NBER WORKING PAPER SERIES

A DEPRESSING SCENARIO:
MORTGAGE DEBT BECOMES UNEMPLOYMENT INSURANCE

Casey B. Mulligan

Working Paper 14514
http://www.nber.org/papers/w14514

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
November 2008

I appreciate the comments and patience of many University of Chicago students who experienced an even more burdensome exposition of these ideas. I will provide updates on this matter on my blog www.panic2008.net. The views expressed herein are those of the author(s) and do not necessarily reflect the views of the National Bureau of Economic Research.

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JEL No. E24,H21,J22

ABSTRACT

When asset values fall, the owners of collateralized loans are not in an enviable position. Nonetheless, they possess a kind of monopoly power over their borrowers that they do not possess when borrowers are solvent. Lenders maximize profits by price discriminating, but create deadweight costs in the process. From the perspective of the aggregate labor market, it is as if lenders were levying their own labor income tax, on top of the taxes already levied by public treasuries. Governments have an incentive to regulate this price discrimination, repudiate part of the private debts, cut their own tax rates, or acquire the debt themselves. These conditions may describe both the 1930s and economic events today.

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By some measures, housing prices have fallen by a third since 2006 and are forecast to fall further. As a result, many home mortgage amounts significantly exceed the value of the collateral – perhaps by an aggregate amount as much as $1 trillion. The housing turmoil has wealth effects and the price crash curtails residential construction while reducing investment goods prices and encouraging nonresidential investment (Mulligan and Threinen, 2008). But the settlement of the mortgage claims themselves may have further effects on the economy; investigating that settlement is the purpose of this paper.

Debt obligations can sometimes exceed a borrower's capacity to pay, in which case he may not have an incentive to produce income that can be seized by the lender. Debt forgiveness can make both borrower and lender better off. This problem of debt overhang has been widely recognized in the context of sovereign debt (Sachs, 1990), and has been applied to consumer debt as well. I extend the standard collateralized debt overhang model to include multiple and heterogeneous borrowers, and then work out some aggregate implications for the labor market.

Debt overhang has something like a social multiplier. When collateral is valuable, only a few borrowers will not pay their loans in full. Lenders can restructure debt for those few without much consequence for its other borrowers. As collateral values fall, the worst-off borrowers cannot be forgiven as easily, because that forgiveness provides bad incentives for the others. As collateral values fall in the wider economy, the worst off borrowers have increasingly bad incentives to earn income. Sachs (1990, p. 22) discusses a related problem of "precedent" in the country context – that a bank may negotiate with a country with an eye toward future negotiations with other countries. In my model, a bank negotiates with an individual borrower with an eye toward its effect on negotiations with other borrowers, but the connections among borrowers are merely the incentive compatibility constraints that are like those faced by public treasuries.

From an aggregate point of view, low collateral values create high tax rates on labor income, but these taxes do not go to the Treasury – they go to the lenders. Indeed, the Treasury loses tax revenue from lender efforts to recoup some of their principal. That is, lender and Treasury taxation interact with each other – lenders' incentive to tax rises with the Treasury's tax rate.

Fisher (1933), Mishkin (1978), and Bernanke and Gertler (1983), Kroszner (1999) and others have noted that household balance sheets seem to be correlated with the business cycle and have offered theoretical interpretations of this correlation. However, their models operate on an investment or intertemporal margin, whereas my model operates on the consumption-leisure margin. In my approach, credit markets could be functioning well in that new loans permit intertemporal margin rates of substitution to equal the marginal product of capital; employment suffers merely because current income is a criterion for the forgiveness of prior debts. The problem is the settlement of old loans, not the intermediation of new ones.

Section I begins with a simple model of debt overhang and lender profit maximizing debt forgiveness, in which borrowers differ in their willingness to repay and that willingness is only imperfectly observed by the lender. As collateral values fall, a larger fraction of borrowers consider paying less than the full amount and the lender optimally discriminates among them according to income, employment status, and other indicators of the willingness to pay. This discriminating debt forgiveness distorts borrower behavior much like a labor income tax or an unemployment insurance program would.

Section II shows that prior business cycles – especially the Great Depression – have exhibited labor supply distortions that have usually been interpreted as "mysterious" in the sense that they look like they could have been created by counter-cyclical taxes, except that actual taxes paid to the public treasury were not so counter-cyclical. I offer a new interpretation of those mysterious distortions – some of them may be the distortions created by private debt collection.

Section III considers the interactions of the mortgage debt forgiveness with labor income taxes paid to the public treasury. Even a tax (to the public treasury) paid by a minority of persons can distort the labor supply of persons not paying the tax because of its impact on lenders' debt collection strategies. Section IV concludes.

I. A Simple Model of Debt Forgiveness and Labor Market Distortions

I.A. Debt Forgiveness as Mechanism Design

Each individual of a group of *ex ante* identical borrowers obtains a collateralized loan. Initially, the value of the collateral exceeds the amount lent. Some time after the beginning of the loan, but before its final payment, the borrowers experience a common change in their collateral value. Of particular interest is the case in which collateral values fall: the each loan now has par value that exceeds the value of collateral by b. In addition, each borrower has a received an idiosyncratic shock to his privately observed labor productivity: half have productivity w_L and the other half have productivity $w_H > w_L$. n_L and n_H denote the work effort by the low and high types, respectively. Each individual produces the product of his effort and his productivity. Each individual has a utility function $u(c,n)$ defined over consumption c and work effort n. Consumption and leisure are assumed to be normal goods in the sense that c rises and n falls when utility rises for a fixed marginal rate of substitution.

Borrowers have the option of declaring bankruptcy or inviting foreclosure. After a borrower has exercised this option, he works the efficient amount and looses a lump sum $\bar{T}(w)$ that increases with his true productivity. The lump sum loss can be interpreted as time and resources spent on bankruptcy proceedings, psychic costs, or lost access to credit.

There is a positive repayment amount, but less than b and $\bar{T}(w)$ that is mutually preferred to foreclosure by both the borrower and the lender. If the lender knew the borrower's type, he could insist on a payment just a penny less than $\bar{T}(w)$ – backed up with the threat of foreclosure. The borrower would make the payment because it is less than foreclosure costs him. However, I assume that borrower type w is not observed by the creditor.

I assume that borrowers' various creditors have a clear seniority, so that creditors do not compete with each other to obtain repayment. Thus, once the collateral value has fallen below loan par, the senior creditor has a kind of monopoly power vis-à-vis his borrowers. The creditor may not succeed in obtaining full payment for the loan, but he still seeks to maximize the total repayments received. Denoting as T_L and T_H the repayments by the low and high types, respectively, that maximum can be described by:

$$\max_{T_L, T_H, n_L, n_H} \quad T_L + T_H \qquad \text{s.t.}$$

$$u(w_H n_H - T_H, n_H) \geq \max\left\{u(w_L n_L - T_L, w_L n_L / w_H), \bar{u}_H\right\}$$

$$u(w_L n_L - T_L, n_L) \geq \max\left\{u(w_H n_H - T_H, w_H n_H / w_L), \bar{u}_L\right\}$$

$$T_L, T_H \leq b$$

$$\bar{u}_i \equiv \max_{n_i} u(w_i n_i - \bar{T}_i, n_i) \quad \text{given } \bar{T}_i$$

$$\bar{T}_i \equiv \alpha + \beta w_i\,, \quad i = L, H$$

where α and β are constants.

Ignoring for the moment the second term in each of the braces {}, the first constraint requires that the high type prefer the repayment offered to, and income required by, self-declared high types to those offered to self-declared low types. The second constraint requires that the low type prefer what is offered low types. These two incentive compatibility constraints are just as those specified in the Mirrlees (1971) optimal tax problem. As in that case, weak conditions on the utility function ensure that the second incentive compatibility constraint does not bind.

The second term in each of the braces {} creates a "participation constraint." That is, the creditor must offer to forgive enough of the debt that the borrower prefers to repay the rest rather than declaring bankruptcy or inviting foreclosure. As indicated, the outside option depends on the cost of foreclosure $\bar{T}(w)$. The last pair of constraints says that the lender cannot collect more than the par value of the loan.

The full information solution (that is, the solution without incentive constraints) has both types working the efficient amount and paying the minimum of b and the foreclosure cost. If that cost did not vary by type, then the efficient solution would be incentive compatible because the payment is independent of the labor supply decision.

However, unemployed or otherwise unproductive persons may have less to lose from bankruptcy, in which case the efficient solution may not be incentive compatible. That is, a productive person may benefit by reducing his income and receiving the more generous loan forgiveness given to unproductive persons. In terms of the parameters of the model above, this means that $\beta > 0$. In order to characterize solutions to this version of the problem, and to apply it to recent events, it is helpful to consider comparative statics with respect to the parameter *b* – the amount by which the loan's par value exceeds the value of collateral – ranging from 0 to values large enough that both types consider foreclosure.

I.B. Zone I: Full Repayment

If *b* is less than $\bar{T}(w_L)$, then the creditor can obtain full repayment from both types by insisting on it, with the threat of foreclosing if a borrower fails to pay. All borrowers will repay because their foreclosure cost is greater than the amount owed. Borrowers cannot affect the amount of their payment by adjusting their work effort, so they work the efficient amount. The lender is unaffected by a marginal change in collateral.

Figures 1 and 2 illustrate some of the results. Each Figure has *b* on the horizontal axis. Figure 1's vertical axis measures outcomes for the low type: implicit marginal tax rate (that is, the percentage difference between marginal rate of substitution and productivity), labor supply, repayment, and write-offs. Figure 2 displays the outcomes for the high type. Both types have a zero marginal tax in Zone I; they work the efficient amount. For the purposes of illustration, leisure is assumed to be a normal good so that work effort rises with *b* in Zone I.[2]

[2] The wealth effects are best interpreted in relative terms (high type versus low type), because *T* may be offset by other items on borrowers' balance sheets. For example, borrowers may also be bank shareholders or anticipate purchasing additional collateral in the future (see Buiter, 2008, and Mulligan, 2008, for more on this issue).

I.C. Zone II: Efficient Means-Tested Forgiveness

For b slightly larger than $\bar{T}(w_L)$, the creditor does not ask for full repayment from the low type, because otherwise the low type would choose foreclosure. The low type just pays $\bar{T}(w_L)$. The high type still repays in full, because from his perspective it is not worth cutting labor supply so much as to earn $w_L n_L$, merely in order to be granted the forgiveness b - $\bar{T}(w_L)$. The forgiveness b - $\bar{T}(w_L)$ is small by definition of the Zone II, but the required change in labor supply to obtain the forgiveness is discrete. In this Zone, the low type is unaffected by b. The high type's repayment continues to be b.

Outcomes in this zone can be implemented with a means test. Namely debt is forgiven in the amount b - $\bar{T}(w_L)$ for anyone who earns less than or equal to $w_L n_L$, where n_L is the efficient labor for a low type making a repayment in the amount $\bar{T}(w_L)$. High types do not ask for the forgiveness because they prefer not to pass the means test. The low type does not have to change his behavior in order to pass the means test.[3]

Low type forgiveness increases one-for-one with b in Zone II. A reduction in the aggregate value of collateral does not affect the low type, but is rather split between the lender (who pays for the low type's loss) and the high type (who pays his own). One empirical test of whether the economy is in Zone I or some other Zone is whether lenders loan value depends on the value of collateral. Given the massive loan write offs by lenders in 2007 and 2008, Zone I will not be an adequate description of today's conditions.

I.D. Zone III: Rising Tax Distortion

Suppose for the moment that $\bar{T}(w_H)$ were enough greater than $\bar{T}(w_L)$ that the high type is willing to cut his labor supply to earn $w_L n_L$ in order to be forgiven $\bar{T}(w_H) - \bar{T}(w_L)$. Then there is some $\hat{b} \in \left(\bar{T}(w_L), \bar{T}(w_H)\right)$ that makes the high type indifferent between passing the means test and repaying $\hat{b}$ in full.[4] For $b \in \left(\hat{b}, \bar{T}(w_H)\right)$,

[3] For more exposition of the implementation of Mirrlees-optimal taxes with means tests, see Salanie (2003).
[4] $\hat{b}$ is defined implicitly by $u(w_H n_H - \hat{b}, n_H) \equiv u(w_L n_L - \bar{T}(w_L), w_L n_L / w_H)$, where n_L and n_H denote the efficient labor for the low and high type, respectively.

the lender has to decide whether he wants to also forgive the high type some amount or strengthen the means test (that is, reduce the income threshold beyond which full payment is demanded) so that the high type can still be induced to pay in full. I refer to $b \in \left(\hat{b}, \overline{T}(w_H)\right)$ as Zone III.

In Zone III, the three potentially binding constraints are (i) the high type's incentive constraint, (ii) the low type's participation constraint, and (iii) the constraint that the high type cannot be forced to pay more than he owes. In this case, the Lagrangian for the debt collection problem is:

$$
\begin{gathered}
L = T_L + T_H \\
+\lambda_H \left[u(w_H n_H - T_H, n_H) - u(w_L n_L - T_L, w_L n_L / w_H) \right] \\
+\lambda_L \left[u(w_L n_L - T_L, n_L) - \overline{u}_L \right] + \lambda_b \left[b - T_H \right]
\end{gathered}
$$

where λ_H, λ_L, and λ_b are Lagrange multipliers. Under the usual assumption that the high type's marginal utility of consumption is lower when he earns $w_H n_H$ rather than $w_L n_L$, a revenue neutral reduction in the high type's payment will tighten the incentive constraint and is therefore not optimal; $T_H = b$.

Clearly, the first order condition for high type effort equates the high type's marginal rate of substitution to his productivity; optimal tax rate is zero at the top as in Mirrlees (1971). Thus, in order to make the high type willing to work the efficient amount, the creditor optimally strengthens the means test by reducing n_L below his efficient amount.[5] Because the low type has the option to pay nothing and pay the foreclosure cost, strengthening the means test requires reducing the payment owed by the low type.

One measure of the strength of the means test is the "marginal tax rate" or the percentage by which the low type's marginal rate of substitution is below his productivity. In Zone II, the low type's marginal tax rate is zero. In Zone III, the low type's marginal tax rate is positive and, assuming that the wealth effect of b on the high type is not too strong, increases with b. Labor supply falls with b because utility is

[5] In terms of the lagrangian, low type effort enters both low type utility and the incentive constraint. If low type utility were the only consideration, low type effort would be efficient. Because low type effort also tightens the incentive constraint, optimal low type effort is less than the efficient amount.

constant (recall the participation constraint) and the marginal rate of substitution is falling.

Low type debt forgiveness increases even faster than *b*. One empirical test of whether the economy is in Zone III (or IV) rather than Zone II is the degree to which reductions in collateral value affect the market value of loans. If the market value of loans falls by more than the value of collateral (or more than the value of collateral times the fraction of loans made to persons not paying in full), then Zone III (or IV) better describes the situation. This is a basic implication of the model: the amount of departure between combined borrower-lender value and the value of collateral indicates the amount of inefficiency.

I.E. Zone IV: Lenders Own All of the Collateral at the Margin

The lender cannot ask the high type to pay back more than $\bar{T}(w_H)$, so *b* greater than this amount is written off for both low and high types. Borrower behavior and marginal tax rates are the same throughout Zone IV as at the border with Zone III. The lender owns all of the collateral at the margin; aggregate loan value varies one-for-one with aggregate collateral value. With a caveat mentioned below. Zone IV has a labor supply distortion for the low type, but does not grow with *b* as it did in Zone III.

Zone III might not exist if $\bar{T}(w_H)$ is too close to $\bar{T}(w_L)$. If so, there is no labor supply distortion for any *b*, and only a small range of *b* in which the low type is forgiven but the high type is not.

I.F. Expectations-Augmented Philips Curve and the Consumption-Leisure Ratio

Obviously, lenders consider the expected future value of collateral when they make a loan and intend the amount loaned would, with significant probability, be less than the value of collateral. If collateral values are expected to rise, more can be lent. In other words, the gap between loan amount and collateral values *b* is positive only sometimes – when collateral values are significantly less than expected. Let μ denote the amount by which the collateral value is expected to exceed the amount lent. At the time of the initial loan, the expected *b* is -μ. The shock -μ-*b* is the "unexpected collateral value inflation:" the amount by which collateral values are surprisingly high. Because the marginal tax rate is a function of *b*, the marginal tax rate is a function of the shock $-\mu-b$ to collateral values. Figure 3 graphs the marginal tax rate as a function unexpected collateral inflation. The marginal tax rate is zero over a wide range of shocks, and is positive for the most negative shocks.

Figure 3 is a kind of expectations-augmented Philips curve. It has unexpected collateral value inflation on one axis. For fixed *w* and *c*, the vertical axis is monotonically increasing in leisure. Interestingly, this expectations-augmented Philips curve says that, for most outcomes, unexpected inflation does not affect leisure. Moreover, even for the more negative shocks, it is not money growth or consumer price inflation *per se* that reduces leisure, but rather collateral value inflation.

Since Barro and King (1984), much of macroeconomics research has used something like the consumption-leisure ratio to study business cycles in the labor market, rather than a Philips curve. My empirical work follows the Barro and King tradition. Let $MRS(c,n)$ denote the marginal rate of substitution function implied by the utility function $u(c,n)$. Because consumption and leisure are normal goods, *MRS* rises with *c* and *n*. It follows that *c* and *n* move in the same direction when the marginal tax rate changes for a given productivity *w* (Barro and King, 1984). Moreover, with a particular functional form for *MRS*, the effect of the marginal tax rate on the relationship between *c*, *n*, and *w* can be quantified. For the purposes of illustration, I use the marginal rate of substitution function $\gamma c/(1-n)$, where *c* is aggregate real consumption expenditure per adult, *n* is total work hours per adult per 16 hour day,[6] and $\gamma > 0$ is a constant. With this function, the ratio $c/[w(1-n)]$ of aggregate consumption expenditure to leisure expenditure is proportional to one minus the marginal tax rate, where the constant of proportionality is γ (the budget share from the utility function).

When collateral values fall enough, *b* exceeds $\hat{b}$ and the marginal tax rate for the low type becomes positive and rising with *b*. The marginal tax rate for the high type is zero, so the average marginal tax rate becomes positive and rises with *b* when *b* exceeds $\hat{b}$. That is, when collateral values fall enough, they will reduce the ratio $c/[w(1-n)]$ of aggregate consumption expenditure to leisure expenditure.

[6] For sensitivity analysis with respect to the functional form and measurement of the aggregate time series, see Mulligan (2002).

II. Aggregate Evidence on Labor Market Distortions over Time

It is well known that the ratio of aggregate consumption expenditure to leisure expenditure is pro-cyclical. Hall (1997) describes the fluctuations in the ratio as preference shifts.[7] Gali, Gertler, and Lopez-Salido (2003) interpret the fluctuations as evidence of imperfections in the labor market such as nominal rigidities. Mulligan (2002, 2005) attempts, with only a little success, to attribute the fluctuations to labor union distortions and public policy distortions such as taxes and regulation.

II.A. Labor Market Distortions during the Great Depression

The Great Depression and World War II are two of the most dramatic instances of changes in the consumption-leisure expenditure ratio, and the difficulty with explaining those changes. In order to consider changes in the ratio in units of marginal tax rates, Figure 4's solid series graphs one minus γ (the budget share from the utility function) times the consumption-leisure expenditure ratio, with some adjustments made during the war years to reflect output mis-measurement and the involuntary nature of wartime military labor supply (see Mulligan, 2005, p. 910). The solid series was high during the Depression and low during World War II.

If preferences were stable and labor income taxes were the only distortion on the consumption-leisure margin, Figure 4's series would follow the marginal labor income tax rate. However, in fact labor income taxes levied by the U.S. Treasury actually changed in the *other direction*, as shown by Figure 4's dashed series. For example, there was no payroll tax for much of the 1930s and hardly anyone paid federal individual income tax until World War II. The largest increases in the marginal individual income tax rate in U.S. history occurred at the beginning of World War II, and some of the largest cuts occurred at the end of the war.

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[7] Hall's characterization is not always taken literally – rather, that the lesson from Hall is that *MRS* = productivity does not adequately model the business cycle.

II.B. Household Debt during the Great Depression

So far no one has explained why the consumption-leisure ratio – an aggregate indicator of the marginal rate of substitution – would depart from the productivity of labor so much in the 1930s, and then depart again in the other direction in the 1940s. Cole and Ohanian (2004) attribute some of the persistence of the Great Depression's low consumption-leisure expenditure ratio to an increase in union power and labor market regulation.[8] Based the weak assumption that Cole and Ohanian's story only explains *part* of what happened during the Great Depression, my purpose here is to suggest the possibility that debt forgiveness may explain another part.

Bernanke (1983, p. 260) describes some of the key debt market events in the 1930s:

> "Given that debt contracts were written in nominal terms, the protracted fall in prices and money incomes greatly increased debt burdens. According to Evans Clark (1933), the ratio of debt service to national income went from 9 percent in 1939 to 19.8 percent in 1932-33. … about half of all residential properties were mortgaged at the beginning of the Great Depression …. At the beginning of 1933, owners of 45 percent of all U.S. farms, holding 52 percent of the value of farm mortgage debt, were delinquent in payments."

Thus, in the 1930s many borrowers owed more on their loans than their collateral was worth. More research is needed to determine how often 1930s creditors means-tested their debt forgiveness. To the degree that it occurred, work incentives were diluted.

III. Trickle Down and Up: Interactions Between Public and Private Taxation

The highest marginal income tax rate increased dramatically in 1932. Depression-era policies, such as the creation of the National Labor Relations Board, strengthened unions (Cole and Ohanian, 2007) and resulted in quite a large "union wage effect" (Lewis, 1963). Although income taxes and monopoly unionism can create distortions on the consumption-leisure margin, some economists have been skeptical of

[8] This may be part of the story, although Mulligan (2005) points out that the vast majority of 1930s workers were not union members and not covered by the suspect regulations. Moreover, union density (the fraction of workers who are union members) increased dramatically during World War II, which in theory would exacerbate the Great Depression ratio or at least allow it to be constant in the face of a reduced distortion per union member.

the quantitative importance of these particular examples because most people paid no income tax during the 1930s (Mulligan, 1998; also notice the dashed line in Figure 4 above is near zero during those years) and most workers were not union members during the 1930s (Mulligan, 2005). However, the debt overhang model implies that the consumption-leisure distortions created by debt collection depend on outside conditions, and therefore on the amount and type of redistribution done by the public sector.

To see this, consider Zones III and IV in which the equilibrium is defined by the incentive constraint for the high type and the participation constraint for the low type:

$$v_H(b) = u(c_L, w_L n_L / w_H)$$
$$u(c_L, n_L) \geq \bar{u}_L$$

where $v_H(b)$ is the high type utility when he pays back b. c_L denotes consumption for the low type. Zone IV is defined by $b = \bar{T}(w_H)$.

Now consider a redistributive public policy that raises $\bar{u}_L$ and lowers v_H, but does not change the ratio w_L/w_H (equivalently, would not affect the proportional change in work effort required for the high type to mimic the low type's labor product). This comparative static can represent, for example, a flat-rate labor income tax used to finance a lump sum transfer. Because the high type earns more than average, this tax and transfer would lower v_H, even though it might also reduce the amount of resources the high type might expect to loose if he invited foreclosure.

Under weak conditions on the utility function, both the increase in $\bar{u}_L$ and the reduction in v_H serve to raise the marginal tax rate on the low type. Debt collectors must respond to public sector redistribution from high type to low type by strengthening the means test, because the high types are more tempted to pass a given means test when the public sector is redistributing.

IV. Conclusions

When asset values fall, the owners of collateralized loans are not in an enviable position. Nonetheless, they possess a kind of monopoly power over their borrowers that they do not possess when borrowers are solvent. Lenders maximize profits by price discriminating, but create deadweight costs in the process. One way debt collectors discriminate is to ask borrowers with more income to pay more. This creates an expectations-augmented Philips curve: over a wide range, surprises to collateral value have no effect (via mortgage forgiveness) on work incentives, but surprises that are bad enough reduce the equilibrium incentive to work and thereby increase the amount of nonemployment.

Although there are many differences between today and the 1930s, one common element is the pervasiveness of mortgage obligations that exceed the value of collateral. I am not aware of market-wide measures of either modern or 1930s bank policies for forgiving loans. However, during the time of writing this paper, Citigroup announced a plan for reducing borrower payment obligations:

"[Citigroup] added that it recently streamlined its loan modification program to rework delinquent loans. This revamped program uses a simplified formula to figure out an affordable payment as a *percentage of the borrower's gross income*. It then reduces the monthly payment to that amount by either reducing interest rates on the loan, extending the loan's term or forgiveness of principal." (Mamudi 2008, emphasis added).

I am not aware of the percentage used by Citigroup, or the frequency over which it measures borrower's gross income for this purpose. For the sake of illustration, suppose that the percentage were 25.[9] An action taken by a borrower to increase his income would increase his payment obligation by 25 percent of the income increment.[10] If an affordable payment were reevaluated monthly, this would amount to a 25 percent

[9] As a benchmark, note that FHA guidelines recommend that monthly housing payments (mortgage plus taxes and related payments) be less than 29% of monthly gross income and that total housing payments plus total debt payments be less than 41% of gross income (http://www.fha.com/debt_to_income_ratios.cfm).

[10] Colleges and universities also ask their customers (i.e., students) to pay tuition according to their family income. It is well known that the process of collecting college tuition according to willingness to pay creates work disincentives. Dick and Edlin (1997) estimated that college tuitions with annual list prices in the range $5,000 - $10,000 created marginal income tax rates in the range of 2 – 16 percent. As ratios to potential income, these amounts seem small compared to the amounts mortgage lenders had to collect in the 1930s and have to collect today. Thus, it seems quite possible that, in unusual circumstances like those, debt collection could create marginal tax rates in the tens of percentage points.

marginal tax rate over the life of the loan. If, say, 2009 income were used to calculate an affordable payment for the years 2010-14 and the interest rate were 6 percent per year, then the marginal tax rate would be *108 percent* for 2009 (4.3 times the percentage from the formula) and zero thereafter.

In order to calculate an economy-wide average marginal tax rate at a point in time from mortgage forgiveness, the marginal tax rate for those being forgiven would have to be multiplied by the fraction of persons who are currently earning income to be used in the forgiveness formula. I do not have the data to make such a calculation, but it seems that the fractions could be large enough to produce average marginal tax rates on the order of those shown in Figure 4 for the Great Depression.

My model features labor income as the only variable indicating willingness to repay a mortgage whose amount exceeds the value of collateral. It is straightforward to modify the model include other such variables, such as asset holdings or family structure. Obviously, when asset holdings or family structure enter the creditor's forgiveness formula, borrowers will have an incentive to seek the levels of assets and to seek the family structures that offer more forgiveness rather than less. Moreover, given the long time dimension of loan terms and the possibility that mortgage loan forgiveness will not be assumable (does not stay with a home when the borrower changes residence), mortgage debt forgiveness may cause people to remain at a given residence longer than is efficient. Yet another extension of this analysis is to property tax forgiveness.

Federal and state treasuries tax labor income and subsidize unemployment. Thus, while forgiveness helps borrowers, creditors' decisions to link forgiveness to borrower income and employment status harm those treasuries. Governments have an incentive to alleviate this practice, perhaps by regulating it (governments sometimes prohibit forms of price discrimination), repudiating some of the debt, cutting their own taxes, or acquiring the debt in the marketplace and administering forgiveness themselves in a way that accounts for the spillovers onto public budgets.

Figure 1. Outcomes for the Low Type

The Figure displays low type work effort (n_L), repayment (T_L), debt forgiveness (b-T_L), and marginal tax rate (MTR_L) as a function of the amount owed (b) in excess of collateral value

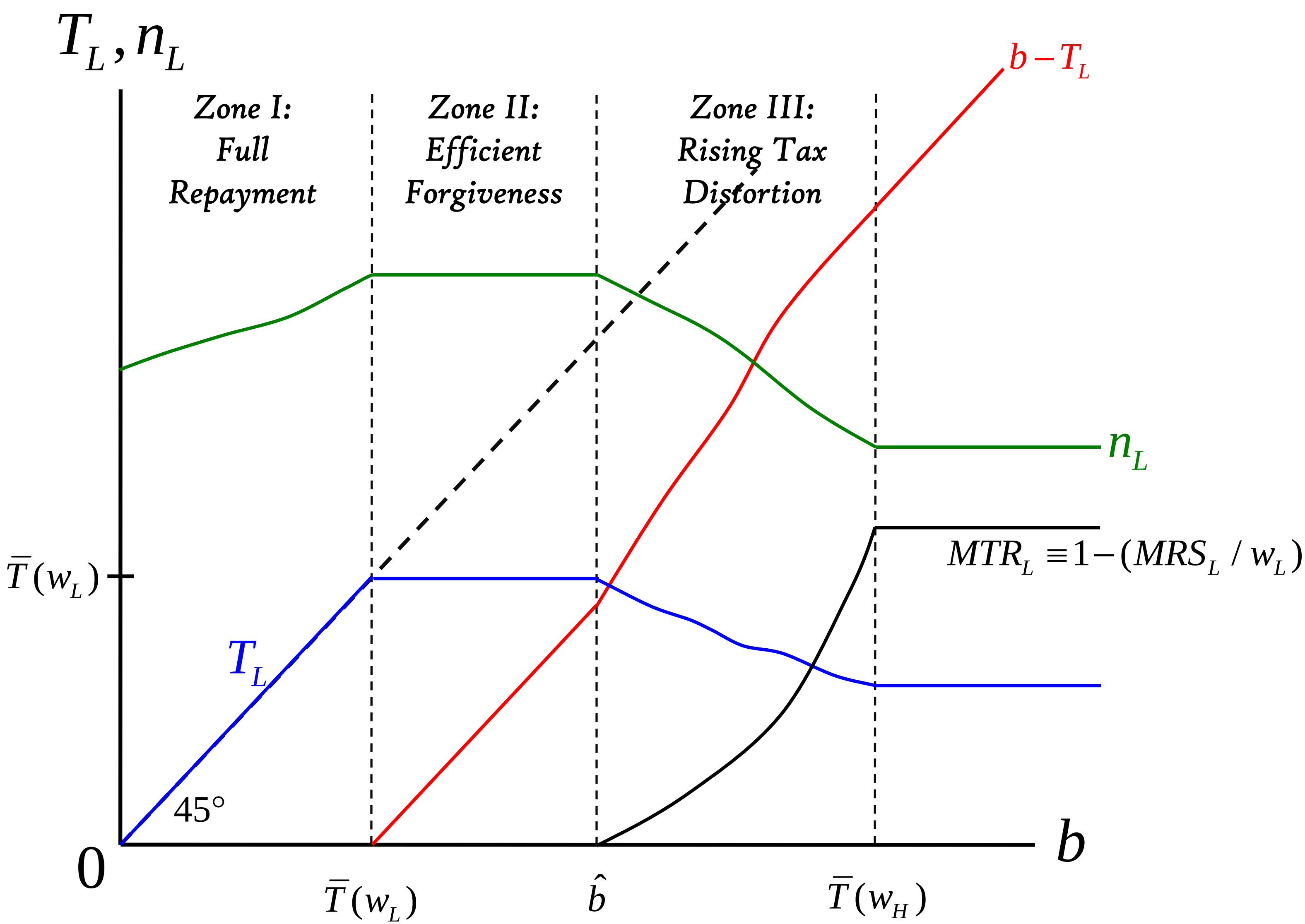


Figure 2. Outcomes for the High Type

The Figure displays high type work effort (n_H), repayment ($\mathrm{T_H}$), debt forgiveness (b-T_H), and marginal tax rate (MTR_H) as a function of the amount owed (b) in excess of collateral value

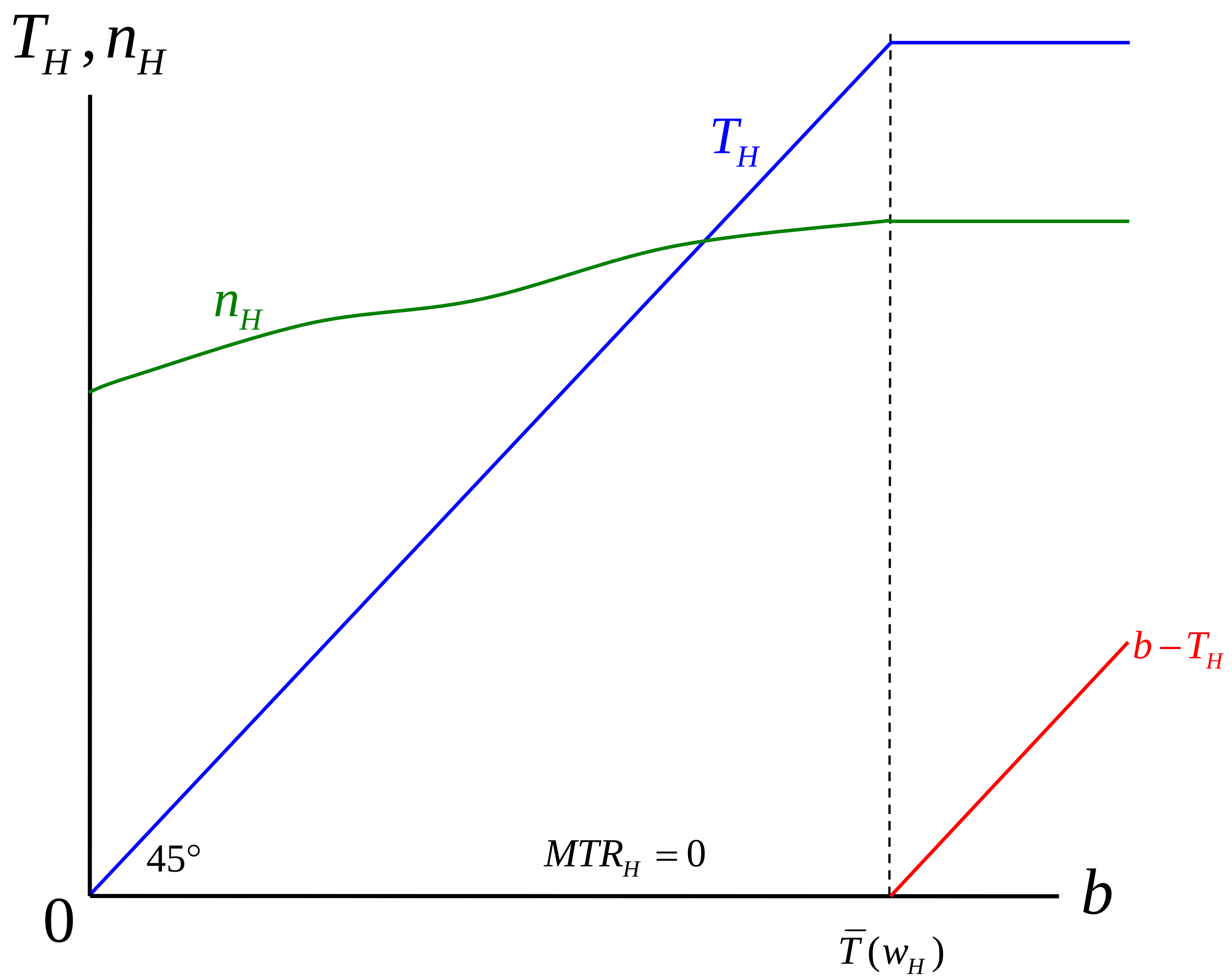


Figure 3. An Expectations-Augmented Philips Curve

The Figure displays the marginal tax rate (MTR_L) as a function of the unanticipated change in the value of collateral ($-\mu-b$)

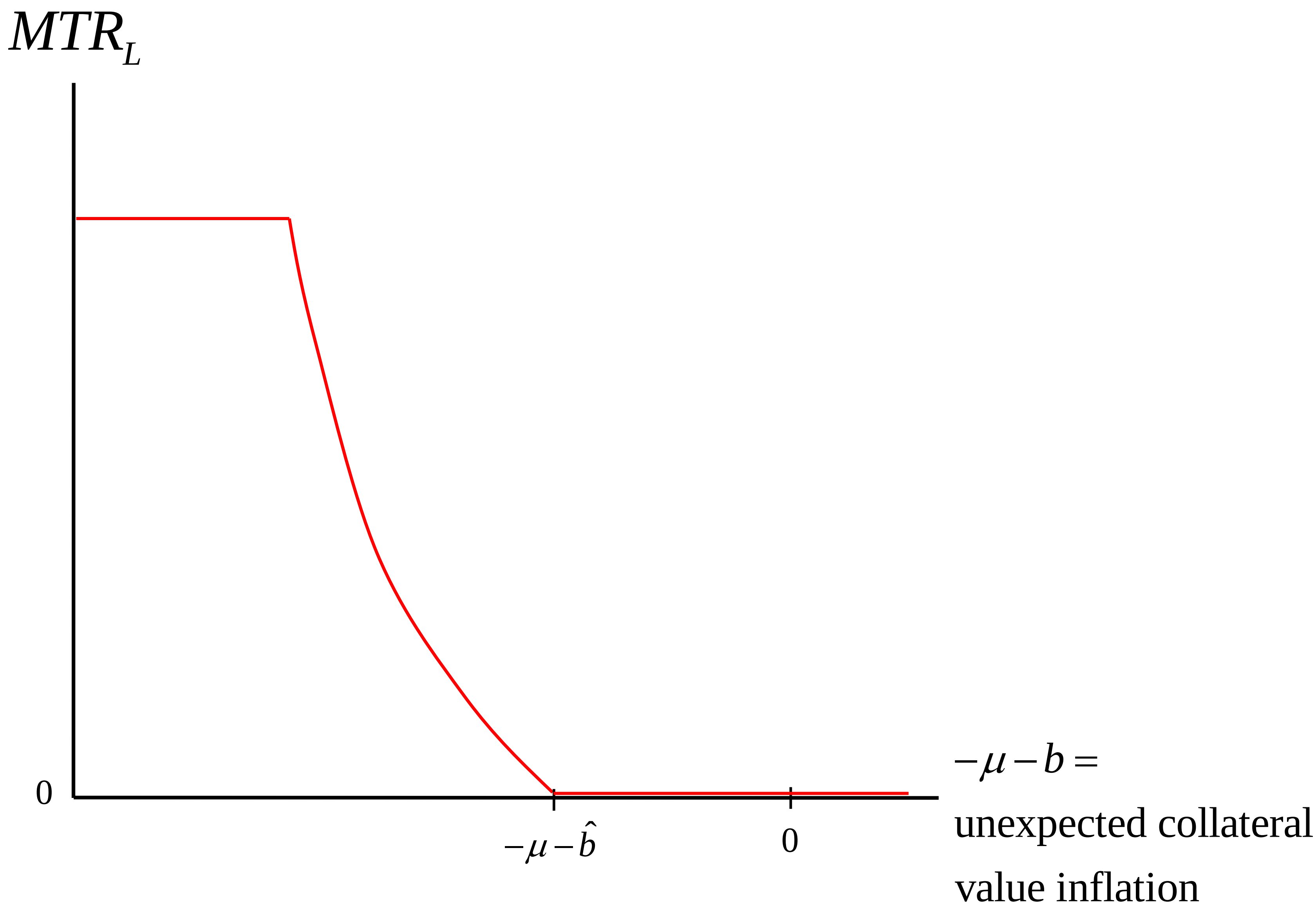
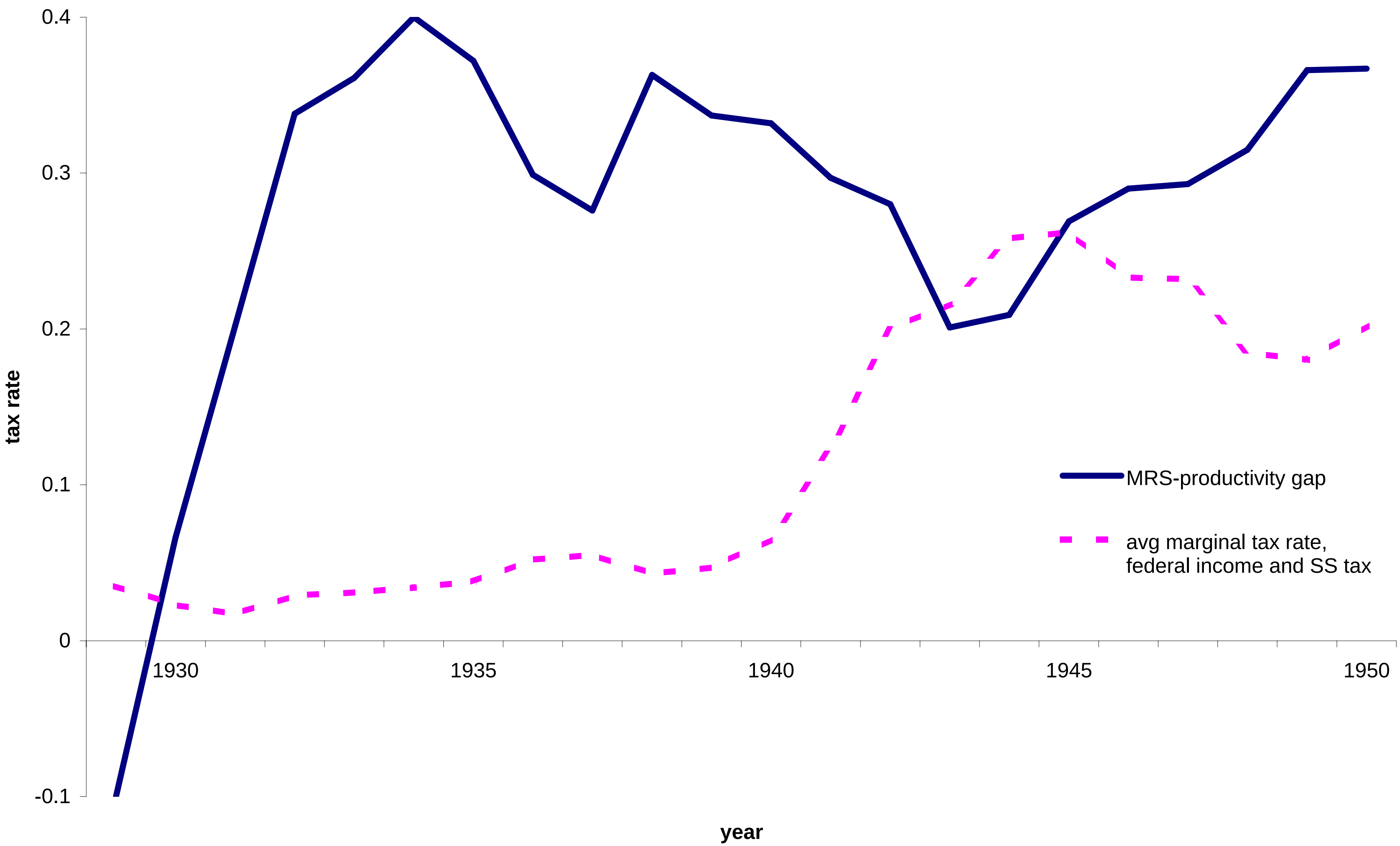


Figure 4. MRS and Marginal Productivity do not Move Together, 1929-50



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