A Century of Labor-Leisure Distortions

by

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WARNING TO READERS: This preliminary and incomplete draft contains errors and miscalculations.

Abstract

I construct direct measures of labor-leisure distortions for the American economy during the period 1889-1996, using a new method for empirically evaluating competitive equilibrium models and extending that method to some noncompetitive situations. I then compare measured labor-leisure distortions to proxies for potential causes of those distortions: marginal tax rates, labor market regulation, and monopoly unionism.

Distortions have grown steadily over the century, with the exception of the Great Depression (when distortions were above trend), WWII (below trend), and the 1980's (below trend). Marginal tax rates are well correlated with labor-leisure distortions at low frequencies, but cannot explain Depression, wartime, or 1980's distortions. Monopoly unionism might explain some, but not all, of the Depression distortions, and the decline of unions might explain a substantial fraction of the reduced distortions in the 1980's.

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I. Introduction

This paper is essentially a study of one important “labor equilibrium” equation from economic theory, the one that equates a consumer’s marginal value of time ($M_{RS}$) to the “after-tax” marginal product of labor ($M_{PL}$):

$$M_{RS_t} = (1 - \tau_t)M_{PL_t}$$  

where $t$ indexes calendar time, and $\tau$ is the marginal “tax” rate. Equation (1) is implied by a huge class of models of the labor market including, but not limited to, various static general equilibrium models, various dynamic general equilibrium models such as the representative agent “real business cycle” models of King, Plosser, and Rebelo (1988) and Kydland and Prescott (1983), (partly) noncompetitive equilibrium models such as Wu and Zhang (2000), and models with discrete choice and heterogeneous agents such as Mulligan (1999).

My approach is to separately measure $M_{RS}$, $M_{PL}$ and $\tau$ and “test” the equality (1). In doing so, I resurrect some old puzzles (e.g., “Why was employment low during the Depression”), but also reveal a new puzzle, and help usefully quantify the old ones. A byproduct of the analysis is time series of the quantity of labor market regulation, and the aggregate effects of monopoly unionism.

II. Construction of the Direct Distortion Measures

II.A. Functional Forms From the Literature

The labor equilibrium equation (1) would be most powerful if $M_{RS_t}$, $M_{PL_t}$, and/or $\tau_t$ could be measured directly, independently, and without error. This is not the case, but many (including, but not limited to, the papers cited above) have supposed that $M_{RS_t}$ and $M_{PL_t}$ are stable and fairly simple functions of output, average consumption, and work hours. In particular, a great many
studies have assumed that the marginal product of labor is proportional to the average product of labor, as it would be if output $Y_t$ were Cobb-Douglas in labor input $L_t$:

$$MPL_t = \alpha \frac{Y_t}{L_t}$$

(2)

where $\alpha$ is the coefficient of proportionality, aka “labor’s share.”$^1$

More than one function, but still relatively few, have been used in the macroeconomics literature to compute the marginal value of time. Two of those are:

$$MRS_t = \theta \frac{c_t}{1-L_t}$$

(3)

$$MRS_t = \theta c_t$$

(4)

The first value of time function (3) derives from time-separable log utility, as used by King, Plosser, and Rebelo (1988), and others. The second, equation (4), derives from the time separable and linear-in-labor utility function used by Hansen (1985) and others.$^2$

Most of the literature cited has not been concerned with explaining behavior prior to 1929, and in doing so it may be desirable to consider a third value of time function (5) – one derived from a Stone-Geary modification of the log:

$^1$MPL might instead be measured as aggregate labor compensation per manhour, but calculations would be essentially the same as those yielded by (2) because labor’s share of output fluctuates very little during the century. WWII is one except, on which I comment below.

$^2$Hansen’s linear utility function has the additional implication that labor is zero (or at its maximum feasible value) whenever $\theta c$ is strictly greater (less) than $(1-\tau)MPL$. Hansen (1985, p. @) derives $\theta c = (1-\tau)MPL$ as a condition of equilibrium, and my calculations offer some tests of whether this equality is true empirically.
where $\gamma$ is a subsistence level of consumption and (5) presumes that $c_t$ exceeds that level.

II.B. Data Sources

(2) and either (3), (4), or (5) can be used to compute time series for the marginal value of time and marginal product of labor. Or they can be used together to compute the marginal tax rate $\hat{t}_t$ implied by the functional forms and the labor equilibrium equation, as in equations (4) and (5):

$$\hat{t}_t = 1 - \frac{a}{\alpha} \frac{c_t}{Y_t} L_t$$ (4)

$$\hat{t}_t = 1 - \frac{a}{\alpha} \frac{c_t}{Y_t} \frac{L_t}{1-L_t}$$ (5)

With a direct measure of the marginal tax rate, we can then test the labor equilibrium equation (1) by comparing measured marginal tax rates $\{t_t\}$ with those $\{\hat{t}_t\}$ implied by the quantity series $\{L_t, c_t/Y_t\}$ and the functional forms (2) - (5).

Hence, to compute times series for $MRS$ and $MPL$, we need four (per capita) time series: real consumption, real output, labor input, and leisure time (which is essentially three series if we restrict labor and leisure time to sum to one). We need one less series to calculate implied tax rates: labor input, leisure time, and the consumption-output ratio.

I measure the four series for the period 1889-1996. “Consumption” is measured as NIPA personal consumption expenditures (1889-1928 from Kendrick (1961, Table A-IIb) and 1929-96 from
Output $Y$ is measured as GDP (same sources as $c$). Labor input is the product of civilian employment and hours per employee. The former is from Kendrick (1961, Table A-V I) through 1928, from Census Bureau (1975, series D-5 and D-15) 1929-58, and from BLS series @ 1959-96. Kendrick also estimates hours per employee, and reports its product with civilian employment (1961, Table A-X) through 1953. After 1953 I measure annual hours per employee as average weekly hours for nonsupervisor nonagricultural employees (plus 2.2, and times 52, to match Kendrick’s annual hours series in 1953).

Leisure hours might be measured as a residual from labor input, and this is essentially what I do during peacetime years. However, during the war years military employment was an important fraction of total employment, and the value of that time is probably dramatically undervalued by wartime military salaries, so I subtract civilian and military manhours (denoted $L$ and $x$, respectively) from a time annual endowment of 2500 hours per man, woman, and child aged 15+ to arrive at leisure hours. Not surprisingly, the subtraction of military manhours only has a noticeable effect on the level and changes in leisure hours during the war years.

The series \{L_t + x_t, c_t / Y_t\} are displayed in Figure 1 for the reader’s reference. It is important to notice that there are four major changes in aggregate labor (including military labor) hours during the period:

(i) labor hours have fallen substantially: compare 1889-1929 with 1950-96,
(ii) labor hours were low during the Great Depression,
(iii) labor hours were high during WWII, and
(iv) labor hours rose in the 1980’s

We see similar, although less dramatic, changes in the consumption-output ratio:

(i) $c_t / Y_t$ is somewhat lower in the latter half of the century,
(ii) $c_t / Y_t$ is relatively high during the Great Depression,
(iii) $c_t / Y_t$ is low during WWII, and
(iv) $c_t / Y_t$ rose in the 1980’s

\footnote{When necessary, these are converted to 1996 dollars by chaining together various GDP deflator series. As mentioned in the text, the deflator is irrelevant for computing implied tax rates as long as the relevant deflator is the same for personal consumption expenditures and GDP.}
These changes drive the main calculations regarding the labor equilibrium equation, so I discuss them in some detail below as I present the calculations.

III. Aggregate Distortions Displayed and Interpreted

III.A. MRS and MPL over the Century

In order to compute the MRS and MRT using the formulas (2) - (5), numerical values must be assigned to the parameters $\alpha$, $\theta$, and $\gamma$. The literature often sets $\alpha$ at $2/3$ and, in the log utility case, $\theta$ at 0.7 or 0.75 in order to match the levels of MRS and MPL with each other and with wage data for the postwar period. I do the same ($\alpha = 0.66; \theta = 0.73$ for log utility; $\theta = 0.0007$ for linear
utility; and $\theta = 1, \gamma = 1000$ 1996 dollars for Stone-Geary utility) to match $MRS$ and $(1-\tau)MPL$ with each other and with wage and tax data (see Section IV) for the period 1950-79, but notice from (4) and (5) that the calculated levels of $MRS$ and $MPL$ are irrelevant for testing the labor equilibrium equation (1), because only their ratio $MRS/MPL$, and its changes over time, affect the implied marginal tax rate and its changes over time.

III.B. Relative trends and fluctuations of $MRS$ and $MPL$

Figure 2 displays the $MPL$ series and two $MRS$ series calculated using the formulas (2) - (5). The $MPL$ grows steadily, although perhaps at a higher rate since 1929. All three of the $MRS$ series are much less smooth than $MPL$. This includes noticeable year-to-year variation as well as three episodes of substantial medium term fluctuations:

(i) Both $MRS$ series fall substantially during the Great Depression
(ii) Both $MRS$ series rise substantially during WWII
(iii) Both $MRS$ series rise substantially during the 1980's

Although not shown in Figure 2, (i) and (iii) can also be concluded from the Hansen $MRS$ function. As I discuss below, the Hansen $MRS$ series does not deviate from trend during WWII.

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4The $MRS$ series based on linear utility is omitted in order to avoid cluttering Figure 2, but will be displayed in Figure 3 which is the focus of my analysis.

5Noted that various prewar data series are interpolated between Census years. In particular, sector output fluctuations are often used to interpolate sector employment fluctuations between Census years (e.g., Lebergott 1964, p. 440). This tends to lead to too little variation in the output employment ratio for the interpolated years, and hence too little variation in my quantity-based $MPL$ series.
The statistical sources of (i)-(iii) are clear from Figure 1 and the formulas (3) - (5). The Great Depression and 1980's changes in MRS derive in large part from the fluctuations in labor input. This is also true for WWII, although the reduction in leisure due to changes in military employment are also important. The consumption series mitigate, but do not erase, (i) and (ii) because consumption grows somewhat more rapidly than output during the Great Depression and less rapidly than output during WWII. The consumption series contributes to the 1980's increase in the MRS because consumption is growing more rapidly while labor input is increasing.

Comparing the MPL series with the MRS series, we see that the log and log-Stone-Geary MRS trend upward somewhat more slowly than the MPL. Not surprisingly, the Stone-Geary MRS
grows more rapidly than the log MRS early in the century, and they are practically parallel later. Since the MPL grows steadily throughout the century, the MRS fluctuations (i) - (iii) are each relative to the MPL.

III.C. Implied Marginal Tax Rates

If the labor equilibrium equation is to explain these different trends and fluctuations in MPL and MRS, it is with trending and fluctuating marginal tax rates. Hence the next step in my analysis is to compute the marginal tax rates implied by the labor equilibrium equation (1) and Figure 2. Figure 3 displays those implied tax rates for the log-Stone-Geary (solid line) and Hansen (dash-dot line) MRS functions. They fluctuate a lot from year-to-year because the MRS fluctuates relative to the MPL. They are much higher later in the century, partly because the MRS grows more slowly (which in turn derives from the drop in labor hours from early in the century) and partly because the consumption-output ratio has fallen.
The implied tax rates are high during the Depression, and relatively low during the 1980's. Implied wartime tax rates are relatively low according to the log-Stone-Geary preferences - because leisure time declines so much relative to the $MPL$ - and are relatively high according to the Hansen preferences because those preferences imply that the $MRS$ is independent of the amount of leisure time, varying only with consumption. These various differences over time are very large - implied rates rise by 30-50 percentage points 1929-34, change by 15 percentage points 1934-43 (falling according to log-Stone-Geary, rising according to Hansen), and fall 10 percentage points 1979-96.
IV. Potential Causes of Labor-Leisure Distortions

If the labor equilibrium equation (1) and the functional forms (2) - (5) are useful for explaining labor market trends and fluctuations, then ideally measured marginal tax rates – or labor market distortions more generally – should mimic the implied marginal tax rates in Figure 3. Have labor market distortions risen, and by as much, as implied marginal tax rates over the century? Do marginal tax rates increase by 40 or 50 percentage points during the Depression? Or fall 15 percentage points during the war? Or fall 10 percentage points during the 1980's? In order to answer these questions, I calculate “marginal tax rates” for the century by examining three potential sources of labor market distortions: federal labor income taxation, federal labor market regulation, and monopoly unionism. These marginal tax rate series are then compared with the implied marginal tax rates shown in Figure 3.

IV.A. Federal Labor Income Taxes

Of course, taxes on labor income are expected to drive a wedge between $MRS$ and $MPL$. I use Barro and Sahasakul's (1986) series on marginal federal personal income and payroll tax rates on labor income, as updated by Stephenson (1998) and Mulligan and Marion (2000). To a good approximation, this series uses disaggregated data on federal individual income tax returns to compute, for each calendar year, cross-return averages of the statutory marginal tax rates.6

Figure 3 displays the Barro-Sahasakul “measured” series (dotted line), together the those implied by labor equilibrium. The measured series is zero prior to 1917, because there was no federal personal income or payroll tax prior to that year. There is barely any increase during the Great Depression, and tremendous increases (from 3 to 21% 1940-44) and cuts (from 21 to 13% 1944-49) surrounding WWII. Marginal rates increase fairly steadily after 1949, with minor exceptions of the famous Kennedy and Reagan tax cuts.

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6For example, a federal return in the 15% bracket, with labor income below the Social Security ceiling, filed in a year when the Social Security payroll tax rate was 7% on employee and employer, would be assigned a marginal tax rate of 23.7% (.237 = (.15+.07)/(1-.07)) which, according to Barro and Sahasakul's (1983) model of taxes, is the wedge between $MRS$ and $MPL$ for the person filing that return.

Barro and Sahasakul use data on the ratio of personal income to AGI to make an adjustment to their series for nonfilers prior to 1947 who are presumed to face a zero marginal tax rate.
The trend over from the 1890's to the 1970's is reasonably well explained by the labor equilibrium equation (1). Implied marginal tax rates grew from roughly 0 to 30% while the federal marginal tax rates grew from 0 to 25 or 30%. In other words, federal labor income taxes and the labor equilibrium equation can explain a majority of the difference in the long term trends of $MRS$ and $MPL$.

Short and medium term fluctuations of the implied rates are very poorly explained by the Barro-Sahasakul series. First, federal tax rates cannot explain why there were so many labor hours prior to 1930 (ie, why the workweek has been shortened) and hence why $MRS$ is so high during that period. The shorter workweek has been explained as a wealth effect, which is partly captured by the Stone-Geary functional form (5) since consumption has risen more in real terms than has leisure time. There is substantial agreement in the literature that work hours per capita have declined (although see Schor’s 1991 and Leete and Schor’s 1994 dissenting view, and Stafford’s 1992 and Juster and Stafford’s 1992 reply), and that the decline is an income effect of some kind (eg., Hunt and Katz 1998, Owen 1979). The shorter workweek is also explained by the Hansen functional form (4), but for very different reasons – consumption has risen less than has the marginal product of labor schedule.

Second, implied rates increase by 30 to 60 percentage points, depending on the pre-Depression benchmark year, during the Great Depression while there was hardly any increase in marginal federal labor income tax rates. Third, the implied rates derived from log and log-Stone-Geary functions proceed to fall by 20 or 30 percentage points during WWII while measured rates rise almost 20 percentage points. Fourth, the implied rates rise after the war while the measured rates fall. These departures of implied from measured tax rates is one way of numerically demonstrating the unexplained (by economists at least!) employment reduction during the Depression and (according to Mulligan 1998) the unexplained employment and hours increases during WWII.

According to the linear Hansen $MRS$ function, the wartime $MRS$ is low, and implied tax rate high, when compared either to the 1930's or the late 1940's. This seems consistent with the labor equilibrium equation (1) since the Barro-Sahasakul measured tax rates increase and fall during the 1940's much like the implied tax rates. However, this result derives from wartime errors in the output series. If we were to measure $MPL$ as labor compensation per manhour, rather than $\alpha Y / L$,
this would not affect calculations for the nonwar years since labor compensation tracks very closely, but implied wartime tax rates would be 10 percentage points lower.

Fifth, implied rates fall dramatically in the 1980's and 1990's while measured rates are relatively stable. The 1980's failure of the labor equilibrium equation (1) has not been examined in the literature, but we see in Figure 2 how the divergence between MRS and MPL is 15 percentage points or so, and hence of the same order of magnitude as the more well-known Depression and War episodes.

IV.B. Federal Labor Market Regulation

Labor market regulations are varied. Some may have no effect because the regulations require workers and employers to do things that they would already do, or because the regulations are not enforced. Others may lower the marginal product of labor schedule, perhaps by restricting firms from using the most efficient production process. But of particular interest for my study are regulations that drive a wedge between MRS and MPL. According to the textbook analysis, a binding minimum wage is one example because it puts some people out of work - a movement down the aggregate labor supply schedule - and moves employers up their MPL schedule (aka, labor demand curve). Mandatory fringe benefits, if they are valued by employees at less than their cost to employers, also drive such a wedge.

It is hard to identify which regulations drive a wedge between MRS and MPL, let alone accurately quantify the wedge created by the large and varied portfolio of federal regulation. However, recall from Figure 3 that the changes in implied tax rates to be explained are quite large - on the order of 10 percentage points or more for the entire labor force. Hence, even a rough qualitative analysis of federal labor regulation can reveal whether labor market regulation and its changes over time are a viable explanation. It is such a qualitative analysis that I present here.

Figure 4 displays as a dashed line the number of labor market regulations in effect in each year since 1910, as listed and dated by the Center for the Study of American Business' Directory of Federal Regulatory Agencies. According to the dashed line, there is a growth in labor market regulation over the century, and that may explain why the postwar implied marginal tax rates grew

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^n.e, the mandated benefits exceed the amount workers would demand in the absence of regulation. See, for example, Summers (1989) for some analysis of this point.
somewhat more rapidly than the measured marginal federal labor income tax rates. There was a growth in labor market regulation in the 1930's that may have increased the wedge between $MRS$ and $MPL$ but, at least according to the dashed line, even more growth in regulation was found in the 1960's and 1970's when we did not see nearly such a divergence of $MRS$ and $MPL$ as in the 1930's.

Of course, all regulations count equally in computing the dashed line, and there is no adjustment for the fact that some regulations do not drive a wedge between $MRS$ and $MPL$, but rather decrease the $MPL$ (or have no effect on either $MRS$ or $MPL$). Nor is there an adjustment...
for the differential importance of various regulations (eg., the 1910 Mine Safety Act counts the same as the Civil Rights Act), or for the differential impact over time of any single regulation (eg., the minimum wage is presumably less important when the real minimum wage is low). Figure 4’s solid line reports an attempt to remedy one or two of these problems, by weighting each act by estimates of the number of employees affected, as explained in the Appendix. The solid line suggests that labor regulation reached its modern order of magnitude with the 1935 Wagner Act which, for the purpose of calculating the solid line, we assume affects all nonagricultural nonsupervisory employees (compare this the previous regulations which applied only to miners, federal employees, longshoremen, and construction workers on federally funded projects). Nevertheless, the solid line suggests that labor regulation growth was as rapid, and probably more rapid, in the 1960's and 70's than in the 1930's because, with the exception of the 1935 Wagner Act and 1938 Fair Labor Standards Act (FSLA, affecting any medium-sized or large firm engaged in interstate commerce) the 1930's Acts only applied to specific industries while several 1960's and 1970's Acts were much more comprehensive.8

It may be argued that, while a number of 1960's and 1970's regulations covered a lot of employers, none was so important as the Wagner Act or FSLA. The importance of the Wagner Act is quantified in part below in the context of monopoly unions. An important part of FSLA – the minimum wage, can also be quantified to some degree by looking at the minimum wage as a fraction of labor compensation per manhour, as in Figure 5.

IV.C. Monopoly Unionism

Monopoly unions, by definition, deliberately drive a wedge between MRS and MPL in order to raise member incomes. In the labor economics literature, the size of this wedge for union workers is often measured as a “union wage gain”, rather than a percentage wedge between MRS and MPL, but the monopoly union wage gain can be converted to a wedge for union workers using

8For example, the 1931 Davis-Beacon Act applied only to construction employees working on federally funded projects and the 1936 Walsh-Healy Act applied only to federal government contractors, while the 1963 Equal Pay Act, Title VII of the 1964 Civil Rights Act, the 1967 Age Discrimination in Employment Act, the 1972 Equal Employment Opportunity Act applied to a huge number of industries and employers.
the Cobb-Douglas production and utility functions. To do so, I denote the wage rate as \( w \), which is determined by the bargaining power of the monopoly union and other factors not of particular interest here. According to the monopoly union model, the wage equals the marginal product of labor – proportional to \( L^{-1} \) with Cobb-Douglas production – which can be inverted to determine labor input as a function of \( w \). If workers consume \( wL \), then we can compute their marginal rate of substitution, \( \theta c/(1-L) \) as a function of \( w \). The \( MRS \) is not equal to \( MPL \), except when \( w \) is equal to its competitive equilibrium value.

We define the union wage gain \( \omega \) to be the difference, in log points, between the wage rate that would prevail in a competitive labor market (ie, would equate \( MRS \) and \( MPL \)) and that prevailing in the presence of the union. We see from above how the wedge \( \hat{\tau} \) created by the monopoly union can be calculated as a function of \( \omega \) and competitive equilibrium labor input (\( L^* = 1/(1+\theta) \)):

\[
\hat{\tau} = \frac{e^{-\omega} - 1}{e^{-\omega} - L^*}
\] (6)

Not surprisingly, equation (6) implies that the wedge between \( MRS \) and \( MPL \) driven by the monopoly union increases with the union wage gain \( \omega \), and is zero when there is no union wage gain. Table 1 uses equation (6) to calculate the wedge implied by various union wage gains:

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\(^9\)This wage rate can be viewed as the wage net of taxes and regulations unrelated to the monopoly union effect.
Table 1: Wedges as a Function of Wage Gains

<table>
<thead>
<tr>
<th>parameter values</th>
<th>0.66</th>
<th>0.66</th>
<th>0.66</th>
<th>0.60</th>
<th>0.75</th>
</tr>
</thead>
<tbody>
<tr>
<td>labor's share, ( \alpha )</td>
<td>0.50</td>
<td>0.55</td>
<td>0.60</td>
<td>0.50</td>
<td>0.50</td>
</tr>
<tr>
<td>competitive labor, ( L^* )</td>
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<td>0.24</td>
<td>0.26</td>
<td>0.28</td>
<td>0.21</td>
</tr>
<tr>
<td>wage gain, ( \omega )</td>
<td>0.10</td>
<td>0.41†</td>
<td>0.43†</td>
<td>0.46†</td>
<td>0.36</td>
</tr>
<tr>
<td></td>
<td>0.15</td>
<td>0.53†</td>
<td>0.55†</td>
<td>0.58</td>
<td>0.48†</td>
</tr>
<tr>
<td></td>
<td>0.20</td>
<td>0.62†</td>
<td>0.64†</td>
<td>0.67†</td>
<td>0.56†</td>
</tr>
<tr>
<td></td>
<td>0.25</td>
<td>0.68†</td>
<td>0.71†</td>
<td>0.73†</td>
<td>0.63†</td>
</tr>
<tr>
<td>addendum: worker-optimal wage gain</td>
<td>0.08</td>
<td>0.07</td>
<td>0.06</td>
<td>0.12</td>
<td>0.04</td>
</tr>
</tbody>
</table>

† For these parameters, a marginal wage gain reduces worker utility.

The columns in the Table correspond to different values of the parameters \( \alpha \) and \( L^* \), and we see that wedges calculated from (6) are more sensitive to the wage gain \( \omega \) than to those parameters.

There is a large literature attempting to estimate the union wage gain for various industries. Lewis (1986) surveys that literature and Lewis (1963, eg., pp. 4f) comments on how the wage gain appears to have varied over time. Both his 1963 and 1986 books suggest that there is no union wage gain in many industries, and that the wage gain averaged across unionized industries and time periods is no larger than 15 percentage points. He does suggest that union wage gains were highest during the Great Depression, about 25 percentage points when averaged across unionized industries. From Table 1, we see that Lewis’ estimates imply, for unionized sectors, tax wedges that are substantially larger than those driven by the income tax. For a typical union wage gain of 0.10, we have a typical wedge of about 40% for those in the unionized sector. For a wage gain of 0.25, we have a wedge of 70%.

The wedges calculated for the union sector are so large because labor supply and demand are fairly elastic under the Cobb-Douglas functional forms. It should be noted, however, that not
all sectors are unionized, and those that are unionized are probably not representative in terms of the elasticities of labor supply and demand. Indeed, while the Cobb-Douglas functions may well describe aggregate behavior, note that applying them to the union sector (as in Table 1) implies that labor compensation is lower under monopoly unionism and that the wage gain maximizing worker utility is 0.10 or less, as shown in the last row of the Table. Hence, Table 1 probably understates union-induced wedges.

My calculations of implied tax wedges are for the entire economy, and not just the union sector. How much can monopoly unionism affect the average tax wedge? Assuming the monopoly union wedge is zero for nonunion workers, the size of the monopoly union wedge for the average worker is the product of the union wedge and union density (i.e., the fraction of the labor force that is unionized). Using Rees’ (1989 Table 1) time series for nonagricultural sectors, we see from the dashed line in Figure 6 that union density increased somewhat during the 1930s – reaching 18% – while the largest increases during the century were after the Depression. Union density has declined since the 1950s (see also Freeman and Medoff 1984, Figure 15-1), and perhaps that decline accelerated in the late 1970s and 1980s.

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I use Census Bureau (1975, series D-17, 1900 value) to fill in Rees’ missing nonagricultural employment for the year 1897.
The solid line in Figure 6 illustrates how changes in union density might affect the time series for the economy's average monopoly union wedge. The solid line assumes a nonunion sector wedge of 0, a Depression union sector wedge of 70%, and a non-Depression wedge of 40%. The solid line suggests that monopoly unionism should have created a wedge of 5 or 10 percentage points by 1920, which we don't see in the implied wedge series graphed in Figure 3. Union membership growth during the Depression, and especially the assumed growth in the union sector wedge, add almost 10 percentage points to the economy average wedge in the 1930's, and might thereby explain some, but not all, of the Depression's implied tax wedge shown in Figure 3. However, even though it is assumed that the union sector wedge declines from 70% to 40% after the Depression, the post-Depression growth in union membership implies that the economy-average wedge is stable. The
1980’s decline in union membership reduces the wedge by a couple of percentage points, and can thereby explain some but not all of the 1980’s reduction in the implied tax wedge. Finally, since 1930, monopoly unionism may have added a few percentage points to the tax wedge.

Figure 6’s assumed union sector wedges and their Depression changes are certainly overstated, but this bias only reinforces the main conclusions from Figure 6:

- the growth of unionism prior to 1920 only makes the 1920’s gap between MRS and MPL only more puzzling
- Depression unionism can only explain a small part of the Depression’s implied tax wedges
- monopoly unionism might explain a few percentage points, but no more, of the growing implied tax wedge since 1930

V. Conclusions

Using quantity data and functional forms from the literature, I calculate time series for the marginal value of time (MRS) and marginal product of labor (MPL). According to the labor equilibrium equation, \( MRS = (1 - \tau)MPL \), where \( \tau \) is a wedge driven between MRS and MPL by tax policy, regulatory policy, or monopoly unionism. I use the MRS and MPL series to calculate the marginal tax rates implied by the labor equilibrium equation (namely, the implied rate is \( 1 - \frac{MRS}{MPL} \)), and compare them with direct measures of marginal tax rates. My comparisons partly resurrect some old puzzles (e.g., “Why was employment low during the Depression”), but they also reveal a new puzzle, and help usefully quantify the old ones.

V.A. Additional Test of Linear Preferences

The linear functional form (4) for the marginal value of time has the strong implication that labor is zero (or at its maximum feasible value) whenever \( 0 < (1 - \tau)MPL \). Equivalently, labor is zero (or at its maximum feasible value) whenever actual tax rates are greater (less) than those implied by the labor equilibrium equation \( \tau = (1 - \tau)MPL \). With direct

\(^{11}\text{Lewis (1986) survey only studies data up to 1979. If union wage gains were largely eliminated during the 1980's, then we see from Figure 6 that a 1980's reduction in monopoly unionism might explain almost all of the 1980's reduced implied tax wedge.}
measures of marginal tax rates, my MRS and MPL series permit a simple test of this implication.

Figure 3 reports that tax rates (as measured by Barro and Sahasakul) exceeded implied rates prior to 1930 and since 1980. The linear functional form (4) implies that labor should be zero during these periods, which is far from the case especially prior to 1930 when employment and hours were at their highest levels in history. Figure 3 also reports measured tax rates that are less than implied rates during the Great Depression. Because Depression labor input was below trend, and far from its maximum feasible value, this is another contradiction of the theory.\(^2\)

V.B. Work Hours Prior to 1930

Other features of the implied marginal tax rate series are probably best summarized by historical time period. First, labor input is high prior to 1930 – even higher than one would expect in the absence of labor income taxes. This shows up in my calculations as a negative implied tax rate derived from the log utility function. Stone-Geary preferences can partly “explain” high labor input during this period as an income effect, as has been suggested in the literature. But even with the Stone-Geary preferences, implied rates are often negative prior to 1930, so the labor equilibrium equation is not fully successful at explaining the reduction in hours from the beginning of the century.

V.C. Trends 1930-70

Implied rates have increased from roughly 0 to 30% between 1930 and 1970. Marginal federal labor income tax rates have increased almost this much, labor regulation has probably contributed to the tax wedge, and union density has increased, so the labor equilibrium equation explains the 1930-70 secular trends pretty well.

V.D. The Great Depression

Implied rates rise dramatically in the early 1930’s and persist for the decade. None of this increase can be attributed to federal labor income taxes, because only a small minority of the population was liable for such taxes. Labor regulation and the effects of monopoly unionism

\(^2\)Another question, beyond the scope of this paper, is whether the linear functional form can be reconciled with micro data (Mulligan 1999 addresses this question).
probably did grow in the 1930’s and in this sense explain some, but only a minority, of the Depression wedge between \( \text{MRS} \) and \( \text{MPL} \). However, this explanation implies that the wedge would grow (beyond any growth due to incometaxation) after the 1930’s whenever labor regulation or the effects of monopoly unionism grew. Instead, Figure 3 shows how implied tax rates grew together with, rather than in excess of, marginal federal labor income tax rates, even during the period 1940-55 when union density almost doubled and during the period 1960-80 when labor regulation grew at least as rapidly as it did in the 1930’s.

Measuring the effects of regulation and unionism is a tricky business, and future research can undoubtedly improve on my efforts. Regardless what that research shows, one contribution of my analysis is to reformulate the old question “Why was employment low during the Depression?” as “What drove a 30% wedge between marginal product and value of time?” As Mulligan (2000) argues, this reformulation can direct those searching for explanations away from those that do not create tax wedges (e.g., productivity shocks) towards those that do.

V.E. W W II

According to either the log-Stone-Geary or Hansen functional forms, \( \text{MRS} \) exceeds the after-federal-tax real wage during \( \text{W W II} \), mainly because federal tax rates grow from practically zero to more than 20%. In other words, \( \text{W W II} \) leisure time is lower (or consumption higher) than implied by the labor equilibrium equation.

V.F. Leisure and Consumption Since 1980

Perhaps the more novel result from my calculations is that the value of time grew much more rapidly than the marginal product of labor during the 1980’s. It appears that only a small part of this is due to marginal federal labor income tax rate cuts. Part may also be due to the decline of monopoly unionism, although more research is needed to determine how much this trend might have reduce the wedge between the value of time and the marginal product of labor.

VI. Appendix: Quantifying Labor Regulation

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VII. References


