European Disunion and Endogenous Money

Steve Keen, University of Western Sydney
Matheus Grasselli, Fields Institute, Toronto

"It ain't what you don't know that gets you into trouble. It's what you know for sure that just ain't so." (Mark Twain)[1]

Introduction

That the Euro has fallen into crisis a mere decade after its introduction is hardly surprising. The intrinsic problems in its design were evident to economists as widely separated intellectually as Wynne Godley and Milton Friedman. Writing in 1992, Godley observed that

> The central idea of the Maastricht Treaty is that the EC countries should move towards an economic and monetary union, with a single currency managed by an independent central bank. But how is the rest of economic policy to be run? As the treaty proposes no new institutions other than a European bank, its sponsors must suppose that nothing more is needed. But this could only be correct if modern economies were self-adjusting systems that didn't need any management at all.
>
> I am driven to the conclusion that such a view – that economies are self-righting organisms which never under any circumstances need management at all – did indeed determine the way in which the Maastricht Treaty was framed… All that can legitimately be done, according to this view, is to control the money supply and balance the budget…
>
> If a country or region has no power to devalue, and if it is not the beneficiary of a system of fiscal equalisation, then there is nothing to stop it suffering a process of cumulative and terminal decline leading, in the end, to emigration as the only alternative to poverty or starvation. (Godley 1992, pp. 3-4)

As the father of Monetarism (Friedman 1969), Friedman can be counted as one who did believe that "All that can legitimately be done is to control the money supply and balance the budget". Yet in 1997, he too disparaged the prospects for the Euro, because Europe did not meet the requirements for a successful currency union:

> A common currency is an excellent monetary arrangement under some circumstances, a poor monetary arrangement under others…

[1] http://www.brainyquote.com/quotes/quotes/m/marktwain109624.html#gG1VCldE1ax6zG0l.99.

> Europe's common market exemplifies a situation that is unfavorable to a common currency. It is composed of separate nations, whose residents … have far greater loyalty and attachment to their own country than to … the idea of "Europe."... goods move less freely than in the United States, and so does capital. The European Commission … spends a small fraction of the total spent by governments in the member countries. They, not the European Union's bureaucracies, are the important political entities… wages and prices in Europe are more rigid, and labor less mobile. In those circumstances, flexible exchange rates provide an extremely useful adjustment mechanism. (Friedman 1997)

One might hope that, with economists as disparate as Godley and Friedman able to agree that the Euro was always a bad idea, its unwinding—or at least the addition of the missing elements from a genuine common currency, such as fiscal union—could also be easily achieved. But current events indicate that Europe may persist with its unsustainable system until the social collapse and political disunity that Godley and Friedman anticipated finally destroys perhaps even the EEC itself.

There are many political reasons for this dogged determination to follow folly to its end—including the disparate benefits and costs of the Euro to different countries, the inherent inertia in multi-country political agreements, and Weimar Republic-based fears that fiscal expansion will cause hyperinflation.

But economic theory has also played a role, by promulgating the belief that government debt should be constrained, while private debt can be left unmonitored. This belief was entrenched in the Maastricht Treaty's limits on public debt, and is being enforced today via the selective imposition of austerity programs on the weaker economies that are in breach of these limits.[2]

Table 1: Selective enforcement of Maastricht rules; countries not in breach show in italics (OCED Data)

Country	Debt 2010	Deficit 2012
Austria	**65.754**	-2.91524
Belgium	**96.789**	-2.76901
Denmark	39.59	**-3.93904**
Estonia	3.227	-1.95331
Finland	41.683	-0.65739
France	**67.418**	**-4.4837**
Germany	44.403	-0.87541
Greece	**147.839**	**-7.37947**
Ireland	**60.703**	**-8.43531**
Italy	**109.015**	-1.71118
Luxembourg	12.578	-1.37629
Netherlands	51.845	**-4.28624**
Portugal	**87.962**	-2.8845
Slovak Republic	39.078	**-4.63447**

[2] Of European countries with populations above 10 million, only Germany is currently abiding by the Maastricht rules.

Slovenia	36.023	**-3.91918**
Spain	51.693	**-5.368**

The root of this belief is the Neoclassical "exogenous" model of money creation, in which "nothing is so unimportant as the quantity of money expressed in terms of the nominal monetary unit" (Friedman 1969, p. 1), the money supply is determined by the actions of the Central Bank, the level of private debt is determined by the supply of and demand for loanable funds, and private banks, as mere intermediaries between savers and borrowers in the loanable funds market, can be ignored in macroeconomics.

Ironically, though belief in this vision of money played a major role in the design of the European Monetary Union, and it is accepted by Neoclassical economists who argue for austerity as the solution to the crisis, it is also adhered to by Neoclassical critics of austerity. With unabashed hubris, this latter group—the self-described New Keynesians—are now claiming to be vindicated by the crisis, while appropriating Hyman Minsky and casting themselves as the future of economics in the process:

> We economists who are steeped in economic and financial history – and aware of the history of economic thought concerning financial crises and their effects – have reason to be proud of our analyses over the past five years…
>
> So the big lesson is simple: trust those who work in the tradition of Walter Bagehot, Hyman Minsky, and Charles Kindleberger. That means trusting economists like Paul Krugman, Paul Romer, Gary Gorton, Carmen Reinhart, Ken Rogoff, Raghuram Rajan, Larry Summers, Barry Eichengreen, Olivier Blanchard, and their peers. Just as they got the recent past right, so they are the ones most likely to get the distribution of possible futures right. (deLong 2012)

The revisionism in this argument is breathtaking. As late as September 2009, Blanchard was proclaiming that "the stage of macro [by which he meant DSGE modeling] is good" (O. J. Blanchard 2008, p. 210; O. Blanchard 2009, p. 2). Krugman, described here as working "in the tradition of Minsky" first actually read Minsky in May 2009 (Krugman 2009)—and found what he read (Minsky 1986) rather difficult to fathom.[3] And non-Neoclassical experts on Minsky with a long pedigree—like Randy Wray (Larry Randall Wray 1988) and Steve Keen (Keen 1995)—were completely ignored.

Though it is laughable, this revisionism should not be treated lightly. IS-LM analysis, which those who are truly aware of the history of economic thought know was a Walrasian model masquerading as Keynes (J. R. Hicks 1935; J. Hicks 1981),[4] was originally developed in what purported to be a book review

[3] This is not amazing since, as Keen observed in a comment on that blog post, Stabilizing an Unstable Economy was Minsky's worst book: "I second many of the comments here Paul–Stabilising an Unstable Economy was a very poor book. Leave it behind in Seoul and buy Can "It" happen Again? when you get back to New York. Steve Keen" http://krugman.blogs.nytimes.com/2009/05/19/actually-existing-minsky/?apage=3#comments.

[4] ""Wages and Interest: the Dynamic Problem" (Hicks 1935) … is important here, because it shows (I think quite conclusively) that that model was already in my mind before wrote even the first of my papers on Keynes." (Hicks 1981, p. 140); "It will readily be understood, in the light of what I have been saying, that the idea of the IS-LM diagram came to me as a result of the work I had been doing on three-way exchange, conceived in a Walrasian manner." (Hicks 1981, p. 141-142)

(J. R. Hicks 1937) of *The General Theory* (Keynes 1936). There is thus a prospect that a disaster caused in large measure by imposing a Neoclassical fantasy on the real world (the belief in self-equilibrating markets) and which is being amplified by imposing yet another Neoclassical fantasy (austerity as an economic stimulus) will be used to entrench still a third Neoclassical fantasy as the pinnacle of post-crisis macroeconomics (exogenous money and a neo-Walrasian macroeconomics derived from it by adding in a pinch of imperfect competition and incomplete information).

While there is no certainty that this Neoclassical juggernaut can be stopped, it is certain that it will roll over non-Neoclassical opposition unless a coherent, empirically accurate, and compelling alternative theory is developed. In what follows we set out essential elements of that alternative—starting with the empirical point of divergence between the dominant Neoclassical explanation for the severity and longevity of this crisis, and an endogenous money explanation.

Private Debt and Aggregate Demand

The New Keynesian Analysis: a "Liquidity Trap"

The New Keynesian explanation for the crisis is that we are in a liquidity trap as defined by Hicks (J. R. Hicks 1937, pp. 154-155), when the capacity of monetary policy to stimulate the economy fails:

> For the last fifty years the business of ending recessions has basically been the job of the Federal Reserve, which … controls the "monetary base," … Well, the Fed has tripled the size of the monetary base since 2008; yet the economy remains depressed… What the Fed can do by pushing more cash into the banks is drive down interest rates… But … it can't push them below zero… Unfortunately, a zero rate turned out not to be low enough, because the bursting of the housing bubble had done so much damage… And that's the liquidity trap: it's what happens when zero isn't low enough. (Krugman 2012f, pp. 31-33)

Krugman asserts that this alters an essential regularity in macroeconomics. Normally, the level and rate of change of private debt are irrelevant to macroeconomics, because private debt is simply a transfer from one agent to another, with a net sum impact on the macroeconomy of very nearly zero:

> to a first approximation debt is money we owe to ourselves… the overall level of debt makes no difference to aggregate net worth—one person's liability is another person's asset. It follows that the level of debt matters *only* if the distribution of net worth matters, if highly indebted players face different constraints from players with low debt…. when debt is rising, it's not the economy as a whole borrowing more money. It is, rather, a case of less patient people … borrowing from more patient people. The main limit on this kind of borrowing is the concern of those patient lenders about whether they will be repaid, which sets some kind of ceiling on each individual's ability to borrow. (Krugman 2012f, pp. 146-147, emphasis added)

The crisis occurred—and private debt assumed macroeconomic significance—because "for some reason" (Krugman and Eggertsson 2010, p. 3), this ceiling was reduced. The asymmetric consequences

this had for spending is why debt matters: because decreased spending by indebted individuals was not offset by rising spending by savers. This itself could have been countered had the Federal Reserve had the flexibility needed to drop interest rates, but nominal rates were already historically low, and the Federal Reserve rapidly came up against the zero lower bound:

> What happened in 2008 was a sudden downward revision of those ceilings. This downward revision has forced the debtors to pay down their debt, rapidly, which means spending much less. And the problem is that the creditors don't face any equivalent incentive to spend more… because of the severity of the "deleveraging shock," even a zero interest rate isn't low enough to get them to fill the hole left by the collapse in debtors' demand… (Krugman 2012f, p. 147)

This in turn means that fiscal policy must be used to support monetary policy, so that rising public-sector spending can fill the gap between excessive deleveraging by borrowers and insufficient additional spending by savers:

> we had a period of too much optimism about debt, in which debtors borrowed and spent too much; since one person's debt is another's asset, creditors had to be induced to spend less via high real interest rates. Then people remembered the dangers of debt, and we moved from leveraging to deleveraging. But the problem is that this isn't symmetric, because you can't get real interest rates low enough to induce sufficient spending on the part of those not deep in debt.
>
> So one way to explain our depression is to say that debtors, as a group, are trying to deleverage too fast, in the sense that the collective rate at which they are trying to pay down debt isn't feasible given the zero lower bound on interest rates.
>
> And that's the role of fiscal policy: its goal is not to stop aggregate deleveraging … but to slow it down to a pace that can be accommodated by monetary policy.(Krugman 2012e)

In common with Post Keynesian analysis, we support government deficit spending during this crisis (though we argue it alone is not enough). But Krugman's argument about why deficits are needed is strongly falsified by the empirical data.

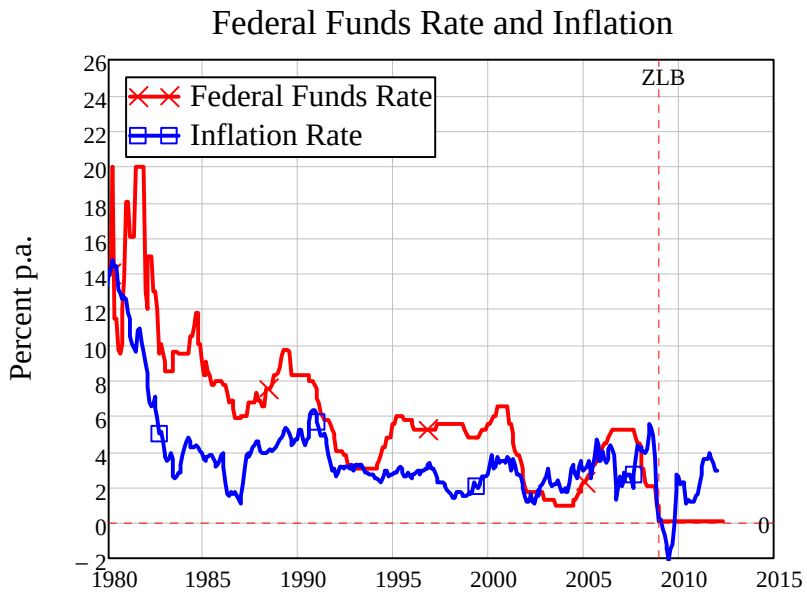
Testing the "Liquidity Trap"

Two key empirical propositions can be derived from Krugman's analysis:

1. High real interest rates should be correlated with high rates of growth of real debt; and
2. The level and rate of change of debt should only matter when the zero lower bound causes a liquidity trap

The first proposition is moderately supported by the data.[5] Figure 1 shows the two factors determining the real Reserve interest rate: the Federal Reserve Funds rate and the inflation rate.

Figure 1: Federal Funds Rate and Inflation

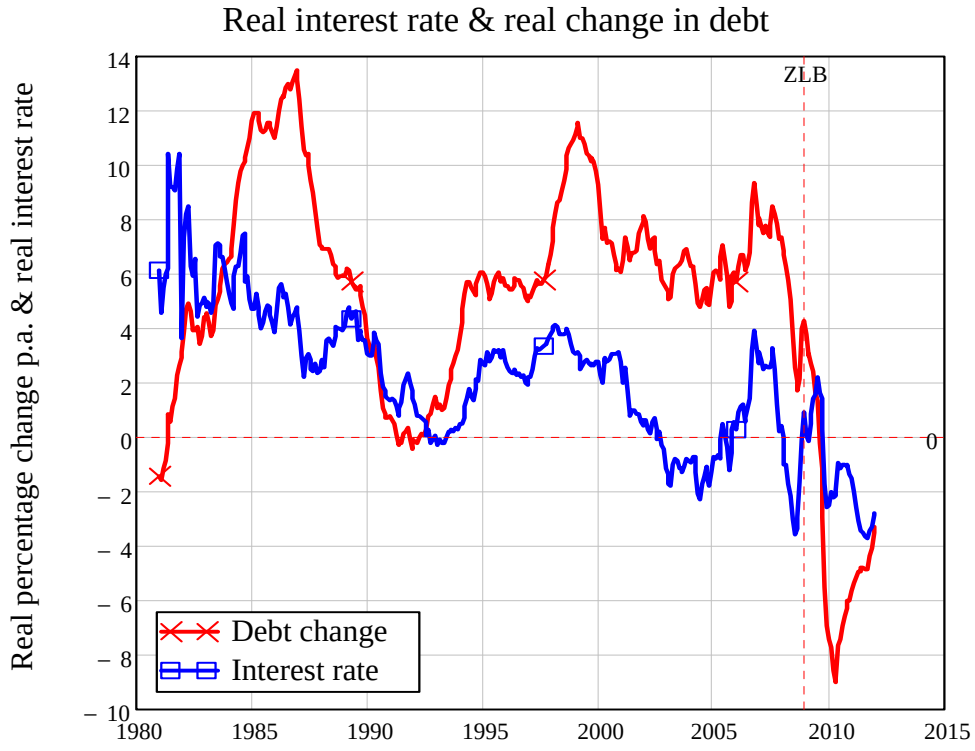


Sources: Federal Reserve Release H 15; BLS CPI-U

Figure 2 shows the correlation between the real Reserve rate and the inflation-adjusted change in the level of private debt (derived from the Flow of Funds Table L.1). It is a reasonably strong 0.46 across the whole time series, but only 0.21 for the period prior to the Zero Lower Bound (the *ZLB*—defined as when the Federal Fund target rate dropped to 0.125 per cent in January 2009). Most of the strength of the correlation comes from *after* the *ZLB* was reached, when the correlation rises to 0.65. Krugman's first proposition is thus at best only weakly supported by the data.

[5] Though an issue of causation arises—does a higher real Reserve interest rate cause higher lending, or is a higher real Reserve interest rate a policy response (intended or otherwise) to high rates of private debt growth?

Figure 2: Real interest rates and private debt growth



Sources: As for Figure 1 plus Flow of Funds Table L1

His second proposition—that private debt should have no macroeconomic significance except after the *ZLB*—is strongly contradicted by the data. Firstly, the negative correlation that Krugman expected to apply between change in debt and unemployment *after* the *ZLB* is there, but it is weak—only -0.27. However, his expectation that there would be no relationship between the change in debt and unemployment prior to the ZLB is wrong: the correlation between changes in real private debt and unemployment is substantially stronger *before* the ZLB: -0.69. Over the whole time period, the correlation is -0.55.

Krugman's "liquidity trap" explanation for why debt matters can thus comfortably be rejected: changes in the aggregate level of debt have macroeconomic significance at all times, even when there is clearly no liquidity trap.

Figure 3: Real change in private debt and unemployment

Sources: As for Figure 2 plus BLS LNS14000000

The failure of the "liquidity trap" hypothesis as to when and why private debt matters, paves the way to test an alternative: that private debt always matters, because changes in private debt add to aggregate demand.

Testing Endogenous Money

The proposition that changes in private debt add to aggregate demand sparked Krugman's blogosphere stoush[6] with Keen (Keen, 2012; Krugman 2012d, 2012c, 2012g, 2012a, 2012b) in early 2012:

> Keen then goes on to assert that lending is, by definition (at least as I understand it), an addition to aggregate demand. I guess I don't get that at all. If I decide to cut back on my spending and stash the funds in a bank, which lends them out to someone else, this doesn't have to represent a net increase in demand. Yes, in some (many) cases lending is associated with higher demand, because resources are being transferred to people with a higher propensity to spend; but Keen seems to be saying something else, and I'm not sure what. I think it has something to do with the notion that creating money = creating demand, but again that isn't right in any model I understand. (Krugman 2012c)

[6] An Australian idiom meaning brawl, argument; see http://www.abc.net.au/newsradio/txt/s1591014.htm

To test this proposition, the change in debt needs to be compared to GDP, since we are measuring its contribution to aggregate demand, and a 10% change in debt represented a 10% increase in demand above GDP in 1970 (when the debt to GDP ratio was 100%) but a 30% increase in 2009 (when the ratio peaked at 300%)—see Figure 4.

Figure 4: The impact of a given percentage change in debt has grown as debt has grown relative to GDP

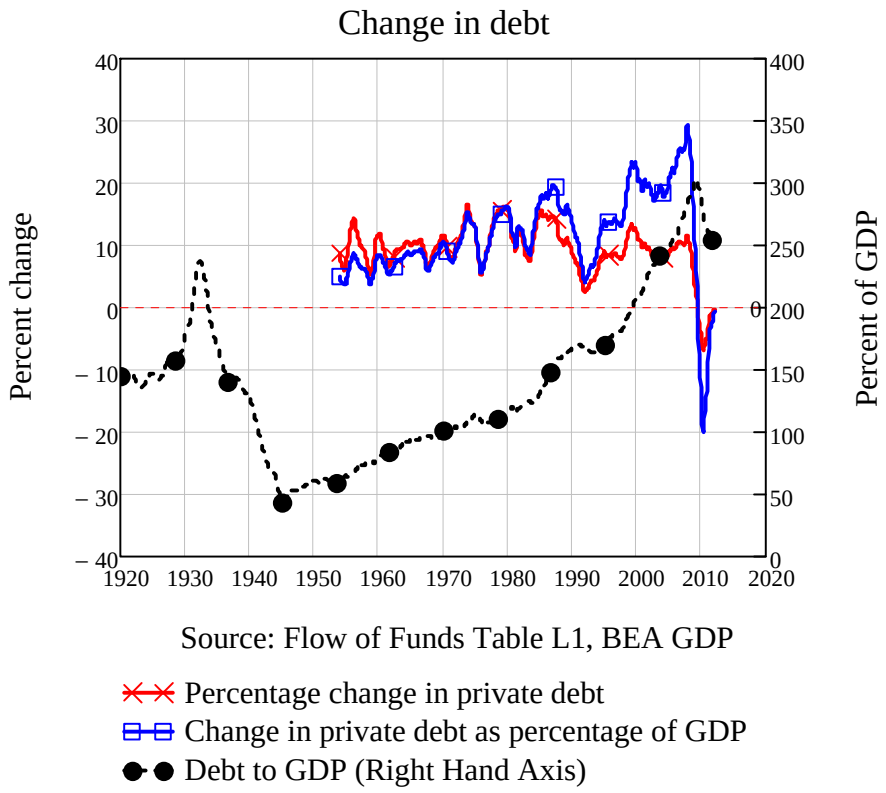
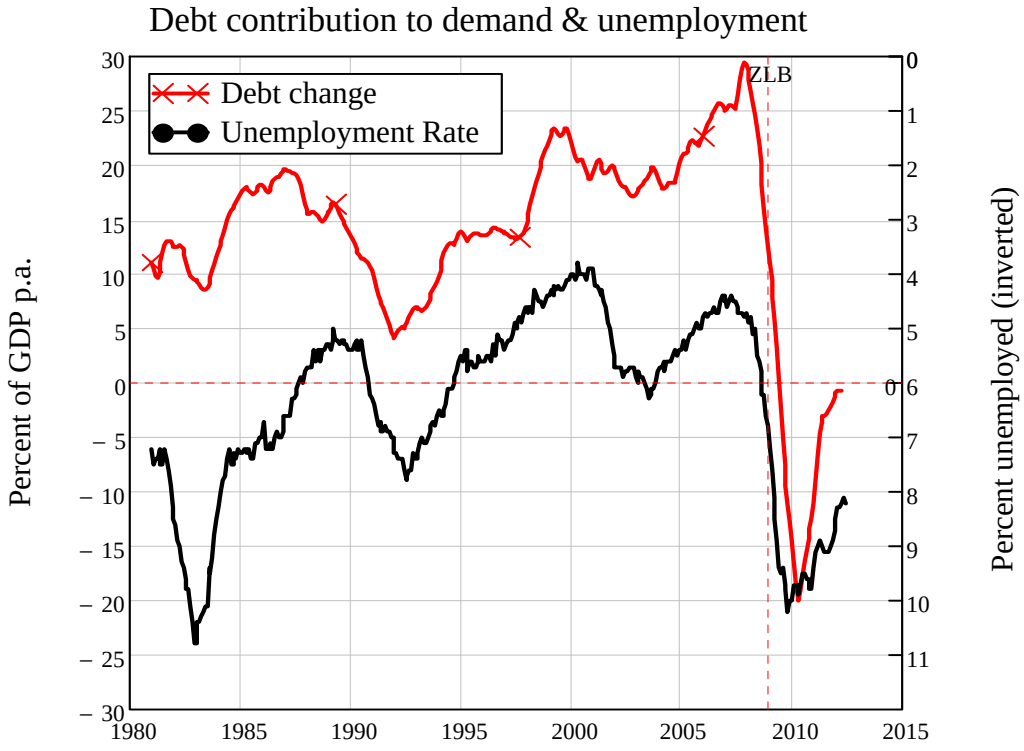


Figure 5 shows that the empirical relationship between unemployment and the change in private debt (measured as a percentage of GDP) is high and relatively stable either side of the *ZLB*. It is -0.76 for the entire time period from January 1980 till March 2012, -0.63 since the *ZLB*, and -0.84 prior to the *ZLB*.

Figure 5: Change in private debt and unemployment



Sources: As for Figure 3 plus BEA GDP

Table 2 summarizes the correlations uncovered here. Clearly, there is a strong empirical regularity between change in debt and macroeconomic performance that survives periods of both boom and bust, and low and high real and nominal interest rates.

Table 2: Summary of correlations

Correlation Coefficients	Before ZLB	After ZLB	1980-2012
Real interest rate & change in real private debt p.a.	0.21	0.65	0.46
Change in real private debt & unemployment	-0.69	-0.27	-0.55
Change in debt percent of GDP & unemployment	-0.84	-0.63	-0.76

These results call for a hypothesis that is consistent with them: the endogenous money hypothesis.

Endogenous Money

The essence of endogenous money hypothesis is that banks create spending power for borrowers without reducing the spending power of savers. If true, this makes banks far more than mere intermediaries, and a crucial part of a valid theory of macroeconomics. An essential pre-requisite of this theory is that bank lending is not effectively constrained by the Central Bank.

Both the essence and the pre-requisite receive substantial support from existing empirical research (as well as the results above), and from information on the actual practices of Central Banks.

Empirical Data

While testing the "pecking order" theory of corporate dividends, Fama and French uncovered a strong relationship between changes in aggregate corporate debt and the level of corporate investment. Using the Compustat database of company reports from publicly-traded US non-financial corporations between 1951 & 1996, Fama and French calculated aggregate non-financial corporate investment, and correlated it with equity issue, retained earnings, and new debt (see Figure 6).

Figure 6: Correlations of investment to new equity, retained earnings and new debt (Fama & French 1999, p. 1954)

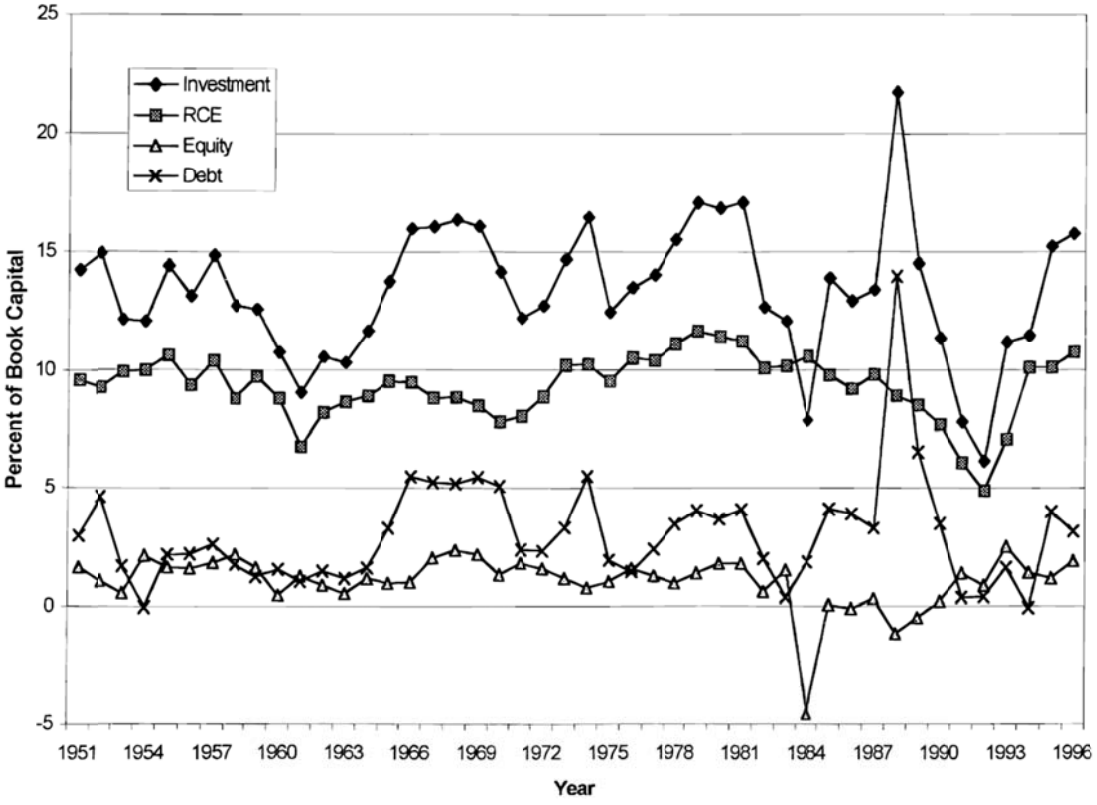


Figure 3. Investment and its financing.

They concluded that "the source of financing most correlated with investment is long-term debt":

> new net issues of stock do not move closely with investment… the correlation of investment, It, and new net issues of stock, dSt, is only 0.19… retained cash earnings move more closely with investment. The correlation between It and RCEt is indeed higher, 0.56, but far from perfect. The source of financing most correlated with investment is long-term debt. The correlation between It and dLTDt is 0.79…These correlations confirm the impression from Figure 3 that debt plays a key role in accommodating year-by-year variation in investment. (Fama and French 1999, p. 1954)

Kydland and Prescott developed a novel method for testing economic models, and were candid that their results contradicted Neoclassical theory:

> The purpose of this article is to present the business cycle facts in light of established neoclassical growth theory… We find these features interesting because the patterns they seem to display are inconsistent with the theory. (Kydland and Prescott 1990, p. 4)

On the relationship between reserves and credit, they concluded that:

> the monetary base lags the cycle slightly… The difference of M2-M1 leads the cycle by … about three quarters… The fact that the transaction component of real cash balances (M1) moves contemporaneously with the cycle while the much larger nontransaction component (M2) leads the cycle suggests that credit arrangements could play a significant role in future business cycle theory… (Kydland and Prescott 1990, p. 15)

These findings confirmed the results of the Post Keynesian economist Basil Moore (Moore 1979, 1983, 1988), that bank lending was not reserve-constrained. The "Horizontalist" model he devised (Moore 1988, 1997) sparked the development of the endogenous money hypothesis by Post Keynesian economists.

Practical issues

The timing relation between bank loans and deposits and reserves is the opposite of what would be required for reserves to act as a constraint on lending. Federal Reserve Bank of New York Vice President Alan Holmes put it this way when expressing his opposition to Monetarism in 1969:

> The idea of a regular injection of reserves … also suffers from a naive assumption that the banking system only expands loans after the System (or market factors) have put reserves in the banking system. In the real world, banks extend credit, creating deposits in the process, and look for the reserves later… the reserves required to be maintained by the banking system are predetermined by the level of deposits existing two weeks earlier. (Holmes 1969, p. 73)

The relationship that loans and deposits lead and reserves lag is *more* pronounced today, with the reserve lag in the USA now being 30 days (O'Brien 2007, Table 12, p. 52). The European Central Bank has also recently confirmed that the Post Keynesian position that "loans create deposits, and determine reserves with a lag" accurately describes private and Central Bank procedures in the EU:

> In fact, the ECB's reserve requirements are backward-looking, i.e. they depend on the stock of deposits (and other liabilities of credit institutions) subject to reserve requirements as it stood in the previous period, *and thus after banks have extended the credit demanded by their customers*. (ECB 2012, p. 21, emphasis added)

Lastly, the collapse in the ratio of broad money to base money during and after the crisis inspired an FRB Discussion Paper which concluded that the "money multiplier" model of money creation, which is an intrinsic part of the "exogenous money hypothesis", is false:

> the relationships implied by the money multiplier do not exist in the data for the most liquid and well-capitalized banks. Changes in reserves are unrelated to changes in lending, and open market operations do not have a direct impact on lending. We conclude that the textbook treatment of money in the transmission mechanism can be rejected. (Carpenter and Demiralp 2010, pp. 27-28)

Theoretical arguments

Though the concept that changes in the level of private debt affect aggregate demand had several progenitors, the direct antecedent of today's endogenous money theorists was Joseph Schumpeter. In trying to explain the origin of profits (while starting from a Walrasian general equilibrium in which profits were zero), Schumpeter linked discontinuous change by entrepreneurs with endogenous money creation by banks. He argued that an entrepreneur was the possessor of an idea that could transform production who lacked the monetary means to put that idea into operation (Schumpeter acknowledged but downplayed the possibility of investing out of retained earnings). Lacking revenue from selling goods in "the circular flow", to acquire money the entrepreneur had to get a bank loan:

> the entrepreneur—in principle and as a rule—does need credit … in order to produce at all… And this purchasing power does not flow towards him automatically, as to the producer in the circular flow, by the sale of what he produced in preceding periods… he must borrow it… He can only become an entrepreneur by previously becoming a debtor… He is the typical debtor in capitalist society. (Schumpeter 1934, p. 102).

This bank loan in turn did not require a saver to forego spending power, because banks could create additional spending power simply by double-entry bookkeeping:

> Even though the conventional answer to our question is not obviously absurd, yet there is another method of obtaining money for this purpose … the creation of purchasing power by banks… It is always a question, not of transforming purchasing power which already exists in someone's possession, but of the creation of new purchasing power out of nothing. (Schumpeter 1934, pp. 72-73).

This meant that total purchasing power (which Schumpeter confusingly describes as "total credit") in a growing capitalist economy exceeds purchasing power from the sale of goods and services alone (which he confusingly describes as "fully covered credit", in contrast to "abnormal credit"—which isn't abnormal at all!—that emanates from bank loans to entrepreneurs):

> From this it follows, therefore, that in real life total credit must be greater than it could be if there were only fully covered credit. The credit structure projects … beyond the existing commodity basis… Normal credit creates claims to the social dividend, which represent … previous delivery of existing goods. That kind of credit, which is designated by traditional opinion as abnormal, also creates claims to the social product, which … could only be described as certificates of future services or of goods yet to be produced. Thus there is a fundamental difference between the two categories, in their nature as well as in their effects. Both serve the same purpose as means of payment and are externally

> indistinguishable. But the one embraces means of payment to which there is a corresponding contribution to the social product, the other means of payment to which so far nothing corresponds…. (Schumpeter 1934, pp. 101-102).

In rather clearer language, Minsky elaborated Schumpeter's key point—that aggregate spending in a growing capitalist economy *exceeds* received income, and the difference is made up by rising debt:

> If income is to grow, the financial markets, where the various plans to save and invest are reconciled, must generate an aggregate demand that, aside from brief intervals, is ever rising. *For real aggregate demand to be increasing, . . . it is necessary that current spending plans, summed over all sectors, be greater than current received income and that some market technique exist by which aggregate spending in excess of aggregate anticipated income can be financed. It follows that over a period during which economic growth takes place, at least some sectors finance a part of their spending by emitting debt* or selling assets. (Minsky 1982, p. 6, emphasis added)

Minsky added that money was borrowed not only by Schumpeterian entrepreneurs, whose spending would ultimately increase society's productive capacity, but also by Ponzi Financiers, who would drive up asset prices and financial fragility:

> A Ponzi finance unit is a speculative financing unit for which the income component of the near term cash flows falls short of the near term interest payments on debt so that for some time in the future the outstanding debt will grow due to interest on existing debt… Ponzi units can fulfill their payment commitments on debts only by borrowing (or disposing of assets)… a Ponzi unit must increase its outstanding debts. (Minsky 1982, p. 24)

There are therefore two sources of monetary aggregate demand—income gained from selling goods and services, and new credit created by debt issued by banks—and two broad classes of expenditure—newly produced goods and services, and financial claims on existing assets. This can be summarized in the following statement:

> ***Aggregate Demand equals current received income plus the change in debt, and Aggregate Supply equals Output plus new purchases of financial assets.***

The initial reaction of most economists to this proposition is that it must involve double-counting. In the next section, we resort to mathematical logic to show that this is not so.

Mathematical Proof

Economists customarily think in "discrete time" when writing equations; this section will be easier to follow if the reader instead thinks in "continuous time"—so that any term of the form *X* implies "the value of *X* at time *t*" while expressions such as ΔX refer to the change in a variable at an instant in time. Throughout we will use Y_I for income, Y_E for expenditure, W for Wages, Π for profit (which are all flows), and D for debt (which is a stock). we begin with a simple model in which all wages are consumed,

and capitalists can both consume and invest but do not speculate (i.e., the purchasing of existing assets is not considered), and progressively consider more complex arrangements.

Closed Economy, no government or speculation

We start with the identity that total income equals wages plus profits:

$$Y_I = W + \Pi \tag{1.1}$$

Profits are either distributed (and then consumed) or retained for investment:

$$\Pi = \Pi_D + \Pi_R \tag{1.2}$$

Expenditure is either on consumer goods or investment goods:

$$Y_E = C + I \tag{1.3}$$

Consumption is financed by wages and distributed earnings, so that the sum expended buying consumer goods equals wages plus distributed earnings:

$$C = W + \Pi_D \tag{1.4}$$

We now assume that investment, as Fama and French's empirical research confirmed, is financed by retained earnings *plus the change in debt*:

$$I = \Pi_R + \Delta D \tag{1.5}$$

Expenditure and income are therefore:

$$\begin{aligned} Y_E &= W + \Pi_D + \Pi_R + \Delta D \\ Y_I &= W + \Pi_D + \Pi_R \end{aligned} \tag{1.6}$$

Subtracting income from expenditure yields the result that the difference between expenditure and income equals the change in debt—which is the argument put by both Schumpeter and Minsky:

$$Y_E - Y_I = \Delta D \tag{1.7}$$

Therefore aggregate demand equals income plus the change in debt:

$$Y_E = Y_I + \Delta D \tag{1.8}$$

Closed economy with speculation by capitalists

Distributed profits are now either consumed or used for speculation:

$$\Pi_D = \Pi_C + \Pi_S \tag{1.9}$$

Expenditure is on both goods and services and assets:

$$Y_E = C + I + A \tag{1.10}$$

Purchases of assets are financed out of profits *and money borrowed for speculation*:

$$S = \Pi_S + \Delta D_S \tag{1.11}$$

Two types of debt are now considered: debt for investment D_K and debt for speculation D_S.

Expenditure and income are now respectively:

$$\begin{aligned} Y_E &= W + \left(\Pi_C + \left(\Pi_S + \Delta D_S\right)\right) + \left(\Pi_R + \Delta D_K\right) \\ Y_I &= W + \Pi_C + \Pi_S + \Pi_R \end{aligned} \tag{1.12}$$

Subtracting Y_I from Y_E yields:

$$Y_E - Y_I = \frac{d}{dt} D_S + \frac{d}{dt} D_K \tag{1.13}$$

Closed economy with speculation and government

Expenditure now includes net government spending $\left(G - T\right)$:

$$Y_E = C + I + A + \left(G - T\right) \tag{1.14}$$

Government spending equals the change in government debt:

$$G - T = \Delta D_G \tag{1.15}$$

Expenditure is thus equal to income plus the sum of the change in investment, speculative and government debt:

$$Y_E = Y_I + \Delta D_S + \Delta D_K + \Delta D_G \tag{1.16}$$

Though the maths is easy to follow,[7] we are aware that the argument still appears to involve double-counting to many economists, so some further clarification is in order. We believe that this confusion arises from a tendency to think about this relationship in an "ex post" manner—comparing recorded expenditure with recorded income. This comparison is valid for recording what has happened, but not valid for considering the causal process in which, as Keynes emphasized, expenditure precedes income, and the income for investment is in part borrowed:

> "I proceed to the third possible source of confusion, due to the fact (which may deserve more emphasis than I have given it previously) that an investment decision (Prof. Ohlin's

[7] The number of terms and potential directions of flows grows dramatically when an open economy is considered, making this approach very difficult to follow. A full treatment including international trade and financial flows is the subject of a later paper.

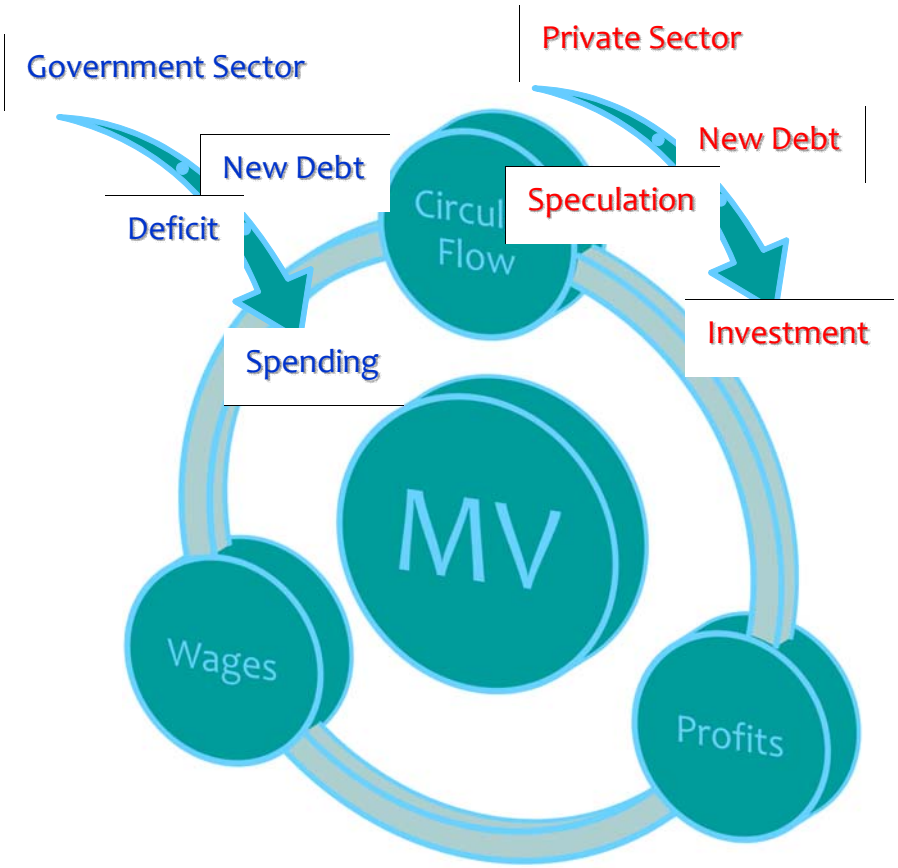
> investment ex-ante) may sometimes involve a temporary demand for money before it is carried out, quite distinct from the demand for active balances which will arise as a result of the investment activity whilst it is going on. This demand may arise in the following way.
>
> Planned investment—i.e. investment ex-ante—may have to secure its " financial provision " before the investment takes place…There has, therefore, to be a technique to bridge this gap between the time when the decision to invest is taken and the time when the correlative investment and saving actually occur. This service may be provided either by the new issue market or by the banks;—which it is, makes no difference." (Keynes 1937, p. 246)[8]

We elaborate on this point in the Appendix.

A stylized flow diagram might also help. Incomes from "the circular flow" are generated by the turnover of the existing stock of money, while newly borrowed money adds spending power of an equivalent amount when it is spent into the economy, and also boosts the amount of money in circulation—thus enabling incomes to grow as well.

[8] Keynes is wrong on this last point of course—it makes no difference to the individual firm, but a great deal of difference to the economy, since the former represents investment out of current income which does not boost aggregate demand, whereas the latter does.

Figure 7: A stylized circular flow plus new debt diagram



This leaves one last issue: what is the mechanism by which banks endogenously create credit without being constrained by existing savings or the reserve requirements set by the Central Bank?

The Mechanism

Neoclassical economists accept that the Central Bank has the capacity to create money "out of thin air":

> The crucial thing is where the Fed gets the funds with which it purchases assets. And the answer is that it creates them out of thin air… there's nothing behind that credit; the Fed has the unique right to conjure money into existence whenever it chooses. (Krugman 2012f, p. 153)

This unique right is the essentially infinite licence to create the currency that a Central Bank of a sovereign nation possesses—or rather has conferred upon it by the government. But Neoclassical economists ignore the fact that the possession of a private banking licence confers a similar—though not infinite—capacity to a bank to create money "out of thin air". The exercise of both these capacities determines the money supply in our mixed state-credit financial system.

The mechanism, in both cases, commences with the capacity to create matching assets and liabilities via double-entry bookkeeping, as "Modern Monetary Theory" (*MMT*) economists emphasize:

> Credit and debt are two sides of the same coin. Both creditor and debtor are sinful. They balance. Exactly. The sinful balance is ensured by double-entry book-keeping. (L. R. Wray 2011)

In its model of government money creation, *MMT* has to date treated the government and the central bank as a single entity for the sake of simplicity (Fullwiler et al. 2012).

> it is convenient to consolidate the treasury and central bank accounts into a "government account". To be sure, the real world is more complicated… But, as Paul Davidson has frequently noted, the appropriate general case is the one that makes the fewest assumptions while enabling analysis or understanding of the fundamental or "true" nature of the object of inquiry. (Fullwiler et al. 2012, p. 20)

This consolidation has been subject to criticism by other Post Keynesians (Fiebiger 2012). we will start with a double-entry bookkeeping representation of this arguably over-simplified model—and an equally over-simplified model of private banking—before moving on to a more general representation of both.

Simplified double-entry model of mixed state-credit money creation

Kelton, Fullwiler & Wray describe their simplest model in the following terms:

> consider a consolidated government (central bank plus treasury) running a deficit. The basic transactions could be listed as the following:
>
> 1A. The government's spending credits bank accounts with reserve balances (HPM). These accounts are liabilities of the government/central bank.
>
> 2A. Banks credit the deposit accounts of the spending recipients. So, overall, the increased reserve balances have raised bank assets while the increased deposits have increased bank liabilities by the same amount. (Fullwiler et al. 2012, p. 21)

The simplest double-entry-consistent rendition of this model that we can develop is shown in Figure 8 and Figure 9. The capacity of a sovereign government to create its own currency is shown as the intangible asset of a "Fiat Licence", with an initial value that is essentially limitless. That in turn lets it create the liability of its currency, which is stored in a "Central Bank Vault".

Government spending begins with a transfer from this Vault to the Treasury's Deposit account (labeled row 1 in Figure 8), and its recording as a transfer of Assets from the Fiat Licence to the Treasury's Loan account (row 2). Spending of this borrowed money into the economy is shown on row 3 of Figure 8 and row 1 of Figure 9. The reverse operations of taxation are shown on rows 4-6 of Figure 8 and row 2 of Figure 9.

The private sector's money-creation process is shown on rows 3 and 4 of Figure 9.

Figure 8: Government component of the simplest MMT money creation model

"Government"	"Column"	1	2	3	4	5
"Rows"	"Type"	Asset $_I$	Asset $_T$	Liability	Liability	Liability
"Variables"	"Account"	"Fiat Licence"	"Treasury Loan"	"Central Bank Vault"	"Treasury Deposit"	"Private Bank Reserves"
"Initial"	"Value"	∞	0	$-\infty$	0	0
0	"Symbol"	$CB_C(t)$	$G_L(t)$	$CB_V(t)$	$G_D(t)$	$PB_R(t)$
1	"Lend"	0	0	Gov	–Gov	0
2	"Record Loan"	–Gov	Gov	0	0	0
3	"Gov Spend"	0	0	0	Gov	–Gov
4	"Tax"	0	0	0	–Tax	Tax
5	"Repay Loan"	0	0	–Tax	Tax	0
6	"Record Repay"	Tax	–Tax	0	0	0

Figure 9: Private bank component of the simplest MMT money creation model

"Private Bank"	"Column"	1	2	3	4
"Rows"	"Type"	Asset $_T$	Asset $_T$	Liability	Equity
"Variables"	"Account"	"Loans"	"Bank Reserves"	"Non-Bank Public"	"Bank Equity"
"Initial"	"Value"	$\text{Initial}_{\text{Loan}}$	0	$-\text{Initial}_{\text{Loan}}$	0
0	"Symbol"	$PB_L(t)$	$PB_R(t)$	$PB_D(t)$	$PB_E(t)$
1	"Gov Spend"	0	Gov	–Gov	0
2	"Tax"	0	–Tax	Tax	0
3	"Make Loan"	Loan	0	–Loan	0
4	"Repay"	–Repay	0	Repay	0

Since all these operations are flows, the symbolic sum of each column represents the rate of change of the account shown in that column. The crucial flow equations are the following:

$$\begin{aligned} \frac{d}{dt}G_L &= Gov - Tax \\ \frac{d}{dt}PB_R &= Gov - Tax \\ \frac{d}{dt}PB_L &= Loan - Repay \\ \frac{d}{dt}PB_D &= (Gov - Tax) + (Loan - Repay) \end{aligned} \tag{1.17}$$

Two phenomena are evident in this highly simplified model:

1. The total amount of money in circulation in the economy is increased by government deficits, and by the private banking sector's loans to the non-bank public (when they exceed the non-bank public's repayments of those loans).

2. Government deficit operations affect private bank reserves, but private bank reserves play no role in private bank lending.

However, these results could be artifacts of the excessively simplified nature of the model. we now consider a more complete (but by no means full and final) model in which:

1. The Central Bank and Treasury are separated;
2. Treasury must sell bonds to bond purchasers to raise revenue;
3. The Central Bank can at its discretion purchase government bonds of private bond holders; and
4. Private banks lend from reserves.

More complete double-entry model of mixed state-credit money creation

Three accounts are now necessary:

1. The Treasury;
2. The Central Bank; and
3. The Private Bank Sector

The Treasury has the intangible asset of a licence to create government bonds, which is matched by the liability of the bonds it creates. Having planned its spending, it then sells bonds to bond dealers—and these bonds can in turn be purchased either by the non-bank public, or by the Central Bank.

Figure 10: The Treasury

$$S_T := \begin{pmatrix} \text{"Government"} & A_I & \text{Liab} & \text{Liab} & \text{Liab} & \text{Liab} \\ \text{"Account"} & \text{"Treasury Licence"} & \text{"Gov Bond Holdings"} & \text{"Bond Dealers"} & \text{"CB"} & \text{Public} \\ \text{"Type"} & \text{Ledger} & \text{Bond} & \text{Bond} & \text{Bond} & \text{Bond} \\ \text{"Value"} & \infty & -\infty & 0 & 0 & 0 \\ \text{"Symbol"} & G_{BI}(t) & G_{BH}(t) & BD_{GB}(t) & CB_{GB}(t) & NBP_{GB}(t) \\ \text{"Plan Spending"} & \text{Deficit} & -\text{Deficit} & 0 & 0 & 0 \\ \text{"Gov Sell Bonds"} & 0 & Sell_{BD} & -Sell_{BD} & 0 & 0 \\ \text{"CB Buy Bonds"} & 0 & 0 & Buy_{CB} & -Buy_{CB} & 0 \\ \text{"Pub Buy Bonds"} & 0 & 0 & Buy_{NBP} & 0 & -Buy_{NBP} \end{pmatrix}$$

Having sold those bonds, the Treasury now has money in its deposit account at the Central Bank,[9] from which it can spend. As before, this spending increases the reserves of the private banks (which are a liability of the Central Bank) and increases the non-bank public's deposits at the private banks by the same amount.

[9] This should also be shown as an asset in the Treasury's accounting table, but is only shown here simply to conserve space.

Figure 11: The Central Bank

$$S_{CB} := \begin{pmatrix} \text{"Central Bank"} & A_I & A_T & \text{Liab} & \text{Liab} & \text{Liab} \\ \text{"Account"} & \text{"Fiat Licence"} & \text{"Treasury Loan"} & \text{"Vault"} & \text{"Treasury Dep"} & \text{"Private Bk Reserves"} \\ \text{"Type"} & \text{Ledger} & \text{Ledger} & \text{Money} & \text{Money} & \text{Money} \\ \text{"Value"} & \infty & 0 & -\infty & 0 & -Init_{Eq} \\ \text{"Symbol"} & CB_C(t) & G_L(t) & CB_V(t) & G_D(t) & PB_R(t) \\ \text{"Gov Sell Bonds"} & 0 & 0 & 0 & -Sell_{BD} & Sell_{BD} \\ \text{"CB Buy Bonds"} & 0 & 0 & Buy_{CB} & 0 & -Buy_{CB} \\ \text{"Gov spending"} & 0 & 0 & 0 & Gov & -Gov \\ \text{"Gov Taxation"} & 0 & 0 & 0 & -Tax & Tax \end{pmatrix}$$

The flow of loans by the private banking sector to the non-bank public is modeled as a transfer of the banking sector's assets from reserves to loans, matched by the private non-bank sector depositing the flow in its deposit accounts. The two operations cancel each other out on the aggregate private banking sector reserve account, but increase the loan assets of the banking sector and the deposit liabilities at the same time. Reserves are thus needed to settle transactions between individual banks, and as a conduit for the government sector's financial dealings with the private non-bank sector, but at the aggregate level are neither a requirement for, nor a constraint upon, private bank lending.

Figure 12: The Private Bank Sector

$$S_P := \begin{pmatrix} \text{"Priv. Bank"} & A_T & A_T & \text{Liab} & \text{Liab} & \text{Equity} \\ \text{"Account"} & \text{"Loans"} & \text{"Bk Reserves"} & \text{"Non-Bank Public"} & \text{"Bond Dealers Deposit"} & \text{"Bk Equity"} \\ \text{"Type"} & \text{Ledger} & \text{Money} & \text{Money} & \text{Money} & \text{Ledger} \\ \text{"Value"} & 0 & 0 & 0 & 0 & 0 \\ \text{"Symbol"} & PB_L(t) & PB_R(t) & PB_D(t) & D_{BD}(t) & PB_E(t) \\ \text{"Gov Sell Bonds"} & 0 & -Sell_{BD} & 0 & Sell_{BD} & 0 \\ \text{"CB Buy Bonds"} & 0 & Buy_{CB} & 0 & -Buy_{CB} & 0 \\ \text{"Pub Buy Bonds"} & 0 & 0 & Buy_{NBP} & -Buy_{NBP} & 0 \\ \text{"Gov Spending"} & 0 & Gov & -Gov & 0 & 0 \\ \text{"Gov Taxation"} & 0 & -Tax & Tax & 0 & 0 \\ \text{"Issue Loan"} & Loan & -Loan & 0 & 0 & 0 \\ \text{"Make Loan"} & 0 & Loan & -Loan & 0 & 0 \\ \text{"Repay Loan"} & 0 & -Repay & Repay & 0 & 0 \\ \text{"Record Repayment"} & -Repay & Repay & 0 & 0 & 0 \end{pmatrix}$$

The crucial flow equations in this model are:

$$\frac{d}{dt}PB_L = Loan - Repay$$
$$\frac{d}{dt}PB_R = (Gov - Tax) + (Buy_{CB} - Sell_{CB}) \quad (1.18)$$
$$\frac{d}{dt}(PB_D + D_{BD}) = (Loan - Repay) + (Gov - Tax) + (Buy_{CB} - Sell_{CB})$$

The change in the level of money in circulation is thus determined by net private sector lending, the government deficit, and the monetary operations of the Central Bank. This generalizes, but does not contradict, the results of the earlier more simplified model.

Conclusion

The endogeneity of the money supply means that banks, debt and money are essential components of macroeconomics: they cannot be ignored as in standard Neoclassical macroeconomics, nor caricatured by "patient lends to impatient" bank-less modified DSGE models (Krugman and Eggertsson 2010). An alternative monetary macroeconomics is required, and one can be constructed easily from the principles of double-entry bookkeeping, as we have shown here.

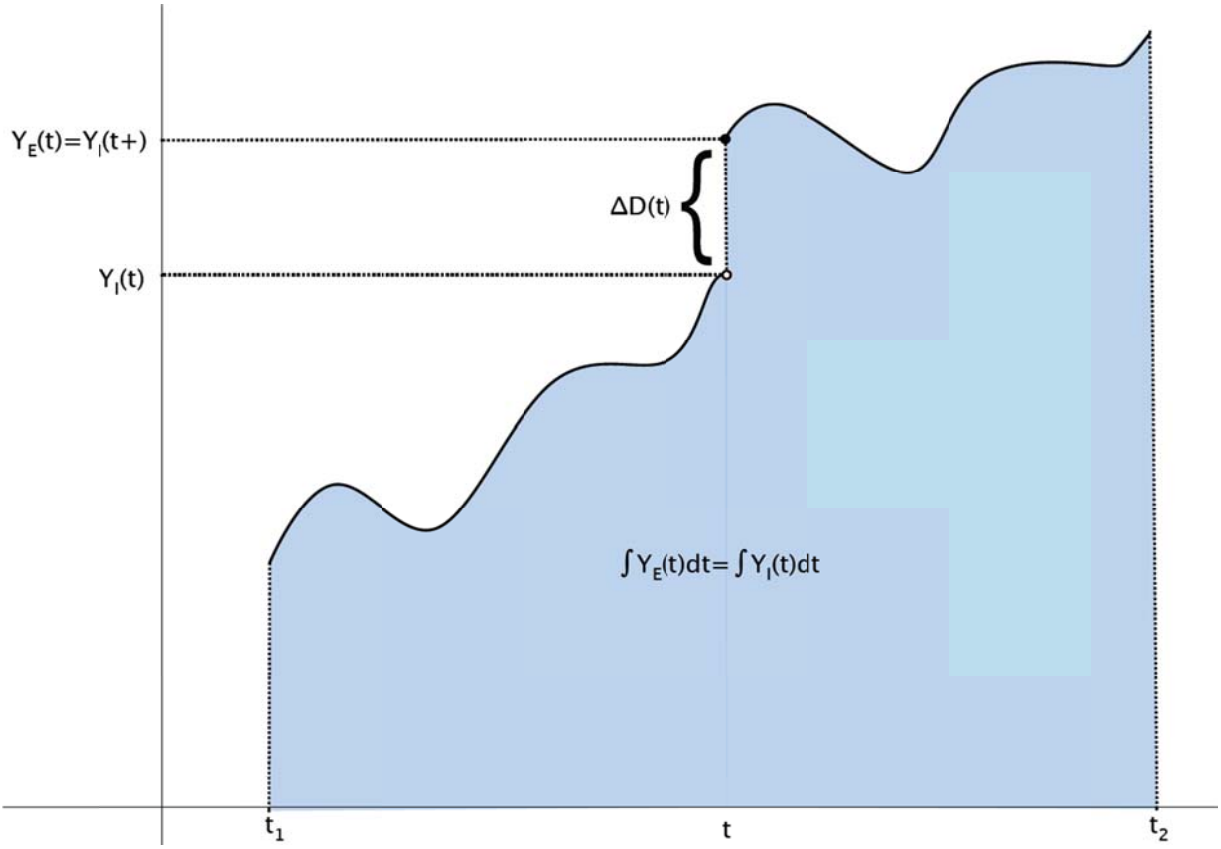
Even at this rudimentary level, this monetary perspective has lessons for the EU crisis. Since the private sector is now deleveraging, its actions are reducing the money supply. If the government runs a surplus, this further reduces the money supply—and hence economic activity. Austerity therefore amplifies the downturn caused by private sector deleveraging.

At the same time, a government deficit is less effective than proponents of a government stimulus approach to the crisis have argued (Krugman 2012f), since on the historical evidence, private sector deleveraging is likely to continue for a decade or more, given the level of accumulated private debt. Debt cancellation will be required as well if policy is to rescue us from this crisis.

Appendix

We present here a simple way to represent the conceptual difference between spending plans and current received income using the language of continuous--time functions with discontinuities.

Figure 13: Change in debt as a jump function



We start by defining aggregate income flow as a function Y_I with the property shown in Figure 13, where $Y_I(t)$ represents the value of the function at time *t* and

$$Y_I(t+) = \lim_{s \to t^+} Y_I(s) \tag{1.19}$$

corresponds to the limit of the values of Y_I as time approaches *t* from the above (that is, from instants immediately *after* t, and therefore after the injection of new debt). The difference $\Delta Y_I(t) = Y_I(t+) - Y_I(t)$ is a ``jump" in the flow of aggregate income, which we argue is caused by a corresponding change $\Delta D(t)$ in the stock of debt. Expressed in this way, equation (1.8) simply says that

$$Y_E(t) = Y_I(t+) = Y_I(t) + \Delta D(t) \tag{1.20}$$

That is, the flow of expenditure always equals the ex-post flow of income, which in turn equals the flow of income plus change in the stock of debt. In particular, observe that flows of expenditure and income coincide except at the points of discontinuity, which are exactly the points when change in the stock of debt is assumed to occur.

Now the total expenditure and income between times t_1 and t_2 is given by the integrals of the corresponding flows. But it follows from the properties of integration that functions differing only at finitely many points of discontinuities *must have identical integrals*. Therefore, provided the change in debt occurs at finitely many points, we have that

$$\int_{t_1}^{t_2} Y_E(t)dt = \int_{t_1}^{t_2} Y_I(t)dt \tag{1.21}$$

which means that recorded expenditure and income over a finite period $(t_2 - t_1)$, such as those found in NIPA tables, necessarily agree. This does not mean, however, that changes in debt do not affect the integrals, but rather that they affect *both* integrals in exactly the same way. Put in another way, whereas comparing recorded expenditure and income over a period does not explicitly reveal changes in debt, ignoring the effect of change in debt in the flows of expenditure and income leads to a grossly incorrect model.

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