Fisher Dynamics in Household Debt: The Case of the United States, 1929-2011

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Abstract

We examine the importance of what we term 'Fisher dynamics'- the mechanical effects of changes in interest rates, growth rates and inflation rates on debt levels independent of borrowing -for the evolution of household debt in the U.S. over a long time horizon (1929-2011). Adapting a standard decomposition of public debt to household sector debt, we show that these factors have been important in explaining rising debt levels, especially between 1980 and 2000. We identify and describe three broad regimes in the growth of household debt and several shorter episodes, distinguished by the distinct roles played Fisher dynamics and borrowing behavior in the evolution of household debt. We then provide some counterfactual trajectories of debt burdens that suggest how important financial changes beginning around 1980 have been in contributing to household debt, independent of any changes in household behavior. Specifically, if average rates of growth, inflation and interest remained the same after 1980 as before 1980, household debt burdens in 2011 would have been roughly the same as they were in the early 1950s, despite the sharp increase in borrowing in the early 2000s. We then discuss the difficulties involved in deleveraging. Under scenarios involving even substantial reductions in household expenditure, returning to debt levels of the 1980s could take decades. If lower private leverage is a condition of acceptable growth,then in the absence of a substantial fall in interest rates relative to growth rates, large-scale debt forgiveness of some form may be unavoidable.

1 Introduction

In the wake of the Great Recession there has been a renewal of interest in leverage and debt dynamics. This is not surprising, given that debt and its implications for macroeconomic performance typically become more salient in periods of financial distress. Perhaps the earliest explicit attempt to explain economic crises in terms of leverage was Irving Fisher's debt-deflation theory of the Great Depression. (Fisher, 1933) The key dynamic in that analysis was that even as households reduced borrowing during the crisis, falling prices and incomes led to rising debt burdens. Rising debt ratios led to cutbacks in expenditure, reducing incomes further and – via bank failures and general disruptions in the financial system – putting downward pressure on the price level. The fall in incomes, asset values and prices implied higher leverage, forcing households and businesses to attempt further expenditure cuts, in a self-reinforcing cycle.

In this paper, we offer a more general account of the first step in ths process, the link from growth, inflation/deflation, and interest rates to leverage. We argue that "Fisher dynamics" – understood as the mechanical effects of changes in these three variables on debt-income ratios *independent of borrowing behavior* – are an important but largely neglected factor in more recent changes in leverage of the private sector as well. In particular, the 1980s can be understood as a slow-motion debt deflation (or debt-disinflation), with the combination of slower nominal income growth and higher interest rates producing rising debt-income ratios despite a substnatial *fall* in household spending relative to income.

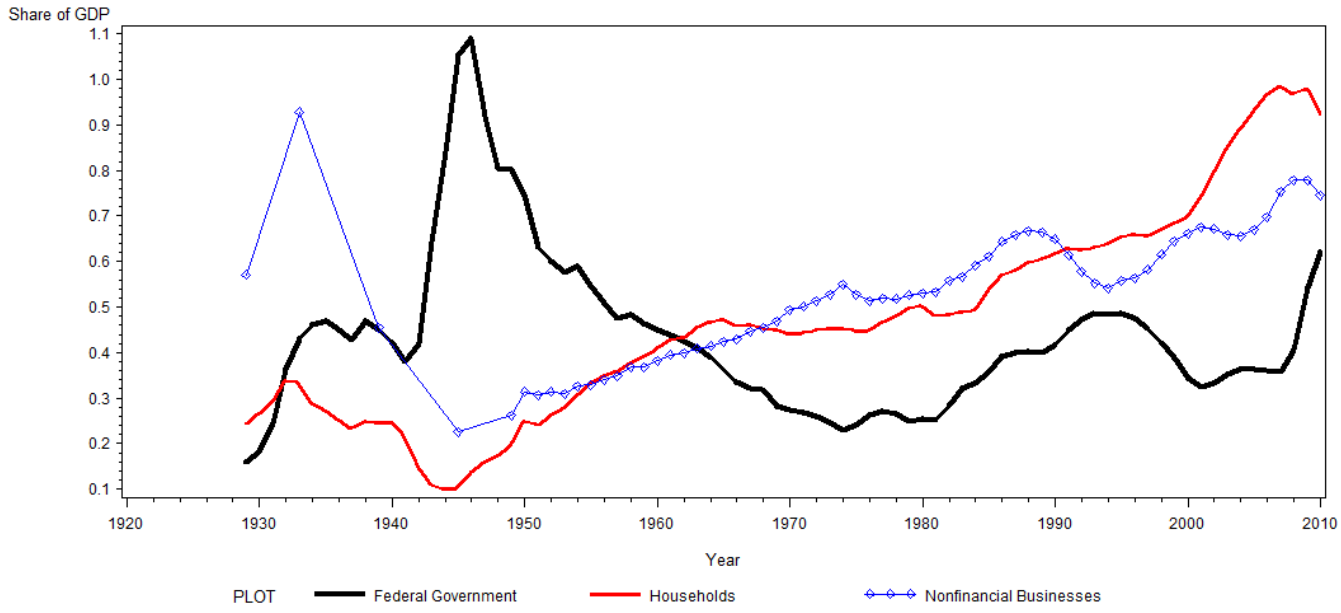
Our analysis focuses on the liability side of household balance sheets, rather than net worth. The conventional measure measure of savings remains appropriate for many purposes, particularly when discussion of household balance sheets is motivated by concern about the availability of real resources for investment. But when the motivation is concern over credit constraints, liquidity, or financial fragility, it is also important to consider the evolution of debt in isolation from assets.

At the outset, it is useful to have a sense of the overall trends in leverage in the economy. Figure 1, drawn from the Flow of Funds, shows private and public debt to GDP ratios for the three main nonfinancial sectors since 1929.[1] Several features bear remark. First is the very large swings in leverage in the early period. The large increases in household and business debt relative to GDP between 1929 and 1933 are especially striking since the nominal value of debt fell substantially for both of those sectors. The leverage increases are entirely due to the fall in nominal GDP, which in turn is due in about equal parts to deflation and the fall in real output. This is a stark example of the importance of understanding the evolution of leverage ratios in terms of the denominator as well as the numerator. Second is the extremely large increase in federal debt during World War II; by comparison, the recent increases are only modest departures from the long-run average. While outside the scope of this paper, it seems clear that it was only the massive increase in federal borrowing that allowed the private sector to deleverage successfully in the 1940s. Third, in more recent decades we see a long-term upward trend in overall debt to GDP ratios. Between 1950 and 1980, the ratio of total nonfinancial debt to GDP was quite stable around 1.3, but over the past three decades it has

[1]The pre-1950 figures of business debt are from Goldsmith (1955), which gives figures only for selected years. Since Goldsmith does not provide a category strictly equivalent to credit market liabilities as reported in the Flow of Funds, we use the sum of payables to financial intermediaries, mortgages, and bonds.

nearly doubled, to around 2.5. This trend is common to most OECD countries (Cecchetti and Zampolli, 2010). Fourth, looking at this same period, while the rise in public debt is responsible for the largest part of the most recent increase in leverage, over the full 30 years increases in business and, especially, household debt have been more important. Only about a third of the total increase in leverage since 1980 is accounted for by federal borrowing. Fifth, both household debt and nonfinancial business debt have consistently exceeded public sector debt since the mid 1960s. And sixth, while in some periods the private and public balances show roughly offsetting movements (1950-1980, 2008-2010), in others they move roughly together. In the 1980s and 2000s, there are are significant increases in all three sectors' leverage.[2] As a whole, Figure 1 suggests that policymakers have good reason to be concerned with rising leverage; but also suggests that private leverage should be at least as much a focus of discussion as public leverage.

Figure 1: Nonfinancial Leverage, 1929-2011



Source: Flow of Funds, Historical Statistics of the United States, A Study of Savings in the United States

Changes in public debt are often analyzed in terms of the independent contributions of the primary balance, interest, growth and inflation. But the evolution of household and business debt is seldom analyzed in those terms. To our knowledge, there is no published

[2]While it is true that net borrowing must sum to zero across sectors, there is no such adding-up constraint on gross debt. Increases (decreases) in inflation or income growth rates will lower (raise) leverage for all sectors simultaneously. Moreover changes in asset positions also can cause one sector's debt to change without an offsetting change elsewhere.

decomposition of changes in private debt into the primary balance, interest, income growth, and inflation, as is standard for public debt evolution. This paper is an initial attempt to fill that gap, applying a modified version of the standard public-debt decomposition to household debt, and revealing that Fisher dynamics have been responsible for a large part of changes in household leverage from 1929 to 2011. In particular, while the period of the recent housing bubble (1998-2005) did see a sharp rise in household borrowing, this was not the case in the rest of the post-1980 period of rising household leverage. In fact, between 1980 and 2000 households reduced their borrowing compared with the prior two decades, yet saw a rise in their debt burden. The increase in household leverage over this period is fully explained by Fisher dynamics–that is by the increased burden of existing debt in an environment of higher nominal interest rates and lower inflation. This is in sharp contrast with the usual story of rising household borrowing after 1980, a contrast we explore in more detail below. An important implication of these findings for policy is that when the household sector is seeking to reduce leverage (as may be the case at currently), its ability to do so will depend on Fisher dynamics. The greater are nominal interest rates compared with growth and inflation, the longer that private actors seeking to reduce leverage need to hold current spending below income, extending the period of depressed demand and large fiscal deficits.

In this paper, we find other interesting patterns that help provide some grasp on the nature of household debt accumulation throughout the period. We provide a rough characterization of household debt dynamics as constituted by several distinct periods where Fisher dynamics and borrowing behavior respectively have had very different impacts on overall leverage. We also note the very large fraction of reent deleveraging accounted for by defaults, which has received little attention in either scholarly or policy-oriented work, and suggest that in the absence of a substantial fall in interest rates and/or rise in inflation, additional write-offs are the most realistic path to further household deleveraging.

The outline of the remainder of the paper is as follows. We begin by a consideration of the renewed focus on private debt as a key macroeconomic variable. We then discuss the value of focusing on debt levels as opposed to net wealth. The sections that follow describe the accounting procedure used to model Fisher dynamics, as well as the data sources we use for the task. We move then to a description of the evolution of U.S household debt over the period 1929-2011, focusing on the various periods in which one can identify different dynamics that drove its trajectory. Finally, we provide some simple counterfactual simulations meant to underline the importance of these dynamics.

2 Why Does Private Debt Matter?

2.1 The Renewed Interest in Leverage

Leverage is normally defined as the ratio of liabilities to either income or net worth; in this paper, we use the ratio of debt to income. Traditionally, economists have attributed only a minor role to leverage in the determination of macroeconomic outcomes . Conventional economic analysis had suggested that consumption choices depend on debt only to the extent that debt affects household net wealth. (Benito and Zampolli, 2007). While a

minority of economists going back at least to Fisher have seen leverage as an important factor constraining aggregate demand, the predominant view, at least until the last few years, was well summarized by Bernanke (2000): since one unit's liability is another unit's asset, changes in leverage "represent no more than a redistribution from one group (debtors) to another (creditors). Absent implausibly large differences in marginal spending propensities among the groups... pure redistributions should have no significant macroeconomic effects." For governments, which are assumed to not have substantial asset positions, gross debt has long been seen as a central variable.[3] But for households and private businesses it has not generally been considered of first-order importance.

In the wake of the Great Recession, however, there has been a renewed interest in private leverage, both among macroeconomic theorists and policymakers.[4] What constitutes a sustainable ratio of government debt to GDP has long been a central concern for public finance; more recently the behavior of, and limits to, the debt-income (or debt-net worth) ratios of other economic units have become salient questions as well. How these ratios adjust is evidently an important consideration in formulating macroeconomic policy.

Recent theoretical and empirical work has sought to show that the accumulation of debt in the household sector, and the subsequent behavioral adjustment of heterogeneous households to shocks in household balance sheets, might be seen to be the key factor in the prolonged state of depressed demand observed currently in the U.S. and elsewhere, (Eggertson and Krugman, 2010; Guererri and Lorenzoni, 2011; Hall, 2011a,b; Philippon and Midrigan, 2011) as well as in the Great Depression.[5] (Mishkin, 1978; Olney, 1999) In these more recent macroeconomic models, heavily indebted households cut back consumption in the face of a sudden shock to assets (such as a fall in house values), but less indebted households do not increase consumption in similar proportion for various reasons (financial frictions, zero lower bounds), thereby causing a recession that cannot easily be remedied by traditional monetary policy. Mian, Rao, and Sufi (2011) provide strong empirical evidence of the impact of accumulated liabilities, particularly household debt in the mid 2000s as contributing to falling consumption and leading to subsequent economic crises. These papers suggest important reasons to care about the level and distribution of gross private sector debt independent of the net position of the sector, and offer clear theoretical justification for a focus on the process of household leveraging and deleveraging.

2.2 The Importance of Gross Liabilities

The importance of gross liabilities becomes obvious in periods of financial distress, when a significant fraction of units face difficulties in servicing their debt. The focus on net wealth implicitly assumes that assets are liquid, and can be mobilized (either through sale or as collateral) to meet debt obligations. But assets cannot always be reliably converted to means of payment, either because their market value fluctuates, because they are inherently illiquid, or because they become so in a crisis. Thus leverage, as opposed to net wealth,

[3]See Arestis and Sawyer (2008) for a criticism of the usual assumption that the public sector lacks significant assets.

[4]For example, Larry Summers recently described his rule for screening new research during the first two years of the Obama administration as "read virtually all the ones that used the words leverage, liquidity..." **?**

[5]Koo (2008) provides a similar analysis of the Japanese "lost decades."

matters mainly in the context of liquidity constraints. If units' assets are not reliable sources for either funding or market liquidity, then the capacity to service debt out of current income becomes paramount. (Tirole, 2011) These are the conditions in which leverage matters.

The need to reduce leverage following a financial crisis is probably a large part of the reason why recovery from such crises has been so slow historically. Because debt is a stock, its adjustment must take place over time; an economic unit targeting a substantially lower level of leverage will typically seek to reduce its consumption relative to its income over a number of periods, producing an ongoing drag on aggregate demand. Unlike other factors depressing output whose effects should not be expected to persist once the initial cause is removed, a crisis that results in many units finding themselves with leverage levels that are seen to be "too high" may lead to a long period of depressed output even after the initial crisis is resolved. Indeed a key finding of Reinhart and Rogoff (2010) is that deleveraging recessions are almost always longer and more painful than others. Put another way, the debt built up in bubbles, beyond the fluctuations of asset prices themselves, is a major component of the macroeconomic costs.. This factor might be part of the explanation why the macroeconomic effects of the housing bubble were so much more severe than those of the dot-com bubble of ten years earlier, even though the loss of wealth at the end of the two bubbles was very similar: The fall in the value of corporate equity owned by households over 2000-2002 equalled 61 percent of GDP, compared with 62 percent of GDP for the fall in housing wealth from 2006 to the present.[6]

Discussions of leverage typically focus on the saving decisions of individual units. So with respect to households, we might ask why they chose to increase consumption relative to income, resulting in higher leverage. Or we might ask how much (and for how long) they would have to reduce consumption relative to income to achieve some target, lower level of leverage. It is insuffiicently recognized that such changes in borrowing behavior are only one of several ways in which leverage levels can change. To pick just one typical example, a recent paper on the causes of "The Rise in U.S. Household Indebtedness" begins with the sentence, "During the past several decades in the United States, significant changes have occurred in household saving and borrowing behavior," without any acknowledgment, or even, seemingly, awareness, that this represents a significant narrowing of the question posed by the title. (Dynan and Kohn, 2007) It is true that changes in sectors' net savings are important drivers of (de)leveraging episodes. But in the presence of existing stocks of debt, changes in behavior are not the whole story; changes in interest rates, growth rates and inflation – what we call Fisher dynamics – also play an important role in the evolution of leverage over time. We suggest that when the private sector is seeking to reduce leverage, its ability to do so will depend critically on Fisher dynamics.

In what follows, we suggest that to understand the evolution of private-sector leverage over time, it can be useful to adopt the accounting framework long used to understand the evolution of public debt. This framework differs in three essential ways from the standard conventions used for private units. First, it it focuses on gross liabilities, rather than net wealth. (I.e. rather than netting out asset purchases from borrowing, it treats them as current expenditure.)[7] Second, it treats expenditure (and savings) decisions as a structural

[6]From the Flow of Funds; there was also a decline in stock market wealth of equal to 19 percent of GDP in the recent period.

[7]Both Peter Skott and Perry Mehrling responded toearly drafts of this paper by suggesting that a better

variable, rather than as the result of optimization. (This does not imply that households behave irrationally – though they may – but simply that unanticipated shocks to growth, interest rates or inflation may result in households finding themselves, perhpas persistently, with a ratio of liabilities to income that they would not ahve chosen *ex ante*.) And third, it focuses on the primary balance, or borrowing net of interest payments.

The primary surplus is related to conventional savings as follows:

savings = primary surplus + tangible investment + net acquisition of financial assets - interest payments

This framework is clearly not appropriate for all discussions of household sector financial positions[8], but to the extent that we are interested specifically in the evolution of leverage over time, it is clearly necessary to focus on the factors determining the ratio of liabilities to income. It is to the discussion of this that we therefore now turn.

3 Public sector debt dynamics

"The least controversial equation in macroeconomics" (Hall and Sargent, 2011) is the law of motion of government debt:

$$b_{t+1} = d_t + (\frac{1+i}{1+g+\pi})b_t$$

$$\Delta b_t = b_{t+1} - b_t = d_t + (\frac{i-g-\pi}{1+g+\pi})b_t$$

where b is the ratio of gross debt to GDP, d is the ratio of the primary deficit – that is, deficit net of interest payments – to GDP, i is the *nominal* interest rate, g is the *real* growth rate of GDP, and π is the inflation rate. The key point, well understood in the context of public debt, is that the evolution of debt ratios is not solely determined by public-sector borrowing; the primary balance, interest rates, growth rates and inflation each play an

way of capturing the argument would be to focus on asset-liability mismatch, and to net assets from liabilities neither completely, as in the conventional savings measure, nor not at all, as in our primary-balance measure, but partially, to the extent that they can be readily sold or hypothecated to meet immediate cash commitments. While we agree that, conceptually, this might be a superior approach, the practical difficulties in assessing the degree of liquidity of various household assets are formidable. To the extent that the Skott-Mehrling approach is the ideal one, ours can be seen, in combination with the conventional savings measure, as bracketing the houshold sector's true liquidity position.

[8]Whether the primary balance or the conventional savings measure is more appropriate depends on the question we are asking. If we are concerned about saving because we think that is what releases real resources for investment, then whether saving takes the form of reducing liabilities or increasing financial assets makes no difference. A household that reduces its borrowing by 1 percent of income or that increases its net financial asset purchases by the same amount has reduced its claim on current output by the same amount either way. In such an example, the conventional approach of treating a net increase in assets and a net decrease in liabilities as equivalent is clearly appropriate.

independent role. (Escolano, 2010) The equation itself is (almost) an accounting identity.[9] A common application is to consider the primary balance that is required for the debt-GDP ratio to converge to a finite value given a starting debt stock and some values of real growth and interest rates. Another application, more interesting for our purposes, is to decompose actual historical changes in the debt-GDP ratio: The usual approach is to distinguish changes due to the primary balance, the real growth rate, the nominal interest rate, and inflation.[10] Similarly, it allows for decomposition of the divergence between different long-run debt-GDP trajectories. In this case one can also meaningfully separate out spending from revenue.

Decompositions of the changes in the debt-GDP ratio have been carried out for various countries and periods, including the US (Aizenman and Marion, 2009; Hall and Sargent, 2011), the UK (Buiter, 1985; Das, 2011), India (Rangarajan and Srivastava, 2003), and more or less broad sets of countries (Abbas, Belhocine, ElGanainy, and Horton, 2011; Gianannitsarou and Scott, 2008). Because these are essentially accounting exercises rather than econometric estimates, there are relatively few major methodological differences between them. Differences that do exist include the reconciliation of stock-flow discrepancies, the correct computation of yields on government debt, correctly netting out taxes on government interest payments, and accounting for the effect of inflation on nominal interest rates. Notably, almost all of these studies use nominal interest rates and an inflation term, implicitly assuming that changes in inflation move real interest rates at least in the short run, and are fully passed on to nominal rates, if at all, only with some delay.[11] Only Abbas, Belhocine, ElGanainy, and Horton (2011) includes an explicit stock-flow adjustment term; it is not clear how the other studies handle divergences between the observed debt stock and the stock implied by Equation 3. A common finding of these studies is that, while theory may predict a real interest rate that equals or exceeds the the growth rate and that is unaffected by inflation except in the very short run (Blanchard and Sartor, 1991), in practice we observe a variety of relationships between these variables. In particular, changes in inflation are not passed through to nominal rates one for one, at least not over any relevant time horizon, requiring the use of nominal interest rates and a separate inflation term; and many countries experiencing long periods of real interest rates below growth rates.

[9]The equation may not hold exactly because of the existence of government actions that result in changes in the debt stock but that, depending on accounting conventions, do not affect the primary balance. These include off-budget operations such as privatizations or assumptions of private debt, as well as default. For countries borrowing in foreign currency, a term capturing changes in leverage due to exchange rate movements is also needed. Additionally, in practice the equation also will not hold exactly due to measurement errors. These factors may require the addition of a stock-flow adjustment (SFA) term.

[10]The use of the nominal interest rate and real growth rate is standard. It depends on the uncontroversial assumption that changes in inflation are passed through one for one to nominal growth (true almost by definition) and the slightly more controversial assumption that changes in the inflation rate are *not* passed through one for one to nominal interest rates.

[11]Other approaches use only real variables and omit the inflation term, implicitly assuming that the Fisher equation holds strictly over the relevant time frame.

4 Extension of Public Debt Framework to Private Debt

In public debt decompositions, the primary balance is generally taken to be exogenous. It is not clear that this is a better assumption for the public sector than for other sectors. Certainly, if one were to adopt a model of an optimizing household with perfect foresight as to the trajectories of interest, inflation and income, and the ability to adjust its expenditure decisions instantaneously and costlessly, such an assumption would be nonsensical. Alternatively one could take another extreme case, and regard consumption out of income not as the result of any kind of optimizing process, but as a behavioral parameter that must be explained in sociological terms. Hypotheses of this kind have been put forward by a number of researchers regarding the last few decades of consumption behavior.(Cynamon and Fazzari, 2008) In such a case, regarding the household primary balance as an exogenous structural variable, just like the government primary balance, would need no further justification. However, one need not make such a strong claim for debt dynamics to matter. As discussed in Section **??** below, it is sufficient that households with preexisting stocks of debt sometimes face unanticipated changes in interest rates and growth rates, and that adjustments to consumption are slow and/or costly. If we allow that unanticipated changes in real income (or inflation, given that debt contracts are almost always fixed in nominal terms) may occur over the life of a loan, even an optimizing household's leverage may fnd itself off its preferred path. If loans are adjustable rate, or need to be rolled over, changes in interest rates over the life of the loan will similarly produce unintended changes in leverage. This will be true to some extent even with fixed rate loans that are not rolled over, since changing interest rates affect the borrower's ability to refinance. The only necessary condition for debt dynamics to come into play is that there is already a significant stock of debt when there is some exogenous change in income, interest rates or inflation; the effect of dynamics will be larger and more persistent to the extent that units are slow to adjust their expenditure relative to income in response to changes in interest and growth rates.

In any case, the validity of the accounting decomposition of changes in leverage is not affected by behavioral assumptions. It is true by definition. Only its economic interpretation is affected. For instance, insofar as units reduce their borrowing in response to higher interest rates, the share of an increase in leverage that should be attributed to the rise in interest rates is less in an economic sense than that due to it in accounting terms deriving from this framework.[12]

So for the decomposition, we replace the usual concept of sectoral savings with sectoral primary balances, defined by analogy with the government primary balance. This differs from the conventional savings rate in that it excludes interest payments from current expenditure, but includes net asset purchases.

Since leverage is computed as the ratio of debt to some measure of repayment capacity

[12]In some sense, the idea that falls in prices and income can have an independent impact on leverage needs no real defense. Fisher (1933) describes how the fall in prices and incomes over 1929-1933 led to a 40% increase in household leverage even as the nominal stock of debt fell. He and later economists apparently did not consider the possibility that rising leverage in the early 1930s was the result of deliberate choices by borrowers in the late 1920s with correct expectations of the path of prices and incomes a hypothesis even worth exploring! If debt deflation is possible in depressions, there is no reason the same kind of debt dynamics should not operate in less dramatic (de)leveraging episodes.

– GDP for governments, disposable income for households, and net worth or total assets for firms – it is also affected by the growth rate of the denominator.

$\Delta b = \frac{\Delta B}{1+g}$

When units carry large stocks of debt that must be periodically rolled over (or that carries an adjustable interest rate), changes in interest rates are another independent source of variation in leverage. It might be argued that to the extent that households incur debt to finance purchase of specific durable goods it will not rolled over from period to period, but (1) personal debt (credit cards, etc.) actually is often rolled over in practice and (2) durable-financing debt must in effect be rolled over if there are no good market substitutes for the flow of services from durables. For example, in many cases rental housing is not a close substitute for owner-occupied housing. Changes in market interest rates also change the effective interest rates on fixed rate loans to the extent that they affect refinancing opportunities. In any case, for a sector as opposed to an individual unit, the assumption that there is a stock of debt being continuously rolled over is clearly reasonable.

To the extent that changes in inflation rates are not immediately incorporated into nominal interest rates, inflation can be an independent determinant of leverage. The Fisher equation certainly will not hold for unanticipated inflation over the life of fixed-rate loans; more broadly there is good reason to believe that nominal interest rates in general do not fully incorporate changes in inflation,, at least over an economically relevant horizon.[13] The appropriate interest rate here is the effective interest rate, computed as the ratio of total interest payments to the stock of debt.

5 Decomposition of Evolution of Debt

5.1 Data and Variable Definitions

Except where otherwise noted, data used for the decompositions is drawn from the National Income and Product Accounts and their predecessor series. In order to separate out the contributions of the variables, we write a linear approximation of Equation 1:

$$\Delta b_t \approx d_t + (i_t - g_t - \pi_t) b_{t-1}$$

For the range of values of i, g and π observed historically (almost never above 0.1 in absolute value, and seldom above 0.05), the approximation is very close. The variables are defined as follows.

Income. We adjust reported disposable personal income first by subtracting rental income of persons, which consists of the imputed flow of housing services flowing to the personal sector less the cash and noncash costs associated with the housing stock; and then by subtracting property taxes. This adjustment is necessary because the NIPA treatment of housing is inconsistent with the general NIPA convention of not including non-market transactions. Other tangible goods purchases are treated as outlays in the year they

[13] This is a voluminous empirical literature. A useful and comprehensive summary is provided by Cooray (2002), who suggests that "while the majority of studies on the US appear to suggest a positive relationship between interests rates and inflation, they do not establish a one-to-one relationship."

are made, but the NIPA convention for housing is that "owner-occupants are treated as owning unincorporated enterprises that provide housing services to themselves in the form of the rental value of their dwellings." This means that housing purchases are not directly counted as consumption at the time they are made, but instead the BEA imputes both a flow of rental payments (consumption) and rental income to home-owning households. The stated goal is to make measured consumption and saving invariant to households' decision to own or rent homes, but this is not consistent with the procedure followed elsewhere. For example, there is no conceptually equivalent effort to make measured GDP invariant to whether households purchase child-raising or food-preparation services or provide them domestically, by treating households as implicitly operating unincorporated businesses providing those services. Whether this inconsistency is justified in general is beyond the scope of this paper, but for our purposes treating the flow of housing services as income is clearly inappropriate. Credit market borrowing depends on the difference between cash outlays and cash income; imputed flows of non-market services are irrelevant. Depreciation, similarly, besides involving major measurement difficulties, is not a cash expense and should not be subtracted from income here. Furthermore, the NIPA convention, by treating mortgage interest as a deduction from the income of households' unincorporated home-rental businesses, would result in double-counting if we did not subtract rental income, since we include mortgage interest as an independent component of changes in leverage. Property taxes, however, are appropriately subtracted from disposable income. So since they are treated as a deduction from rental income in the NIPAs, we must subtract them again if we subtract rental income.

Debt. The stock variable b is the end-of-period value of total credit market liabilities, divided by adjusted disposable personal income. For years prior to 1947, these are taken from the Historical Statistics of the United States.

Primary balance. Household net borrowing d is equal to the change in credit market liabilities from the previous year. This the same way that standard credit market series are derived; borrowing is not observed directly in the Flow of Funds, but computed from the change in liabilities.[14]

The household primary deficit d is calculated as net borrowing minus interest payments, divided by adjusted disposable personal income. Interest payments are taken from Table 7.11 of the NIPAs. (Interest payments are gross, not net; this is appropriate since interest income is included in disposable personal income.) This is the same way that the primary deficit is calculated for governments. For households, it is also equivalent to the sum of consumption, tangible investment and net acquisition of financial assets, divided by adjusted disposable income, minus one.

Interest growth, and inflation rates. The effective interest rate i is total interest payments divided by the stock of debt at the beginning of the period. In other words, it is not based on observation of market interest rates; it is the *average*, not the marginal

[14] Among other things, this means that defaults show up as lower net borrowing (and more positive primary balances). Unfortunately, we do not have good data on defaults prior to the 1980s, so we can't correct this.

interest rate. Growth g is the annual change in adjusted disposable personal income. Inflation π is the annual change in the personal consumption expenditure (PCE) deflator. The contribution of i, g and π to the change in leverage is equal to the variable multiplied by the previous period's debt stock.

Figure 2 shows the behavior of the three variables over the whole 1929-2011 period. As discussed below, there are clearly three distinct periods in the data. Before 1945, nominal growth rates fluctuate wildly, with periods both well above and well below the effective nominal interest rate. Between 1945 and 1980, nominal growth and nominal interest rates are stable and approximately equal. And since 1980, nominal growth is consistently below the nominal effective interest rate. It's also worth noting that in the first period, price and income changes are strongly correlated, while in the later periods they are not – indeed the relationship is negative. This may be due to the larger role of monetary policy in driving income fluctuations in the postwar period.

Figure 2: i, g and π for Household Debt, 1929-2010

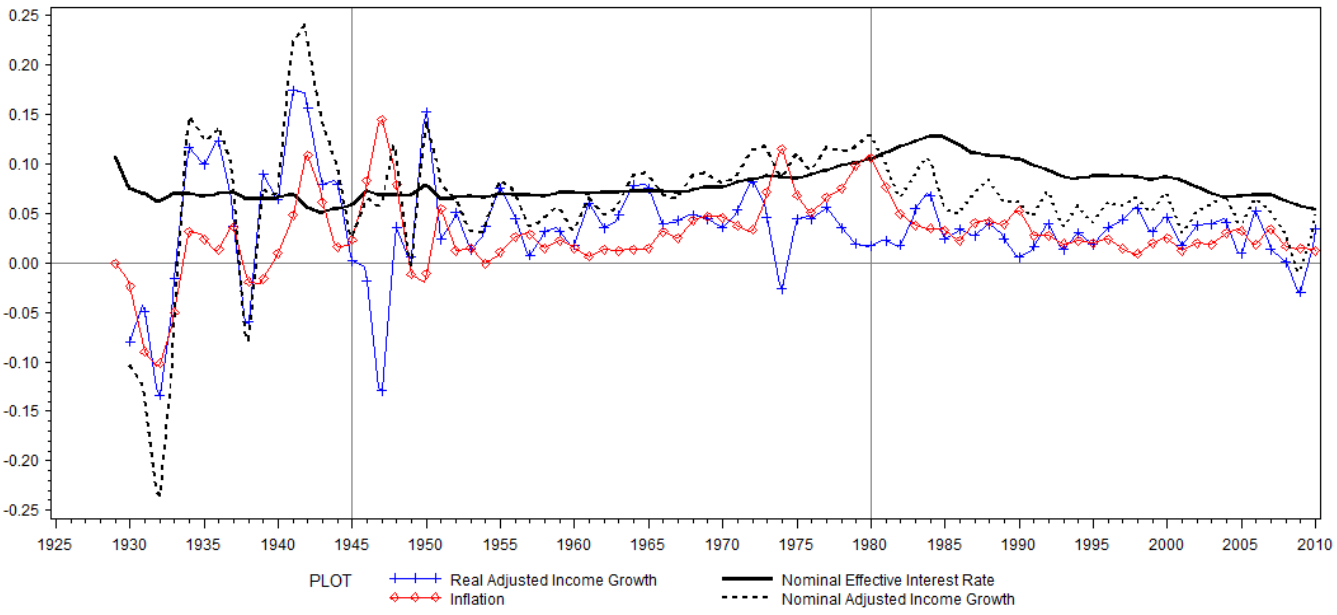
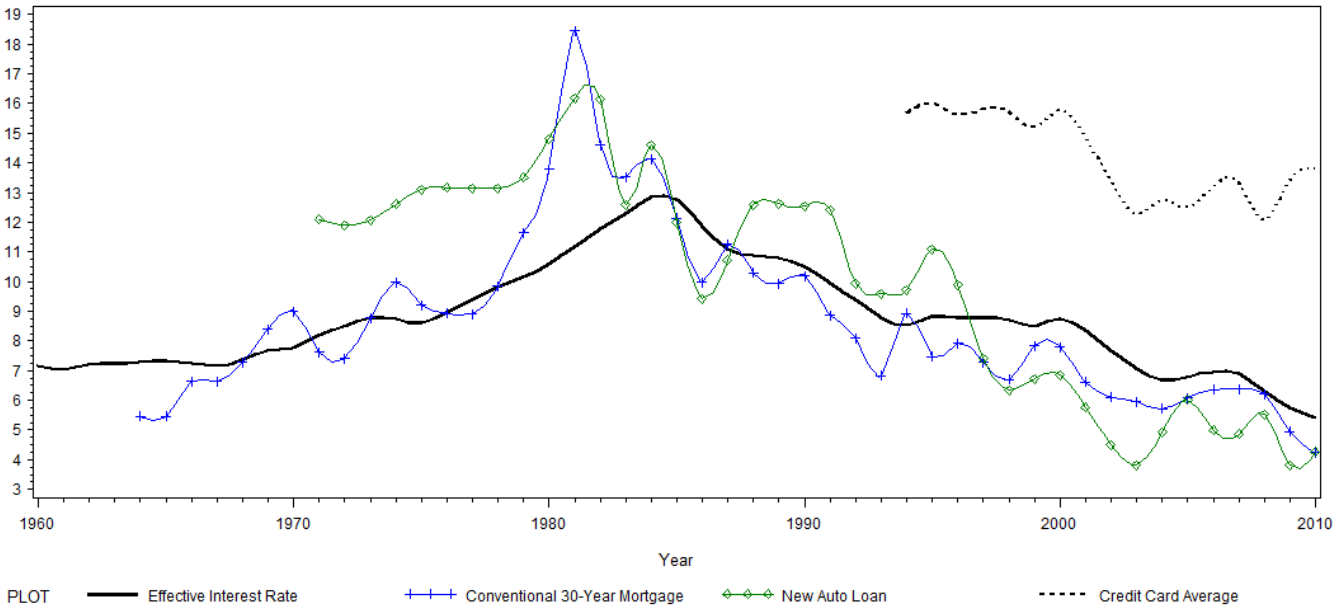


Figure 3 compares the effective interest rate with some representative consumer rates tracked by the Fed – the 30-year conventional mortgage rate, the new auto loan rate, and the average credit card rate reported by commercial banks. Not surprisingly, our calculated effective rate looks like a smoothed, somewhat lagging average of the market rates.

Figure 3: Selected Interest Rates, 1960-2010



5.2 The Household Primary Balance

Typically, economists do not speak about the "primary balance" of a non-government unit or sector; it is normally reserved to denote the fiscal stance of the central government. From an accounting framework, however, the concept is equivalent whether the borrowing is public or private. The primary balance of any sector is simply its cash income less its cash outlays. Table 2 shows its components for the household sector. The primary balance is equal to income, minus personal consumption, minus net acquisition of tangible and financial assets; equivalently, the primary surplus equals personal savings, minus net acquisition of financial assets, plus gross interest payments. The primary deficit represents net new borrowing by households, or the difference between income and total expenditure on consumption and investment of all kinds. It is the net flow of funds to the household sector from the credit markets.

The obvious differences between the primary surplus and the conventional personal savings measure is that the primary balance measure counts net acquisition of assets as expenditure, and does not treat interest payments as expenditure. An additional difference is the treatment of housing, as discussed above.[15] Most important for the long-term results is the treatment of interest. We do not argue that our measure is more appropriate for all purposes. Where saving is of interest because it free real resources for use elsewhere in

[15]In practice, removing the imputed components of disposable income has only a modest effect and is not important to the qualitative results of the paper.

the economy, it is natural to treat net acquisition of financial assets and net reduction in liabilities equivalently. But insofar as policymakers are interested in the evolution of the liability side of balance sheets specifically, because of the importance of the debt stock for financial fragility or because leverage is an important determinant of household and firm behavior, it is necessary to distinguish changes in assets from changes in liabilities. A unit that increases its assets and its liabilities by equal amounts has increased its leverage, even though its conventionally measured savings are unchanged.

Figure 4 compares the personal savings rate as measured by NIPA and the Flow of Funds as well as the primary surplus. There are some conceptual and measurement discrepancies that exist between the two measured savings rates [16] that are reflected in the figure. Nevertheless, these track very closely together (the correlation coefficient is 0.95 over the period). This is not true, however of the primary surplus.The thick black line shows the primary surplus over the period as defined above. The differences in the series are striking. Both the NIPA and FOF savings rate display the conventional narrative of roughly stable savings rates from the 1950s to the 1980s, and declining savings from the peaks of the mid 1980s onwards to the early 2000s, followed by a recovery in savings rates thereafter. The primary balance however shows roughly the opposite story. Households ran (modest) primary deficits for most of the period between 1950 and 1980. Between 1980 and 2000, households ran modest primary surpluses. From 2000 to 2006-the period of the housing bubble–households ran large primary deficits, and reversed these equally sharply in the period that followed. Viewed in terms of the latter series, American households' spending was significantly *lower*, relative to their income, between 1980 and 2010 than during the previous three decades.

Figure 5 provides a decomposition of the difference between the primary surplus and the FOF savings rate over the period. The heavy black line on the graph is the primary surplus minus the conventional savings rate. Any line below the axis reduce the primary surplus relative to conventional savings while any line above it increases it.Three features are worth pointing out. First, the increase in the primary balance relative to savings in the 1980-2010 period is clearly evident. This is the key difference between our story differs from the conventional one. Second, there is a clear increase in the importance of interest payments in the post 1980 period (the red line). Finally, the main driver of the gap between the two series appears to be the net acquisition of financial assets (the green line).

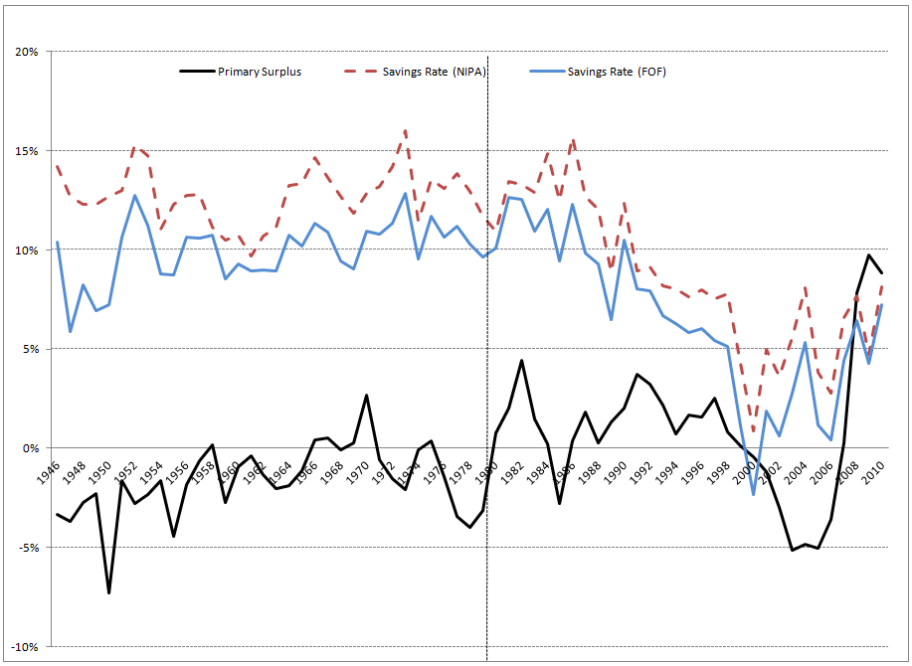
Table 1: Factors Contributing to Differences Between Primary Surplus and Savings Rate

		1946-1979	1980-2010	Change
Primary Surplus-Savings Rate		-11.6	-5.5	6.1
Explained By:	Interest	3.7	7.4	3.7
	Res. Investment	-4.8	-3.4	1.4
	Nonres. Investment	-1.3	-0.8	0.5
	Net acq. Fin. Assets	-10.8	-11.4	-0.6
	Noncredit Liabilities	1.1	1.6	0.5

Table1 provides a more informative breaking out of the factors contributing to the differ-

[16] A more detailed examination of the conceptual and measurement differences between the two series is provided at http://www.bea.gov/national/nipaweb/Nipa-Frb.asp

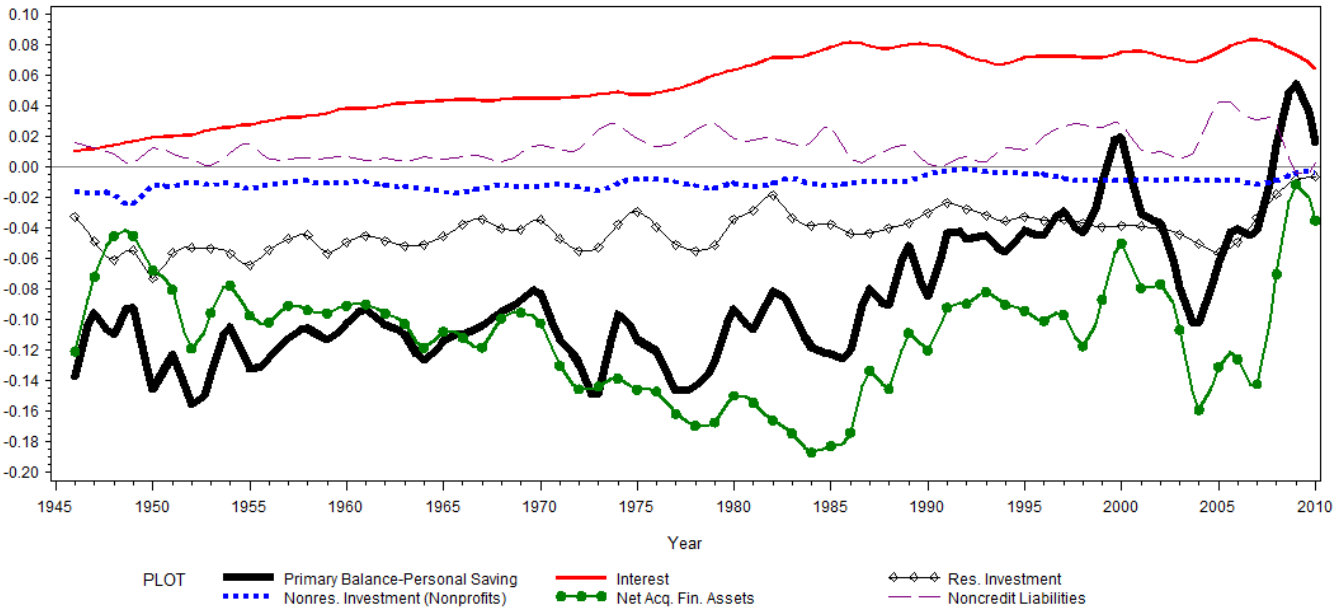
Figure 4: Savings and Primary Surplus as Percentage of Disposable Income, 1946-2010



ence in the two periods. The primary surplus saw an increase of 6 percentage points relative to the conventional savings measure in the post 1980 period compared with the pre-1980 period. This explains the different trends between the two series. The main explanatory factor for this relative increase is higher interest payments as a share of income; the average for the second 30-year period is 3.7 points higher than for the first one. 1.4 further percentage points are explained by lower residential investment in the second period. (Residential investment contributes to the conventional savings rate, but not to the primary balance.) Other factors count for the small remainder. Note here that although the net acquisition of financial assets is by far the largest contributor to the difference in the primary surplus and the savings rate, it has not changed dramatically between the two periods, so it does not account for the different trends between the two series.

Table 2 provides a more disaggregated break-up into decade averages. The divergence between households' primary surplus and the conventional savings rate is due to the fall in nonfinancial investment (from the 1980s on), the fall in net acquisition of financial assets (from the 1990s on), and the increase in interest payments (from the 1980s on). The first two factors tend to raise the primary balance relative to the savings rate, while the last reduces it. Note also that household net borrowing was no higher in the 1980s than in the 1970s. The entire increase in leverage in the 1980s relative to the 1970s was due to slower growth of nominal income. If debt dynamics played no role, that is if the real effective interest rate equaled the real growth rate of income, then column E and F would sum to zero. This is approximately the case for the 1950s and 1960s.

Figure 5: Components of Difference between Primary Surplus and Personal Savings 1946-2010



5.3 The Role of the Accumulated Debt Stock

It is important to recognize that the effect of Fisher dynamics depends on the existing stock of debt (relative to income) as much as on the values of i, g and π. This is obvious from Equations 3 and 5.1 but its implications are sufficeintly central to our story that they're worth spelling out. In particular, if leverage is initialy stable, and the ratio of debt to income then increases for any reason, a more positive primary balance will be needed in subsequent periods to prevent it from continuing to rise. This is why we can say that higher interest payments drove the increase in debt through the whole post-1980 period, even though interest rates by the late 90s they had returned to their pre-Volcker levels (or even lower). By that point the stock of debt was much higher – due to the previous period of high i – so that the same level of i, g and π required a larger primary surplus to keep leverage constant. This can be seen cearly if we draw a phase diagram in i-d space, loosely following a phase diagram for public debt following Taylor (2011)

Figure 6 schematically shows the interest rate is on the vertical axis, and the primary balance on the horizontal axis. The diagonal curve running from the upper left to the lower right is the leverage *nullcline* – those combinations of i and d for which $\Delta b = 0$, i.e. where leverage is constant. Above this locus, leverage is rising, below it, leverage is falling. Since the diagram is drawn in nominal terms, the dotted line is drawn at a level equal to the sum of inflation and growth rates. Then the constant-leverage curve passes through the

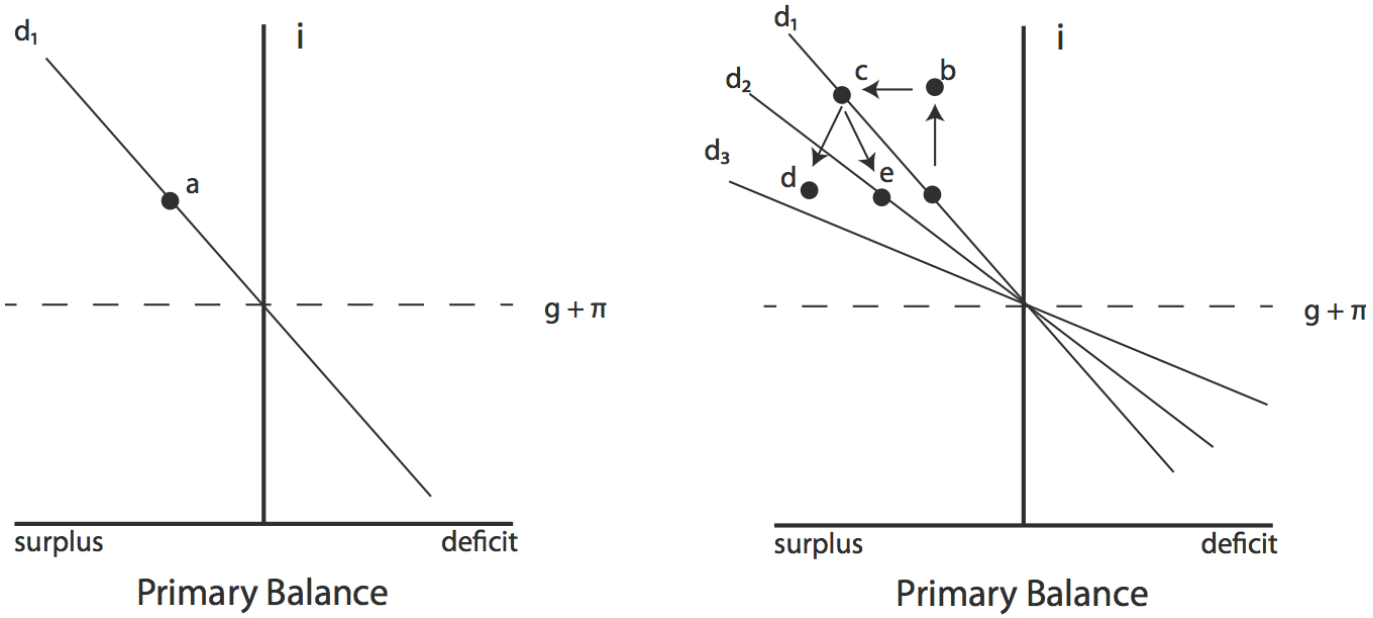
Table 2: Average Annual Household Sector Balances as Share of Disposable Income

Decade	A. Non-financial Expenditure	*Of Which: Nonfinancial Investment*	B. Net Acquisition of Financial Assets	C. Interest Payments	D. Net Borrowing (A+B+C-1)	E. Primary Balance (1-A-B)	F. Change in Debt-Income Ratio
1950s	0.920	*0.080*	0.098	0.031	0.049	-0.018	0.025
1960s	0.888	*0.082*	0.115	0.046	0.049	-0.003	0.002
1970s	0.871	*0.082*	0.144	0.057	0.072	-0.015	0.005
1980s	0.848	*0.068*	0.143	0.082	0.073	0.009	0.017
1990s	0.915	*0.059*	0.076	0.077	0.067	0.010	0.011
2000s	0.944	*0.064*	0.069	0.078	0.090	-0.013	0.024

point where the vertical axis (corresponding to a primary balance of zero) intersects the growth rate, since a primary balance of zero keeps the debt GDP ratio constant if and only if $i = g + \pi$. Changes in inflation or growth shift the leverage nullcline vertically, while changes in the stock of debt rotate the constant-leverage curve around the point where it crosses the vertical axis. (This should be clear from Equation 3.) Since the slope of the nullclie corresponds to the debt-income ratio, it is obvios that when leverage is low, it takes only a small change in the household primary balance to counterbalacne a shock to i, π or g, while if leverage is already high, larger adjustments to the primary balance will be needed to keep leverage constant. Finally, it is evident from this diagram that departures from a constant-leverage path when we are in the lower right – i.e. when nominal interest rates are less than nominal growth rates – will eventually result in leverage stabilizing at a new level, since a position above the nullcline will lead it to rotate upward while a position below the nullcline will lead it to rotate dowward. In the upper-left part of the diagram, on the other hand, departures from the nullcline lead to leverage running away to (positive or negative) infinity unless there is some counteracting change. Thus, if households face an upward shock in interest rates that throw them off the nullcline, even if they respond rationally by reducing spending, every period that they are above the nullcline it will rotate counterclockwise. So there's no assurance that they will ever be able to get back to a point of stable leverage, if they can't adjust spending instantly (or if they are uncertain about the future path of interest rates). And even if they do so, it may be at a much higher level of leverage, even if interest rates eventually return to their old level.

To anticipate the argument of the next section, suppose we are initially at a point like a in the left panel of Figure 6, where interest rates slightly above growth rates are baalnced by moderate primary surpluses, yielding stable leverage. Now there's a positive shock to interest rates, so we jump to point b, as shown in the second panel. In response to higher interest rates, households reduce their spending, moving left to point c. But that does not happen instantly, and the time spent above the nullcline increases the debt ratio from d_1 to d_2, rotating the nullcline, so that c is now above it. Now say that interest rates eventually fall back to their old level. If households are still trying to stabilize debt, we might end up at

Figure 6: Leverage Dynamics in i-d Space



d; if the fall in interest rates stimulates increased spending, we might end up at e. Either one is good enough to at least stabilize debt at d_2. But meanwhile, the time spent above the d_2 curve has increased the debt further and rotated the nullcline down to d_3, so households still have not stabilized leverage. Households may continue to reduce spending (if we think they respond to leverage and not just to marginal interest rates) but there is no assurance they can do so fast enough to catch up with the d curve, which continues rotating counterclockwise as long as the current position is above it. (Eventually, of ocurse, households may increase spending, as they did after 1998, moving to the right in the phase diagram, but even then the rise in debt will be in part accounted for by the earlier interest-rate shock.) This is the logic by which we can say that a large part of the faster growth in debt in the 2000s as compared wth the pre-1980 decades was due to higher interest, even though interest rates were no higher in the 2000s than in the earlier period.

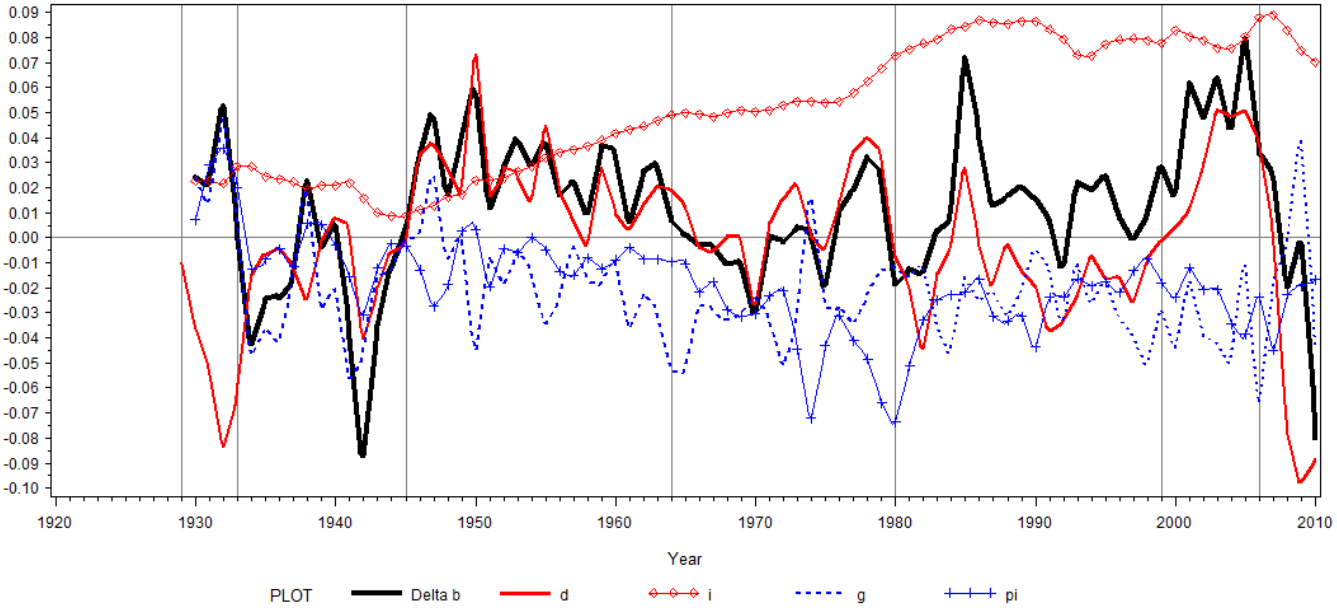
A final point is that we have been spaking so far as if households try to reach a given primary balance, they can do so by adjusting their expenditure. Thi is unproblematically true for an individual household, but for households as a whole, it is true only insofar as some other sector increases spending, or assets are trasnferred from debtor to creditor units. If neither of these conditions are met then the reduced expenditure wll show up in lower income isntead. Thus any attempt to reduce spending by households will produce a combination of a leftward shift in the current position, plus a downward shift of the nullcline; the net effect on the change in leverage is indeterminate, and, as in the 1930s, it may be that attempts to reduce spenidng result in higher leverage. This is the second half of the Fisher story; in this paper, we are for the most part only interested in the first half, the effect of changes in prices and income (and interest) on changes in leverage, but this second obstacle to moving

to the nulcline from a position above it is potentialy important as well.

6 Results

Figure 7 shows the results of our decomposition, the key finding of the paper. The heavy black line shows the annual change in the household sector's debt-income ratio, while the other lines show the contribution of the primary balance, interest, growth and inflation. (Note that interest, growth and inflation are the respective contributions to the growth of leverage from those variables, not the variables themselves.) In the figure, we observe several distinct episodes corresponding to different periods in the regulation of finance.

Figure 7: Annual Change in Household Leverage and Components, 1929-2010



6.1 Periodization of Debt Dynamics

From the broadest perspective we identify three periods which we identify as corresponding to different political economy regimes within the U.S. The Era of Flexible Prices prior to 1945 saw very large swings in the growth rates of incomes and prices, with important episodes of deflation. Thus changes in leverage ratios were dominated by movements of the denominator rather than the nominator. Our data begins in 1929, but it is likely that the earlier period looks similar. The period from 1945-1980 (the Era of Financial Repression) saw much more regulation of finance, and in particular substantial limits on interest rates. Finally, the period

from 1980-2011 (the Era of Financial Deregulation) saw multiple changes that renewed the importance of the financial sector in the U.S economy-from deregulation of interest rates to increased financial innovation, the development of more sophisticated financial products targeted at households, financial deregulation and so on.

The Era of Flexible Prices/Volatile Debt Dynamics Historians of finance and international political economy have often seen the period from 1870-1945 as one in which liberal capital and product markets held sway with the buttressing of the gold standard, albeit with significant interruptions during the world wars and the Great Depression. (Eichengreen, 2008; Frieden, 2008) Frieden (2008) in particular argues that the implicit pact that undergirded the gold standard era was a consensus among policymakers that the domestic economy would best cope with changing conditions by extreme price flexibility. As such, the typical adjustment mechanism often involved allowing or forcing prices and wages to drop and rise sharply. While successful in maintaining international economic integration, such an approach became increasingly difficult from the 1930s with substantial political opposition to the gold standard (which was biased in times of downturns towards creditors). Certainly, by the 1940s laissez-faire banking was over. In that sense, the period 1929-1945 which we examine captures the last part of the period.

Nevertheless, in comparison with what follows, the period does display large price volatility. As is evident from the figure, leverage is between 1929 and 1945 is dominated by large swings in incomes and prices. There is essentially no correlation between the primary balance and debt changes – in fact, the largest increase in leverage, in 1931, is also the year with the lowest new borrowing. This is the moment that inspired the original Fisher debt-deflation story. We could call this the Era of Volatile Debt Dynamics. Unlike later periods, inthis period short-term as well as longer-term movements in leverage were domainated by changes in prices and incomes.

The Era of Financial Repression/Neutral Debt Dynamics As a consequence of the Great Depression and the World War, the international political system moved to the Bretton Woods arrangement of fixed exchange rates and tightly controlled domestic and international capital markets. In this context, interest rates were much more closely regulated and credit much more directed.

The period from 1945 to 1980 has been one of considerable interest to historians of public debt recently as an example of deleveraging of public debt . Reinhart and Sbrancia (2011) suggest that during this period,(what might be called the Era of Financial Repression) real interest rates were lower than in the previous period or following deregulation in the 1980s across the world, and were often negative. They argue that financial repression (understood as the multiple ways in which financial prices were regulated during the period) was critical to the sharp decline in the U.S public debt in the aftermath of the second world war. Certainly, regulations of financial prices, directly in the form of interest rate ceilings and more broadly via the partitioning of financial markets that limited pressure for higher returns, were standard in the United States and elsewhere during the period. Partly as a natural concomitant to the managed globalization of the period, laws such as Regulation Q that prohibited banks from

paying interest on certain deposits, interest rate ceilings on debt, capital account restrictions and transactions taxes were all elements of a regulatory package that worked against the interest of owners of financial assets and, in particular, limited adjustment of nominal interest rates to inflation. Keynes' proposed 'euthanasia of the rentier' came closest to implementation in this period.

While financial repression may have significantly aided in reducing the burden of debt for governments, the impact on household debt was much more muted. In the Era of Financial Repression, from the end of the war to 1980, real interest and growth rates were stable and approximately equal, so essentially all changes in leverage were the result of household borrowing choices as reflected in the primary balance – surpluses in most of 1965-1975, deficits the rest of the time. From 1965 on, real growth rates were slightly above real interest rates, largely as a result of higher inflation, creating a modest tendency for household leverage ratios to fall. We could also call this the Era of Neutral Debt Dynamics.

The Era of Financial Deregulation/Adverse Debt Dynamics The shift away from a heavily regulated/repressed financial system to the deregulated financial system of the last 30 years has been well documented.Following the high inflation of the 1970s in the U.S, restrictive monetary policies (in particular the "Volcker shock") and interest rate deregulation of the early 1980s were the first movements towards more liberal oriented capital markets. The trend strengthened throughout the 1980s and 1990s with increasing liberalization of financial markets as well as growth and innovation in the US financial system. Of most concern to us is the behavior of newly flexible interest rates. During the first part of this period, households faced systematically higher effective real interest rates. (See Figure 3.) Effective rates were slow to fall despite the fact that in response to recessions, the Fed reduced short term rates more sharply than in the earlier periods. By the end of the period, effective interest rates face by households had fallen below pre-1980 levels, but because of the increase in leverage in the intervening period, interest costs faced by households remained higher than before 1980.

In the Era of Financial Deregulation, from 1980 to the present, real effective interest rates have been significantly above growth rates. (About 2.5 points above for mortgages, and a bit over 3 points for total household debt.) As a result, leverage has tended to rise over time regardless of household borrowing choices. This fairly stable gap has coincided with mostly positive household primary balances from 1980 to 2000, large negative primary balances in the first half of the 2000s, and large positive balances since 2006. We could also call this the Era of Adverse Debt Dynamics.

As noted above, most discussions of household leverage ratios take it for granted that they must be driven by changes in household borrowing behavior. But our results show that this is more true in some cases than in others. Over short periods, Fisher dynamics appear to have been more important before WWII than afterward, because incomes and prices used to be more variable. In the pre-1945 period, prices and growth also tended to move together, which has not been true in more recent periods. But over longer horizons, debt dynamics

have generally dominated household borrowing behavior as the main determinant of changes in leverage, after World War II as well as before.

6.2 Disaggregated Periodization

A more detailed examination suggests seven distinct periods in the evolution of household leverage since 1929, as shown in Table 3. The numbers in the table indicate the contribution of each term to the change in leverage, so g, i and π are not growth, interest and inflation themselves, but the rates times the stock of debt. A negative number represents a reduction in leverage and a positive number an increase. The four latter terms don't sum exactly to the change in leverage because of interaction effects. There are four periods of rising leverage, two periods of falling leverage, and one of stable leverage. (These periods are also reflected in the vertical lines in Figure 7). Table 4 summarizes the qualitative results.

Table 3: Average Annual Change in Household Leverage and Components

Period	Δb	d	i	g	π
1929 to 1933	0.025	-0.049	0.024	0.023	0.023
1934 to 1945	-0.021	-0.010	0.019	-0.025	-0.008
1946 to 1964	0.028	0.023	0.031	-0.017	-0.009
1965 to 1980	-0.001	0.008	0.055	-0.027	-0.038
1981 to 1999	0.014	-0.015	0.081	-0.025	-0.025
2000 to 2006	0.050	0.033	0.080	-0.038	-0.025
2007 to 2010	-0.020	-0.067	0.079	-0.006	-0.026

Table 4: Summary of Periodization

Period	Household Primary Balance	Debt Dynamics	Household Leverage
1929 to 1933	surplus	$r > g$	rising
1934 to 1945	surplus	$r < g$	falling
1946 to 1964	deficit	$r = g$	rising
1965 to 1980	deficit	$r < g$	stable
1981 to 1999	surplus	$r > g$	rising
2000 to 2006	deficit	$r > g$	rising
2007 to 2010	surplus	$r > g$	falling

1929-1933 During this period, households ran primary surpluses, but real interest rates exceeded real growth rates. Household debt-income ratios rose by 10 points. This increase took place despite a cumulative primary surplus and moderate nominal interest rates, because falling incomes and prices meant that the denominator of the leverage ratio was falling faster than the numerator. This is the one period in which both g and π made a positive contribution to the change in leverage over this period – the classic Fisher debt deflation.

1934-1945 During this period, households continued to run primary surpluses, albeit smaller ones, but growth rates now exceeded real interest rates. As a result, household debt income ratios fell by 25 points. Half of this deleveraging was attributable to the primary surpluses, and half to high growth and an end to deflation (given stable nominal interest rates).

1946-1964 During this period households began to run primary deficits, as they increased their stock of housing and other tangible and financial assets in the postwar boom. The period saw a large increase in household leverage – 50 points over the whole period. Unlike earlier and later periods, the changes in leverage in the postwar period corresponded almost exactly to cumulative household primary deficits, since real interest rates and real growth rates were approximately equal.

1965-1980 During this period, while households continued to run (smaller) primary deficits, growth rates exceeded interest rates. There was, as a result essentially no change in household leverage (a total increase of 0.6 points over fifteen years). Compared with the previous period, just over half the change in the trend of leverage was due to household primary balances (expenditure exceeded income by an average of 0.8 percent, compared with 2.3 percent in 1946-1964, explaining 1.5 points of the 2.6 point difference in annual debt growth) while the other half was due to faster real growth (0.8 points annually) and an increase in inflation that was not fully passed through to effective nominal interest rates (0.4 points.)

1981-1999 During this period, households switched to primary surpluses, but as a result of financial deregulation and higher interest rates following the Volcker shocks, household debt ratios rose at about half the rate of the postwar years (1.4 percent annually compared with 2.6 percent). This increase took place despite primary *surpluses* averaging 1.4 percent of household income. With growth rates essentially unchanged from the previous period, the growth of leverage was entirely due to higher real interest rates, with higher nominal interest rates contributing two thirds of the increase and lower inflation the other third. It is striking to realize that over this period, accounting for about half of the post-1980 increase in leverage, saw the lowest levels of household spending relative to income of the whole postwar period. Leverage rose only because of the effect of higher real effective interest rates on households' existing stock of debt.

2000-2006 This was the only sustained period since 1980 in which households ran primary deficits. Household leverage rose by 5.2 points per year, by far the fastest rate of increase in the twentieth century. (Before 2001, there had been only three years in total in which household leverage increased by more than four points; this period included six in a row. During the 1920s, to which this period is sometimes compared, annual increases in household leverage averaged 1.7 points, and never exceeded 3 points.) About two thirds of this was due to primary deficits, so the conventional assumption that increases in debt are driven by higher borrowing does hold good for this period. But about a third of the extraordinary rise in household leverage in this period can be attributed to real interest rates continuing to exceed real growth, a gap that added about two points annually to household leverage.

2007-2010 In this final period, households abruptly shifted from borrowing to paying down debt, running primary surpluses of 6.5 percent of income annually. Slow growth and continued high real interest rates offset most of these surpluses, however, increasing leverage by about 4 points per year. As a result, even though the accumulated surpluses in this period were slightly larger than the accumulated deficits during the previous period (cumulative 26 percent of income, compared with cumulative deficits of 23 percent) leverage fell by only 10 points compared with the 36 point increase of the previous period. And as discussed below, about half of these apparent surpluses are actually accounted for by defaults, which appear to have slightly exceeded the total deleveraging in this period. So even the most drastic curtailment of consumption of the postwar period, sufficient to produce a very large output gap even in the face of large fiscal deficits, is not enough to reduce leverage in an environment with a large existing stock of debt and interest rates significantly above growth rates.

The most striking result of this decomposition is that prior to 2000, the large increase in household leverage is not explained by any increase in new household borrowing. Rather, it was the result first, of the sharp disinflation after 1980, scond, from high interest rates in the 1980s and early 1990s, and finally, the effect of the accumulated debt as a result of these first two factors. Between 1965 and 1980, household leverage was essentially constant, increasing by less than 0.5 percentage points over the entire period. Between 1981 and 2000, on the other hand, household leverage increased by 28 points. Yet the primary balance of the household sector actually improved, moving from an average deficit of 0.7 percent of income in the earlier period to an average surplus of 1.3 percent in the second period. In addition, growth was slightly faster in the second period, averaging 0.3 points higher. (This difference is sensitive to the exact dates, but is not important to the rest of the story.) These favorable shifts were more than offset, however, by an annual increase in leverage due to interest payments 2.5 points higher in the second period than in the first one, and a reduction due to inflation 1.4 points lower in the second period than the first one. In other words, households were paying down debt after 1980, but the combination of high nominal interest rates and falling inflation meant that the stock of debt rose faster than households were able to pay it down. In a sense, the ten or 20 years after the Volcker rate increase looks like a slow motion Fisher debt-deflation, or a debt-disinflation. Only starting in the late 1990s did the household sector begin to run large primary deficits; and even during the period of greatest new borrowing, from 2000 to 2005, over one third of the increase in leverage is attributable to the difference between real interest and growth rates.

Another striking result is the similarity between 2009 and 1930-33. Over the initial Depression years, the household sector's primary surplus averaged 5.8 percent of disposable income. But negative growth, deflation, and interest each raised leverage by 2.5 percentage points annually, resulting in an overall increase. In Fisher's view, this was the key to the severity of the Depression. Attempts to reduce leverage by reducing spending resulted in falling prices and incomes and rising real interest rates (despite falling nominal rates), leading to higher leverage and intensified efforts to reduce spending. If units are forced to reduce their debt-income ratios, they will have to reduce spending; but if unfavorable debt dynamics mean that spending reductions do not actually lower debt burdens, then the effort to reduce spending may continue indefinitely. Similarly, in 2009, the household sector had a primary

surplus of 9.5 percent, the highest in the entire series.[17] But the combinations of low and falling inflation, relatively high and stable effective nominal interest rates, and a sharp fall in output (2.4 percent, increasing the debt-income ratio by 3.1 percent) meant that this primary surplus reduced household leverage by less than one point. If even large surpluses do not reduce debt-income ratios, then units seeking to deleverage will continue trying to run surpluses, putting downward pressure on income and prices. If policy interventions had not prevented outright deflation and restored positive income growth in 2010, it is easy to imagine how continued efforts to deleverage by households (and businesses) could have produced a full-fledged debt-deflationary spiral.

In any case, the key point is that there was no increase in debt-financed expenditure by households before the late 1990s. While this to some extent reflects a choice to reduce asset holdings rather than increase liabilities, Table 2 confirms that total nonfinancial expenditure (i.e. consumption plus purchases of tangible assets) was no higher relative to income over the 1980-2000 period than over 1950-1980.[18] As a whole, the household sector's primary balance did not show any sustained movement toward deficit before 1998.

7 Counterfactuals

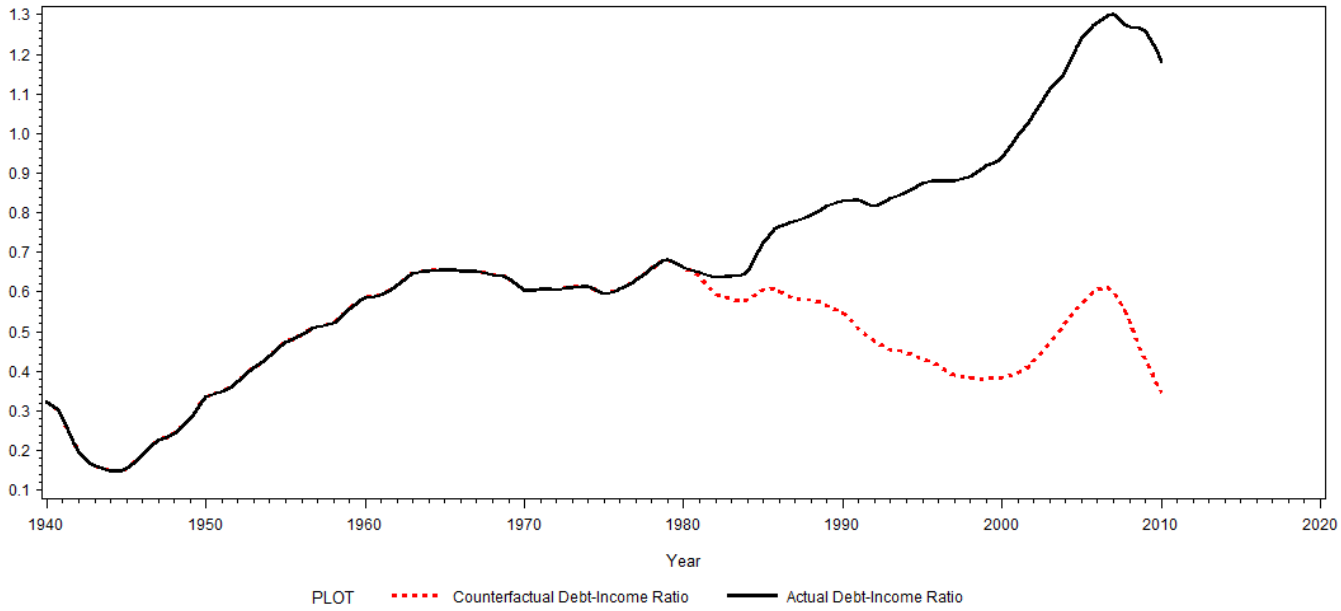
Another way of seeing this is to ask what would have been the trajectory of household leverage if household primary balances had been the same as in reality but growth, interest and inflation rates had been the same in 1980-2010 as in 1945-1980. The result of that exercise is shown in Figure 9. The disinflation of the early 1980s led to a lasting rise in real interest rates. This increase in interest explains, in an accounting sense, the entire rise in household debt since 1980. The figure itself is striking. Apart from a relatively modest increase in the early 2000s, household debts have basically been driven by Fisher dynamics since 1980. In this sense, the common narrative of the profligate American household is applicable only to a short period of intensely increased borrowing in the mid-2000s (following which households have cut back more than proportionately). It would be more accurate to suggest that, at least in comparison with the previous periods, US households have been relatively frugal and have been at the receiving end of a slow motion debt-disinflation dynamic between 1980 and 2011.

Policymakers and media have suggested that the only course to reduce private indebtedness is to have households cut back on consumption and undergo a sustained period of austerity. And indeed, th Figure 7 shows, the last three years have seen the sharpest increase in primary surpluses over the entire period (over 7% every year since 2008). This remarkable and rapid retrenchment has however, only been possible without an even more serious recession because government has been borrowing and running up public debt. In

[17] As discussed below, 4 percentage points of that was really defaults, which the Flow of Funds does not distinguish from reduced borrowing. Some faction of the household surpluses in the early 1930s must have been accounted for by defaults as well. How much is unclear.

[18] Given this, we do not need any explanations of why households would decide to increase current consumption relative to income (because of a change in the rate of time preference, a relaxing of financing constraints, an expectation of higher future income, or a desire to maintain a conventional level of expenditure in the face of declining income in the lower part of the income distribution.) There was no such decision.

Figure 8: Counterfactual Evolution of Household Leverage Given 1945-1980 Average Values of i, g, and π



other words, the burden of growth has been shifted onto the government's balance sheet. Given the relative unwillingness to consider direct financial repression, it might be useful to ask how long it would take to restore debt levels of 1980 under different retrenchment scenarios

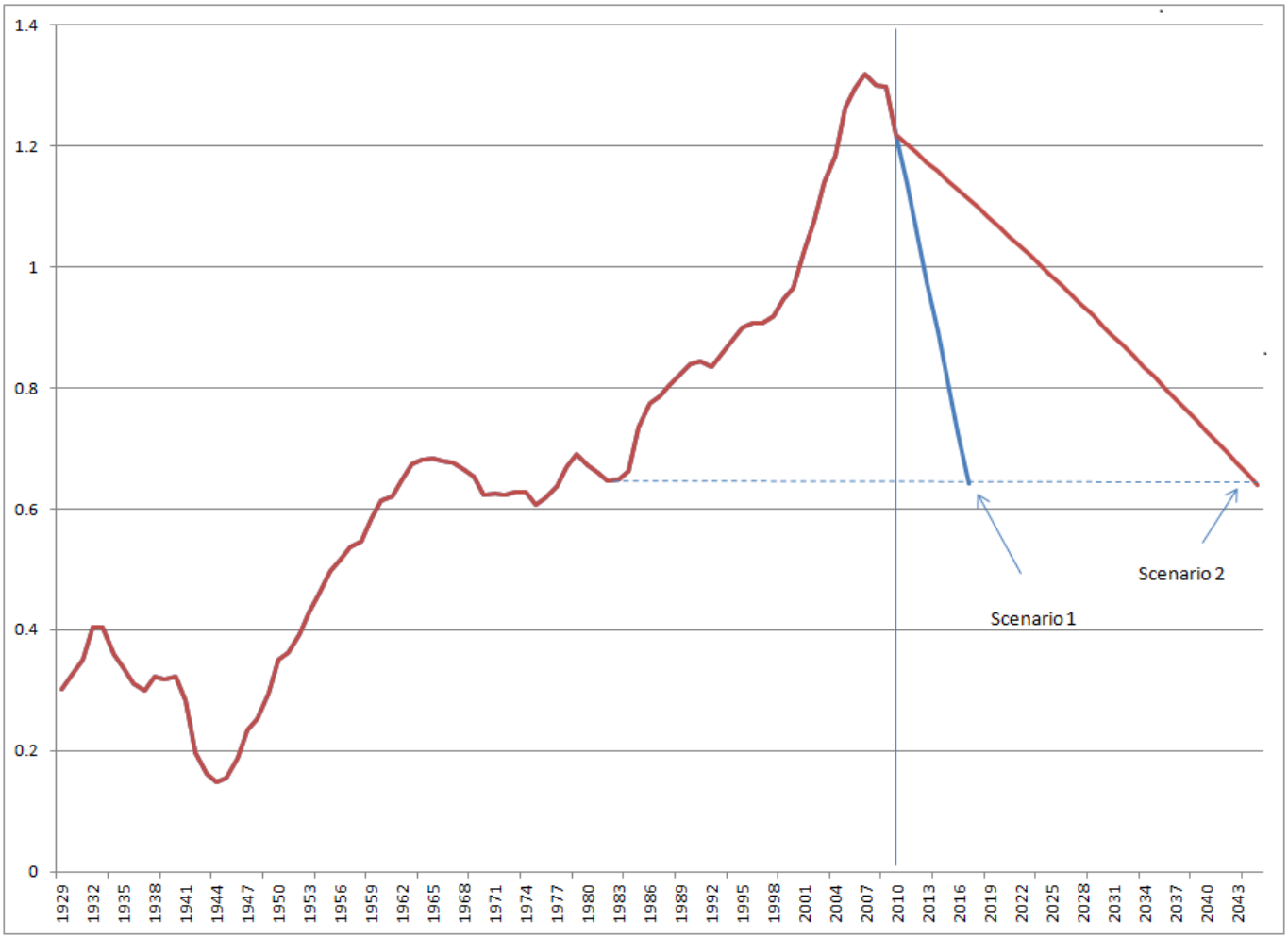
The key recursive equation that governs the dynamics of the debt ratio is given (as noted previously) by

$b_{t+1} = d_t + (\frac{1+i}{1+g+\pi})b_t$

If we assume current levels of i, g, π and d, returning to 1980 levels would require till 2017. Such a scenario (scenario 1) , in the face of the political inability of government to increase investment would necessarily result in a long depression, since the main source of demand-household consumption- would be severely curtailed. Moreover, as we shall argue in the next section, defaults have accounted for nearly half the observed household surpluses, and cannot be expected to continue apace. We could instead conceive of the deleveraging path in the face of current levels of i, g, π but assuming the average level of primary surpluses from 1929 to 2011 whenever the household sector ran a surplus. This number might be a more 'realistic' account of how much households can tolerate in terms of adjustment, even though it too may be biased upwards since it includes the period of massive retrenchment from 2007 to 2009. The deleveraging path in such a situation is depicted as scenario 2. Even if households were to run primary surpluses at this level every year, at current levels of growth and real interest rates, it would take till 2045 to return to debt levels of the early

1980s.

Figure 9: Deleveraging through Primary Surpluses, Two Different Scenarios

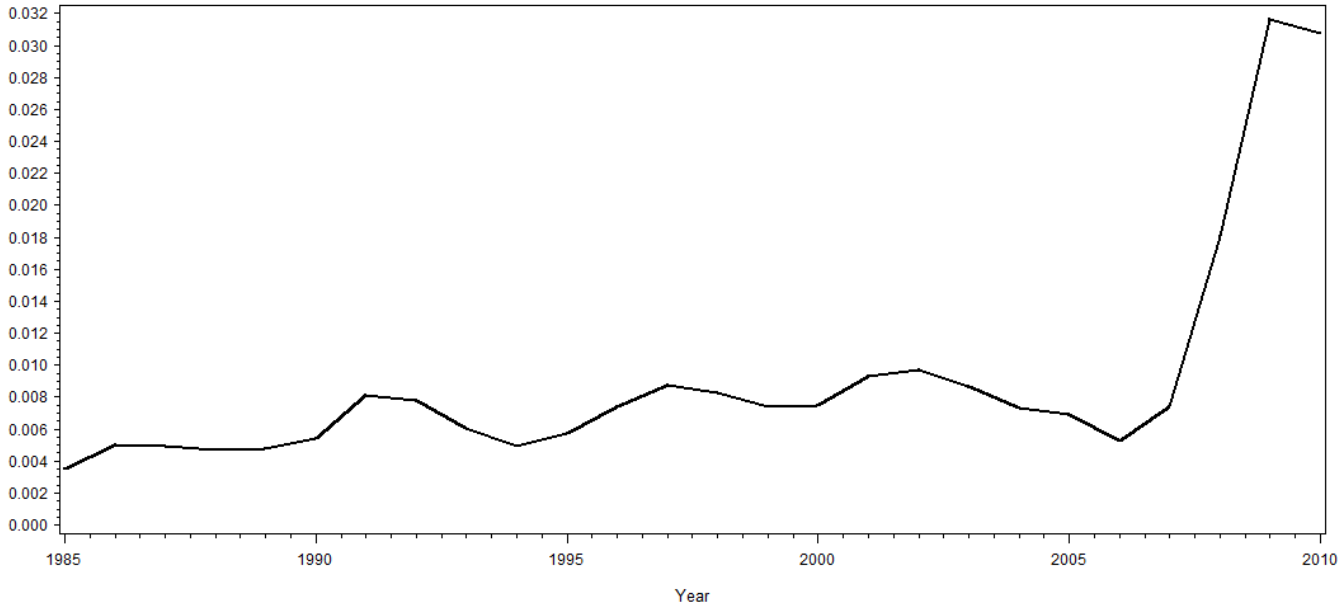


8 Defaults

An important difference between private and public sector debt dynamics is that for public debt, defaults are discrete events, occurring rarely (never for the United States, and almost never for other advanced countries in modern times.) By contrast a fraction of private debt is written off by lenders in every period. So the law of motion for private debt should include an additional term on the right-hand side for defaults. Unfortunately, we have not been able to find a good series for defaults covering the full period under consideration. The Flow of Funds does not record defaults; since net borrowing is computed from the change in debt stock, defaults appear in the FFA as reduced borrowing. We have followed this same approach for our main results. However, since 1985 the Federal Reserve has tracked the

fraction of loans in various categories written off by commercial banks. Figure 10 shows the fraction of loans to households written off.[19] Until 2007, the share of household debt written off annually was always less than one percent, but in 2009 and 2010 it was over 3 percent. (It has come down somewhat in 2011, but remains far above its pre-recession levels.) So while the failure to distinguish defaults from the primary balance probably does not affect the results for most of the postwar decades, it may be important for the most recent period.

Figure 10: Annual Share of Commercial Bank Loans to Households Written Off, 1985-2010



If we assume the default experience of commercial banks is not systematically different from other lenders for a given category of loan, we can estimate the total change in debt due to defaults in each period. So for the past 25 years, we can recalculate our results properly distinguishing a movement in household primary balances toward surplus from an an increase in defaults. Figure 11 and Table 5 show the results.

While the reduction of leverage attributable to defaults is small for the first two periods, it is substantial in the final one. Indeed, nearly half of the apparent primary surplus (6.7 percent average over 2007-2010) is actually due to write-downs rather than reduced expenditure. Since the 2 point increase in the default contribution almost exactly equals the two point average reduction in leverage over 2007-2010, it appears that if households had not increased their default relative to the previous periods, then even the enormous 8-point swing in household balances toward surplus would have been insufficient to reduce leverage at all.

[19]Note that this is the fraction of loan value charged off, not delinquencies. Charge-offs are conceptually the correct measure here.

Figure 11: Average Annual Change in Household Leverage and Components Accounting for Defaults, 1985-2010

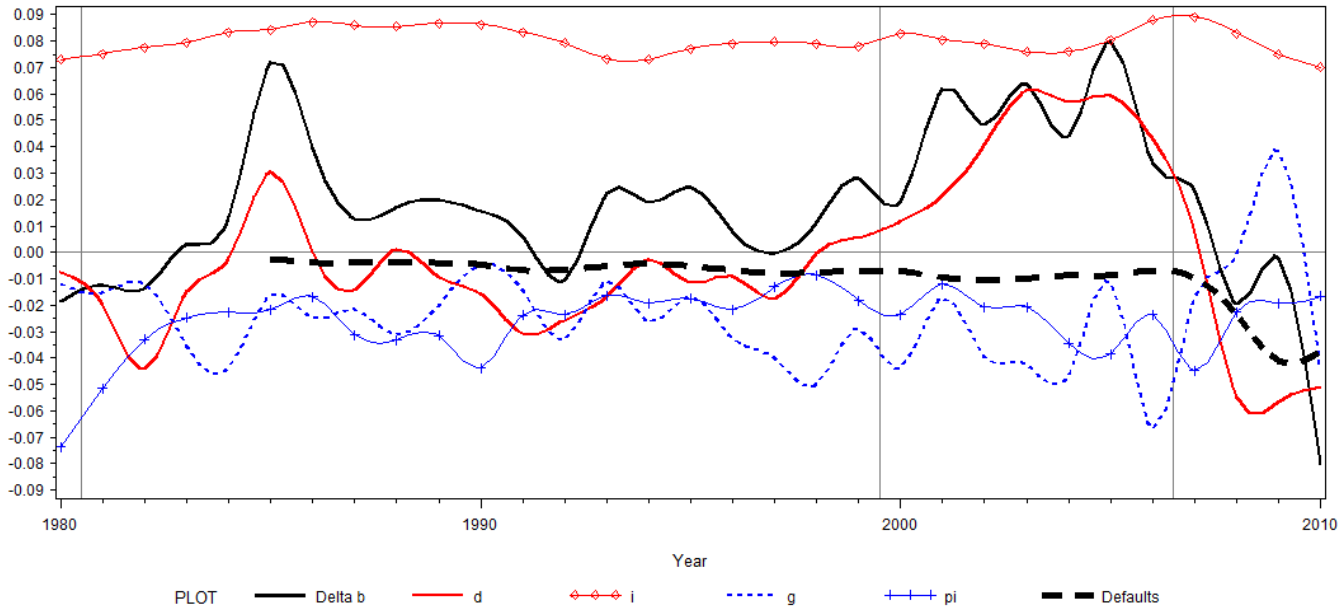


Table 5: Average Annual Change in Household Leverage and Components Accounting for Defaults

Period	Δb	d	Default	i	g	π
1981 to 1999	0.014	-0.010	-0.005	0.081	-0.025	-0.025
2000 to 2006	0.050	0.042	-0.009	0.080	-0.038	-0.025
2007 to 2010	-0.020	-0.039	-0.028	0.079	-0.006	-0.026

This makes it even less likely that changes in household saving behavior will be sufficient to reduce leverage in the future. Defaults, unlike sectoral surpluses, do not directly reduce aggregate demand. If the same deleveraging had been accomplished purely through increased surpluses, the fall in income in the Great Recession would have been substantially deeper than it was.

While it is unlikely that defaults played a major role in household debt dynamics prior to 2007[20], it has been argued that defaults were an important factor in the trajectory of household debt in the 1930s. (Olney, 1999) Unfortunately, we have not been able to produce

[20]They may have been more important for business debt. In particular, the widespread defaults on commercial mortgages in the late 1980s made a nontrivial contribution too the reduction in business leverage in that period. We will revisit this question in a future project examining business debt in a framework similar to that of this paper.

an estimate comparable to that in Table 5 for the fraction of household primary surpluses in the pre-World War II period that should be attributed to defaults. But for residential mortgages, at least, the contribution of default was probably less in the 1930s than in the most recent period. The Federal Housing Authority publishes data on the fraction of mortgages in foreclosure. In 1926, the earliest year available, 0.6 percent of nonfarm structures were in foreclosure. That proportion increased to an average of 1.2 percent over 1931-1935. Mortgage debt was equal to about 30 percent of household income in this period, so even if the fraction of debt charged off equaled the share of properties entering foreclosure, this would have reduced leverage by less than 0.4 points annually, or less than a tenth of the apparent primary surpluses. And this is almost certainly an overestimate. This does not mean that defaults were not important, since consumer debt may have been written down at higher rates. And default may have been more important for businesses than for households. In any case, for the most recent period default certainly is a large factor in deleveraging. Given its quantitative importance, it is noteworthy (though perhaps not surprising) that there has not been more attention by policymakers to making debt write-downs less costly.

9 Conclusion

Our main conclusion it is impossible to understand changes in leverage historically without considering Fisher dynamics. Insofar as policymakers are concerned specifically with the liability side of private balance sheets – and there is good reason to think that they should be – a decomposition similar to that used for public debt is the appropriate way to assess the relative contributions of new borrowing, interest rates, growth rates and inflation. Whenever there are existing stocks of debt, the latter three variables will affect leverage independently of any change in borrowing behavior, and the larger the existing stocks (and the slower and/or more costly are adjustments to expenditure in response to changes in interest and growth) the more important Fisher dynamics will be. Historically, a large fraction of changes in household leverage are due to Fisher effects rather than changes in household borrowing.

From a policy standpoint, the most important conclusion is that in an environment where leverage is already high and real interest rates significantly exceed real growth rates, deleveraging is almost impossible simply via reduced expenditure relative to income. The "headwind" from unfavorable debt dynamics is too large to be overcome by any realistic curtailment of expenditure. In the language of Figure 6, when the leverage nullcline is relatively flat, it is difficult or impossible to reach it by moving horizontally, a downward trajectory is required. Furthermore, unless borrowing is reduced via default or via transfer of assets from debtor units to creditor units, reduced borrowing by one sector requires increased borrowing by another sector or it will simply result in lower incomes and/or prices, potentially increasing leverage rather than decreasing it. Defaults, while they have been a very important contributor to post-2006 deleveraging and may continue to be for some time, are costly and disruptive to the financial system, while most debtor units' assets are illiquid and an increasing portion of household borrowing does not finance asset purchases at all. To the extent households have been able to run genuine primary surpluses (and not just reduce debt via default), it has therefore been only due to the large federal deficits and, to a lesser extent, the improvement in US net exports.

The conclusion this analysis leads to is that if reducing private leverage is a requirement of renewed growth, some combination of higher g, lower i and higher π will be necessary. While growing out of debt would be ideal, it would require a large increase in net exports, government spending and/or private investment, none of which seems plausible for the US at present.[21] So lower nominal interest rates and/or higher inflation is probably essential. How, or whether, monetary policy could deliver the latter is beyond the scope of this article; we content ourselves with pointing out the central importance of changes in inflation rates for episodes of (de)leveraging historically. As for the former, there are two basic approaches. One is to lower market interest rates through some combination of unconventional monetary policy, direct regulation of interest rates (or more broadly "financial repression"), and direct public lending to households, given that there seems to be a floor on the interest rates banks will accept. The other is to accelerate the convergence of effective rates to (lower) market rates by facilitating refinancing of existing debt, as has been proposed at various times for mortgages and student loans. Finally, defaults may remain an important part of the deleveraging process. A recent IMF staff report notes that for public sector debt, defaults are most likely to lead a long-term improvement in the fiscal position, and have generally occurred historically, in countries with small primary deficits, or primary surpluses. In such cases unsustainable debt growth is driven by only high effective interest rates; a one-time reduction in the debt stock can change an unsustainable path to a sustainable one, even if the interest rates on new borrowing rise as a result.[22] (Gottschalk, Forni, Cottarelli, and Mauro, 2010) A similar logic might apply to private sector debt. If so, some form of systematic debt forgiveness may be the logical, and eventually unavoidable, solution to the problem of household leverage.

[21] For some smaller countries, export-driven growth is a feasible route to deleveraging.

[22] As Gottschalk, Forni, Cottarelli, and Mauro (2010) note, if the goal is to stabilize the debt-income ratio, the amount by which default reduces the required adjustment in the primary balance is directly proportional to the interest rate-growth differential.

References

Abbas, S. M. A., N. Belhocine, A. ElGanainy, and M. Horton (2011): "Historical Patterns of Public Debt Evidence From a New Database," .

Aizenman, J., and N. Marion (2009): "Using Inflation to Erode the U.S. Public Debt," NBER Working Papers 15562, National Bureau of Economic Research, Inc.

Arestis, P., and M. Sawyer (2008): "The intertemporal budget constraint and the sustainability of budget deficits in J," *Creel and M. Sawyer (eds.) Current Thinking on Fiscal Policy*.

Benito, Andrew, W. M. Y. G., and F. Zampolli (2007): "The Role of Household Debt and Balance Sheets in the Monetary Transmission Mechanism," *Bank of England Quarterly Bulletin*, 47(1), 70–78.

Bernanke, B. (2000): *Essays on the great depression*. Princeton University Press.

Blanchard, Olivier J., C. J.-C. H. R., and N. Sartor (1991): "The Sustainability of Fiscal Policy: New Answers to an Old Question," Working Paper R1547, NBER.

Buiter, W. (1985): "A Guide to Public Sector Debt and Deficits," *Economic Policy*, 1(1), 13–79.

Cecchetti, Stephen G., M. M. S., and F. Zampolli (2010): ", The Future of Public Debt: Prospects and Implications," Discussion Paper 300, BIS.

Cooray, A. (2002): "The Fisher Effect: A Review of the Literature," Research Papers 0206, Macquarie University, Department of Economics.

Cynamon, B. Z., and S. M. Fazzari (2008): "Household Debt in the Consumer Age: Source of Growth,Risk of Collapse," *Capitalism and Society*, 3(2), 3.

Das, P. (2011): "Decomposition of Debt-GDP Ratio for United Kingdom: 1984-2009," .

Dynan, K. E., and D. L. Kohn (2007): "The rise in U.S. household indebtedness: causes and consequences," Finance and Economics Discussion Series 2007-37, Board of Governors of the Federal Reserve System (U.S.).

Eggertson, G. B., and P. Krugman (2010): "Debt, Deleveraging, and the Liquidity Trap: A Fisher-Minsky-Koo approach," .

Eichengreen, B. (2008): *Globalizing Capital: A History of the International Monetary System (Second Edition)*. Princeton University Press.

Escolano, J. (2010): "A Practical Guide to Public Debt Dynamics, Fiscal Sustainability, and Cyclical Adjustment of Budgetary Aggregates," Discussion paper, International Monetary Fund.

Fisher, I. (1933): "The Debt-Deflation Theory of Great Depressions," *Econometrica*, 1(4), pp. 337–357.

Frieden, J. (2008): "Will Global Capitalism Fall Again," *Brueghel Lecture Series*.

Giannitsarou, C., and A. Scott (2008): "Inflation Implications of Rising Government Debt," in *NBER International Seminar on Macroeconomics 2006*, NBER Chapters, pp. 393–442. National Bureau of Economic Research, Inc.

Goldsmith, R. (1955): *A Study of Saving in the United States: Nature and deprivation of annual estimates of saving, 1897 to 1949*, A Study of Saving in the United States. Princeton University Press.

Gottschalk, J., L. Forni, C. Cottarelli, and P. Mauro (2010): "Default in Today's Advanced Economies: Unnecessary, Undesirable, and Unlikely," SPN 10/12, IMF.

Guererri, V., and G. Lorenzoni (2011): "Credit Crises, Precautionary Savings and th Liquidity Trap," Working paper, University of Chicago Booth School.

Hall, G. J., and T. J. Sargent (2011): "Interest Rate Risk and Other Determinants of Post-WWII US Government Debt/GDP Dynamics," *American Economic Journal: Macroeconomics*, 3(3), 192–214.

Hall, R. E. (2011a): "The High Sensitivity of Economic Activity to Financial Frictions*," *The Economic Journal*, 121(552), 351–378.

——— (2011b): "The Long Slump," *American Economic Review*, 101(2), 431–69.

Koo, R. (2008): *The Holy Grail of Macroeconomics: Lessons from Japan's Great Recession*. John Wiley & Sons.

Mian, A., K. Rao, and A. Sufi (2011): "What Explains High Unemployment?The Aggregate Demand Channel," Working paper, University of Chicago Booth School.

Mishkin, F. (1978): "The Household Balance Sheet and the Great Depression," *Journal of Economic History*, 38(4), 918–937.

Olney, M. L. (1999): "Avoiding Default: The Role Of Credit In The Consumption Collapse Of 1930," *The Quarterly Journal of Economics*, 114(1), 319–335.

Philippon, T., and V. Midrigan (2011): "Household Leverage and the Recession," Working Paper 16965, National Bureau of Economic Research.

Rangarajan, C., and D. K. Srivastava (2003): "Dynamics of Debt Accumulation in India: Impact of Primary Deficit, Growth and Interest Rate," *Economic and Political Weekly*, 38(46), 4851–4858.

Reinhart, C. M., and K. S. Rogoff (2010): "Growth in a Time of Debt," *American Economic Review*, 100(2), 573–78.

Reinhart, C. M., and M. B. Sbrancia (2011): "The Liquidation of Government Debt," NBER Working Papers 16893, National Bureau of Economic Research, Inc.

Taylor, L. (2011): *Maynard's Revenge: The Collapse of Free Market Macroeconomics*. Harvard University Press.

Tirole, J. (2011): "Illiquidity and All Its Friends," *Journal of Economic Literature*, 49(2), 287–325.