contracts and Competitive Markets with Costly State Verification” Journal of Economic Theory, October 1979, 21(2), pp. 265-93.

Williamson, Stephen D., Costly Monitoring, Loan Contracts, and Equilibrium Credit Rationing.” Quarterly Journal of Economics, February 1987, 102(1), pp. 135-45.

Michael, Woodford., Interest and Prices: Foundations of a Theory of Monetary Policy, Princeton University Press, 2003.