

Work and Taxes: Allocation of Time in OECD Countries

By Lee Ohanian, Andrea Raffo, and Richard Rogerson

Policymakers devote a great deal of attention to short-run fluctuations in the labor market. Central banks monitor indicators of labor market tightness in the conduct of monetary policy due to the potential implications for inflation. Fiscal authorities are concerned with the budget consequences of fluctuations in the labor market because they affect both revenues and expenditure programs. More generally, these fluctuations may be associated with significant losses in welfare.

The motivation of this article stems from a striking empirical observation about long-run variations in labor market outcomes: Long-run changes in total hours of work in OECD countries exceed the variation of hours worked over the business cycle in a representative country (say, the United States) by almost an order of magnitude. If understanding changes in hours of work of the magnitude of business cycle fluctuations is an important policy concern, then understanding the sources of these trend differences is also crucial. Surprisingly, the academic and policy debates have focused on the business cycle movements in the labor market, almost ignoring low frequency changes.

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The goal of the article is threefold. First, it describes the main features of the distribution of total hours worked in OECD countries during the postwar period. The most interesting features are the steep decline in average hours worked and the large variation across countries in the magnitude of this decline.

Second, the article investigates what policy or institutional differences can help explain the different evolutions in hours worked across countries. Regression estimates indicate that changes in labor taxes account for a large share of the trend differences. Other variables, particularly employment protection regulation and the duration of unemployment benefit programs, also have a statistically significant correlation with hours worked. The effects of these other factors are small, however, when changes in labor taxes are taken into account.

The third goal of this article is to explore what individuals in some countries do with their time if they work less in the market. A striking finding emerges from recent cross-country time use studies: Countries with high tax rates devote less time to market work, but more time to home activities, such as cooking and cleaning. Moreover, the reallocation of time from market work to home work is much stronger for females than for males.

Section I of the article describes the main patterns in total hours worked across OECD countries during the postwar period. Section II describes the variables used in the analysis to understand the causes of these patterns, specifically taxes and various labor market institutions indices. Section III documents a strong negative relationship between hours and taxes by means of statistical analysis. Section IV explains the relationship between market work, home work, and taxes.

I. LABOR SUPPLY ACROSS OECD COUNTRIES

Standard textbook treatments of labor supply focus on how individuals divide their available time between two uses—market work and leisure—and stress the importance of the wage rate as a key factor shaping this decision. However, following the seminal work of Becker in 1965, most economists agree that to understand labor supply it is often important to consider three uses of time: market work, nonmarket work

(or home production), and leisure. Nonmarket activities include tasks such as cooking, cleaning, and childcare, which an individual performs without receiving any direct monetary compensation.

A key feature of an individual's choice is the substitutability between market work and nonmarket work. In this expanded view of time allocation, the market wage rate influences not only how much leisure the individual chooses to enjoy, but also the relative distribution of hours worked at home and in the market. In other words, individuals who work longer hours in the market can use their additional earnings to purchase services rather than providing the services themselves. For example, an individual who works 12 hours at the office may decide to eat at a restaurant instead of cooking at home.

The notion that total time devoted to work should include both market and home work is important in interpreting trends in the U.S. economy during the last 40 years. In particular, while some studies have claimed that Americans work more hours and therefore enjoy less leisure, recent work shows that during the last 40 years Americans have increased both the time that they devote to market work and their leisure time. Both these amounts have increased because Americans work less at home.¹ As a practical matter, the reallocation of working time from home to market has been the dominant change during the postwar period, with the overall change in leisure being relatively small.²

Total hours of work

This analysis of labor supply differences across countries begins with a close look at the aggregate hours worked in OECD (Organization for Economic Cooperation and Development) countries in the postwar period.³ The measure of hours worked incorporates differences across countries in vacation time, statutory holidays, and sick leave.

The starting point for the analysis is a simple calculation. For each year, the standard deviation of logarithm of hours of work across a sample of 21 OECD countries is computed. Then, the lowest and highest values for the period 1956-2004 are used to characterize the range of cross-country variation. This range is then compared to the

Table 1

CROSS-COUNTRY VARIATION IN HOURS WORKED

	<i>Standard Deviation of Hours</i>
Across OECD countries	
Minimum (1972)	.10
Maximum (1991)	.16
U.S. time series (1956-2004)	.02

standard deviation of the logarithm of hours worked in a representative country (for simplicity, the United States) calculated using the time series 1956-2004.⁴

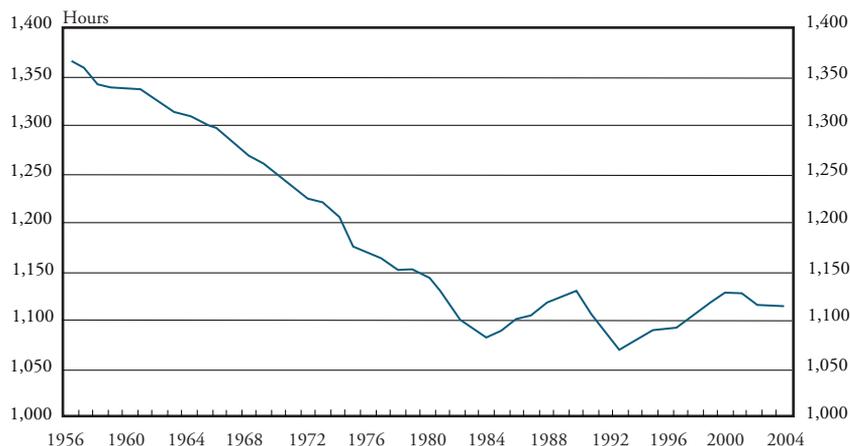
The cross-country variation in hours of work is between five and eight times larger than the time series variation of hours worked in the United States (Table 1). To the extent that economists and policymakers associate business cycle changes in hours worked with large welfare losses, the statistics in Table 1 indicate that cross-country differences in hours worked are potentially associated with even greater effects.

Given that many cross-country labor market studies use the unemployment rate as their measure of labor market outcomes, it would be interesting to see how the two measures compare. While in some countries the qualitative evolution of hours worked and of unemployment are similar, the quantitative differences in hours of work are much larger. Two factors account for this difference. First, changes in hours per employee, holding all else constant, have no direct impact on unemployment. Second, differences in participation rates are not captured by differences in unemployment rates. It turns out that both of these factors are quantitatively important.⁵

Changes in total hours of work across OECD countries, 1956-2004

Having observed that cross-country differences in hours worked are large, the analysis now takes a more systematic look at the main trends in OECD countries in the postwar period. First, the average number of hours worked across countries is calculated for each year in the sample period (Chart 1). On average, hours worked have fallen during the postwar period, with the 2004 value almost 20 percent

Chart 1
AVERAGE HOURS OF WORK, OECD COUNTRIES



Source: See appendix

Table 2
TRENDS IN HOURS OF WORK ACROSS COUNTRIES

2004 vs. 1956			
< .75	(.75, .85)	(.85, .95)	> .95
Austria .74	Finland .75	Japan .85	Australia .97
Belgium .70	Netherlands .81	Spain .86	Canada 1.08
Denmark .71	Norway .82		Greece .99
France .67	Portugal .84		New Zealand 1.05
Germany .60	Sweden .80		United States 1.01
Italy .74	Switzerland .83		
Ireland .70	United Kingdom .79		

below the 1956 value. The timing of this fall is also interesting. The decline in hours held fairly constant until about 1985, when average hours became relatively flat.

Moreover, the changes in hours of work since 1956 are far from uniform across countries. To illustrate this point, Table 2 shows for each country the ratio between the number of hours worked in 2004 and the number in 1956. For convenience, the sample of countries is split into four groups, according to the magnitude of these relative changes.

The variation across countries in the trend changes is significant. In Germany and France, hours worked fell 35 percent to 40 percent. In the United States and Canada, hours worked remained constant or even increased 5 percent to 10 percent.

Another interesting perspective is offered by contrasting differences in the level of hours worked across countries at a given point in time. If we perform this exercise for a recent year, such as 2004, and compare all countries relative to the United States, then the resulting distribution is remarkably similar to that shown in Table 2.

Consistent with this statement, the differences in trend changes of hours worked account for much of the variation in hours worked across countries. A panel regression of the logarithm of hours on a common constant term and a country specific linear trend illustrates this point:

$$\log H_{it} = \alpha + \beta_i t + \varepsilon_{it},$$

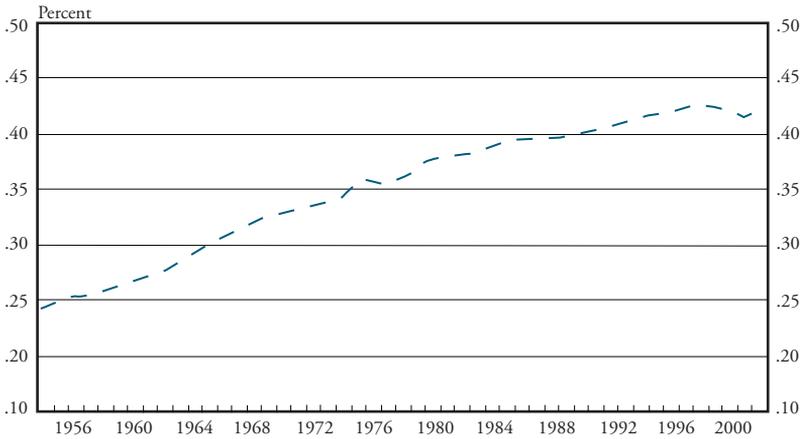
where H_{it} is hours worked in country i at time t . The R^2 obtained from this regression is 0.76.⁶ In contrast, when the trend coefficient β is restricted to be the same across countries, we obtain an R^2 of 0.26. These results suggest that most of the variation in total hours of work across countries originates from differences in trend changes.

In summary, the hours of work have fallen substantially in OECD countries during the postwar period. Moreover, this decline has been far from uniform across countries, displaying a significant amount of variation. Finally, trend changes appear to be the dominant source of variation.

II. ACCOUNTING FOR THE DIFFERENCES

In light of the dramatic changes in the hours worked in OECD countries, it is natural to focus attention on the sources of these differences. The literature on cross-country labor market outcomes has suggested many plausible institutional and policy factors that could play a role. Primary among these are labor taxes, whose direct effect is to reduce the return to working. Because labor taxes vary so significantly across countries, they are likely a primary source of labor market differences in OECD countries.⁷

Chart 2
LABOR TAX TRENDS



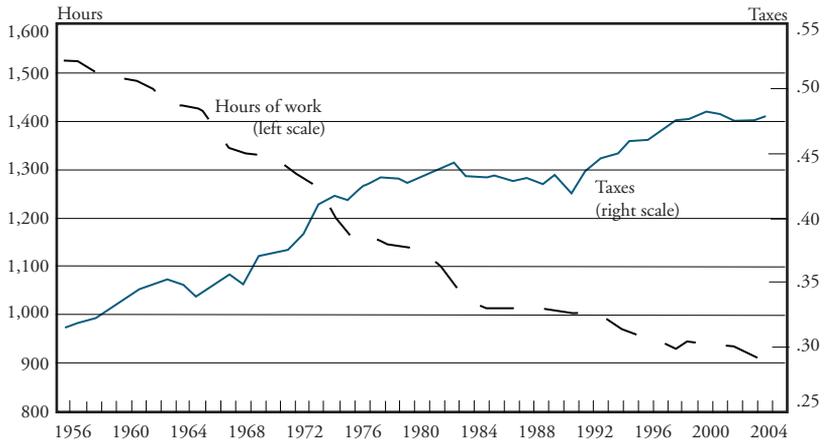
Source: See appendix

Changes in taxes across OECD countries

This section describes the main trends in labor tax factors across OECD countries between 1956 and 2004. The tax factors include both labor income taxes (including payroll taxes) and consumption taxes. Standard economic theory suggests that both kinds of taxes reduce the after-tax real wage, thus making them important determinants of the choice between market work and other activities.⁸ Chart 2 shows the time series of the average tax factors across OECD countries.

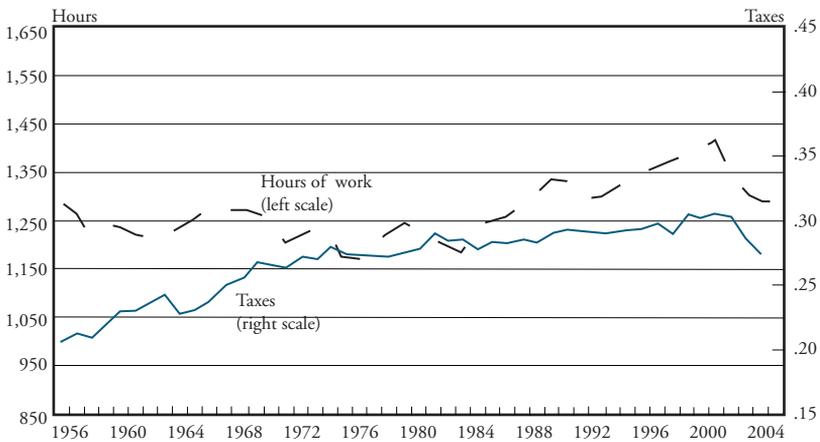
Chart 2 shows a clear upward trend in taxes over time. Recall that in Chart 1, hours of work fell sharply in the first part of the sample (until 1985), followed by a relative flattening. A similar, though somewhat less pronounced, pattern emerges from Chart 2. The average tax rate on labor income jumped from 25 percent to 40 percent between 1956 and 1990. In the second part of the sample, the tax rate increased only slightly, from 40 percent to 42 percent. The correlation coefficient between the series for average taxes and average hours is -0.963 , confirming the strong negative association between labor supply and taxes.

Chart 3
THE GERMAN EXPERIENCE



Source: See appendix

Chart 4
THE U.S. EXPERIENCE



Source: See appendix

As in the case of hours worked, the variation in the extent of changes in tax rates across OECD countries was substantial. Two countries illustrate the extreme patterns observed in the sample—Germany and the United States (Charts 3 and 4).

In Germany, tax rates soared from 30 percent in 1956 to nearly 50 percent in 2003, among the largest increases in tax rates in our sample. As mentioned earlier, the fall in hours of work in Germany was also among the most severe, about 40 percent (Table 1). Similar patterns are observed in many European countries—that is, changes in taxes are a mirror image of changes in hours worked.

In the United States, there were two interesting features. First, in the early part of the sample, tax rates rose, while hours of work fell. The magnitudes of these changes, though, were much smaller than those observed in European countries. Between 1980 and 2000, however, taxes increased from 27 percent to 30 percent. Perhaps somewhat surprisingly, though, work hours increased as well.⁹

Changes in labor market institutions across OECD countries

A large literature documents trans-Atlantic differences in labor market institutions and unemployment. This analysis investigates the relationship between the evolution of these institutional variables and hours of work during the last 50 years.¹⁰

The first institutional variable is an index of employment protection, which captures a firm's difficulty in hiring and firing workers. Research argues that stricter regulations would affect job flows and generate a more stagnant labor market, ultimately reducing hours of work.

Three other institutional variables reflect the role of unions in the labor market. The first of these variables measures the fraction of workers that are union members at each point in time over the sample period. Several authors argue that strong unions might artificially restrict labor supply, primarily by setting excessively high wages and by pursuing policies that reduce the workweek (such as the well-known 35-hour week in France or increases in vacation time). It is reasonable to postulate that the magnitude of these effects is related to the fraction of the workforce that is unionized.

Table 3

**LABOR MARKET INSTITUTIONS:
GERMANY VS. UNITED STATES, 1960-1995**

	Germany		United States	
	1960	1995	1960	1995
Employment protection	.41	1.41	.10	.10
Union density	.35	.27	.29	.15
Bargaining coordination 1	3.00	3.00	1.00	1.00
Bargaining coordination 2	2.50	2.50	1.00	1.00
Benefit replacement rates	.43	.36	.21	.27
Benefit duration	.57	.60	.00	.16

Note: See appendix for variable definitions.

In addition, researchers have argued that the effect of unions is influenced by the extent of coordination of wage bargaining across units. Hence, two other variables are included that describe the degree of coordination in the bargaining process on both the firm and worker side.

Finally, two variables are included that capture some key differences in unemployment insurance programs across countries. The first variable, the benefit replacement rate, measures the average percentage of before-tax earnings covered through unemployment benefits. The second variable is a proxy for the duration of unemployment benefits. A large literature, mostly triggered by the rise in European unemployment during the last decades, has found that generous unemployment programs reduce hours worked through two channels. First, they provide less incentive for unemployed workers to search for a new job. Second, by making unemployment less painful, they create pressure on firms to increase wages, thereby reducing the demand for labor.

Before proceeding with the formal statistical analysis, it is helpful to return to the case of Germany and the United States to examine how the institutions described in this section have changed over time for the two countries. Table 3 reports the values of the institutional variables for Germany and the United States in the first and the last years for which data are available. Some striking features are apparent. In terms of employment protection, the index for Germany in 1965 was four times higher than for the United States (0.41 vs. 0.10). More important, the same index tripled between 1965 and 1995 in Germany, indicating a much stricter employment protection regulation over time, while it remained constant in the United States.

The fraction of workers who are unionized fell slightly from one-third to one-fourth in Germany over the same period. In the United States, in contrast, the fraction of workers who are unionized fell much more sharply, dropping from slightly less than one-third to only 15 percent. Bargaining coordination was greater in Germany in both 1965 and 1995, but this measure did not change in either country over time.

Finally, unemployment benefits have evolved in both countries over time. Benefit replacement rates fell in Germany and rose in the United States, but they still remain higher in Germany. The duration of unemployment insurance benefits increased in both countries, although the level remains much higher in Germany.

The key feature of the time series is the ongoing fall in hours of work in Germany relative to the United States. Intuitively, any factor which is going to play an important role in producing this outcome should also exhibit a pattern of ongoing relative change over time. The only variable in Table 3 that seems promising in this regard is employment protection. This measure increases in Germany and stays constant in the United States. These factors will be explored more rigorously in the next section.

III. EMPIRICAL INVESTIGATION: HOURS OF WORK, TAXES, AND LABOR MARKET INSTITUTIONS

Which factors have been most important in affecting hours of work in OECD countries during the postwar period? The information contained in the time series of variables and in the cross-section of countries helps to identify the factors that are statistically associated with the observed patterns in hours of work.

Three important findings emerge from Table 4. First, the coefficient on taxes is large and significant, and taxes alone explain a large fraction of the variation in hours of work as captured by the R^2 . The results indicate that, on average, a one-percentage-point increase in taxes is associated with a 0.4-percentage-point decrease in hours of work. This strong negative correlation is the statistical counterpart of the strong negative association presented in Charts 1 and 2.

Table 4

REGRESSION RESULTS: HOURS, TAXES, AND LABOR MARKET INSTITUTIONS

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Taxes	-.44 (.02)	-.40 (.02)	-.45 (.02)	-.44 (.02)	-.44 (.02)	-.45 (.02)	-.40 (.02)	-.41 (.02)
Employment protection		-.08 (.01)						-.09 (.01)
Net union density			.06 (.05)					.04 (.05)
Bargaining coordination 1				-.03 (.03)				-.05 (.03)
Bargaining coordination 2					.00 (.01)			.00 (.01)
Benefit replacement rates						.02 (.03)		.11 (.03)
Benefit duration							-.12 (.02)	-.12 (.02)
R²	.52	.55	.52	.52	.52	.52	.54	.59

Note: Standard errors in parentheses.

The second key finding is that the importance of taxes in the regression is not affected by the inclusion of any of the other institutional variables, either individually or collectively. In fact, the magnitude and significance of the coefficient on taxes is virtually unaffected by these other variables.

Finally, although factors such as employment protection and benefit duration turn out to be statistically significant, they add relatively little explanatory power to the fit of the regression. The value for the R^2 , in fact, is always similar to the value obtained with taxes only.

In summary, the findings provide evidence in favor of the idea that changes in taxes explain a large fraction of the changes in labor supply across OECD countries over the postwar period.

IV. EVIDENCE FROM TIME USE SURVEYS

What are the implications of higher taxes for labor supply, and how do taxes affect the incentives to work? To answer these questions, this section relies on information from time use surveys reported by Freeman

and Schettkat (2002, 2005). The section finds that the reallocation of hours worked from home to market activities is an important mechanism affecting the dynamics of total hours of market work.

The previous discussion suggests that individuals living in countries with higher taxes would allocate a larger fraction of their time to home activities. To the extent that, in most economies, women continue to bear greater responsibility for home production activities, this effect should be most significant for married women. This results in both shorter workweeks and lower employment levels.

Market work vs. home production

In time use surveys, respondents record their primary activity for each time interval (usually 10 or 15 minutes) over the course of a day. By interviewing many individuals throughout the course of a year, time use surveys can provide a reasonable representation of how people allocate their time among activities.

Time use surveys include activities that can be grouped into four categories: market work, home work, leisure time, and personal time. Market work is time spent in paid employment, including time spent going to and from work. Home work is time spent in home production, which includes activities such as cooking, cleaning, yard work and child-care. Total time working consists of market work plus home work. Leisure time includes traveling, going to the theater, watching television, or participating in sports. Personal time includes activities such as eating and sleeping.

Table 5 shows statistics on time allocation in selected European countries and the United States for married couples aged 25-54. There are only small differences between the United States and the European countries in the *total* time spent working. In both cases, roughly one-third of the total time available is allocated to working activities. The main difference between Americans and Europeans is how they allocate their total working time between market work and home production. While Americans work more in the market, Europeans split their working time more evenly between home and market activities.

These results have the following implications—at least for couples aged 25-54: Statements about Americans working more than Europeans apply primarily to market hours of work. When total hours of work are considered, Americans and Europeans are similar.¹¹ Further, differences

Table 5

TIME USE IN THE UNITED STATES AND EUROPE

	United States	Europe
Total working time	59.4	59.3
Market work	35.6	31.2
Home production	23.8	28.1
Personal time	71.0	74.1
Leisure	35.6	34.5
Total hours per week	168	168

Notes: Selected European countries are Austria, Germany, Italy, Netherlands, Norway, and Sweden. Figures refer to mean hours per week for couples aged 25-54.

Source: Authors' calculations, based on data from Freeman and Schettkat (2005)

Table 6

TIME USE IN THE UNITED STATES AND EUROPE BY GENDER (HOURS)

	U.S.		Europe	
	Men	Women	Men	Women
Market work	44.1	28.7	43.4	20.7
Home production	16.1	30.1	13.6	40.5
Personal time	70.7	71.2	73.6	74.6
Leisure	36.4	35.0	37.4	32.1
Total hours per week	168	168	168	168

See "Notes" in Table 5.

Source: Freeman and Schettkat (2005)

in "preferences" are not a promising avenue to explain the patterns presented in this article, in that attitudes toward work per se seem not to differ across countries. Rather, one would have to argue that attitudes concerning market versus home work differ across countries. It is difficult to imagine why American and European attitudes would have diverged enough to explain the differing time use trends.

There are also significant cross-country *gender* differences in the allocation of time. Table 6 shows weekly time allocations in the United States and Europe for men and women aged 25-54.

A significant fraction of the differences in total hours of work by Americans and Europeans originates from gender differences. The overall allocation of time for American and European men is similar. In addition, the difference in home production between American and European men

Table 7

FEMALE EMPLOYMENT RATES AND POLICIES

	Average Female Employment Rate	Average Government Family Policies in Percent of GDP
Australia, Canada, New Zealand, United States	.66	1.91
Belgium, France, Germany Italy, Netherlands, Spain	.54	1.93
Denmark, Finland, Norway, Sweden	.71	3.48

Source: Author's calculations based on OECD data.

is only marginal.¹² However, the variation in time allocations for women is substantial. American women spend 28.7 hours working in the market and 30.1 working at home. In contrast, European women allocate a much larger portion of their time to home activities (20.7 hours of market work, 40.5 hours of home work). The total time allocated to personal activities and leisure is essentially the same for the two groups.

In summary, the evidence provided by time use surveys is broadly consistent with the strong negative relationship between hours of market work and taxes. In European countries, high taxes on market work discourage such work and encourage home production, thus distorting the allocation of time between activities.

Do taxes always decrease market work?

The analysis in this article has suggested that taxes play an important role in the allocation of time between home and market activities. It has, however, been silent on the role of government expenditures financed through those taxes, an important factor in shaping the patterns described in the analysis. For example, Rogerson 2007 shows that government programs that provide subsidized childcare for working people partially offset the negative effects of high taxes on labor supply.¹³

Table 7 reports average female employment rates and average expenditures on Family Policies as a percentage of GDP in 2003. According to the OECD classification, Family Policies include government programs such as child care support or income support during parental leave.

Given the patterns in hours of work and taxes observed in the data, the table classifies countries into three groups. The first group includes Australia, Canada, New Zealand, and the United States. In these countries, more than two-thirds of women work in the market, and both taxes and spending on family programs are low. The second and third groups include countries from continental Europe and Scandinavia, respectively. Both of these groups have high taxes, but they differ significantly in spending on social policies and female employment. For example, Sweden, Denmark, Norway, and Finland spend an average of 3.48 percent of their GDP on Family Policies, and their female employment rates exceed 70 percent. Germany, France, Italy, Spain, Belgium, and the Netherlands, in contrast, spend an average of 1.93 percent of their GDP on Family Policies, and their female employment rates are 54 percent.

Overall, Table 7 suggests that the combination of taxes and expenditure programs has important implications for labor supply, particularly for female participation in market work.¹⁴

V. CONCLUSIONS

The motivation of this article stems from a striking empirical fact: The variation in hours of work across OECD countries exceeds the variation over the business cycle in a representative country by almost an order of magnitude. In light of the importance that academics and policymakers attach to business cycle variations in hours of work, cross-country differences in work hours deserve serious attention as well.

This article finds a strong negative relationship between hours of work and taxes. Countries that experienced steep declines in hours of work also display steep increases in labor tax rates. The statistical analysis in this article did not uncover a large role for any of the other policy and institutional variables that are often cited as potentially important.

The article also emphasized the economic mechanism through which high taxes affect labor supply. According to standard economic theory, high taxes should induce a substitution from hours of work in the activity that is taxed (market work) to alternative activities. In fact, the article finds that in high-tax countries people allocate a larger fraction of their time to home production, such as cooking and cleaning. Interestingly, time surveys indicate that the hours of leisure enjoyed by

Americans and Europeans are similar. Thus, differing attitudes toward work between the two groups is not a plausible explanation for the allocation of work time, as some authors suggest. Finally, as with the differences in time allocated to home production, differences in female employment rates seem to be quantitatively significant.

APPENDIX: DATA

For each country, the measure of aggregate hours of work is the product of two numbers: civilian employment and annual hours of work per person in employment. To take into account the fact that countries differ in population size, our statistics are then normalized by the size of population aged 15-64. The rationale for this normalization stems from two considerations related to our sample of countries. First, most individuals under age 15 are full-time students. Second, most individuals over the age of 65 are retired from market work. Aggregate hours of work are computed for each country and for the period 1956-2004 using the formula:

$$H = \frac{(\text{Annual hours per employee}) * \text{Employment}}{\text{Population (15-64)}}$$

Data on hours of work, employment, and population aged 15-64 are from Groningen Growth and Development Centre and the Conference Board. Data on male and female employment rates are from the OECD *Economic Outlook*. The sample of countries includes: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, the Netherlands, Norway, New Zealand, Portugal, Spain, Sweden, Switzerland, United Kingdom, and the United States. When we conduct our statistical analysis, the sample reduces to 15 countries because we do not have institutional variables and tax measures for Denmark, Greece, Ireland, New Zealand, and Portugal.

The measures of average effective tax rates for labor income and consumption are from McDaniel 2006, which extends the procedure of Prescott 2004 for a large set of countries and long period of time. Taxes on labor income reflect both payroll taxes and taxes levied on labor income of households. Average tax rates do not make any adjustment for progressivity. According to economic theory, both income and consumption taxes affect the incentives to supply labor by lowering the real wage. Hence, the tax factor used in this article combines both tax rates as follows:

$$1 - \tau = \frac{1 - \tau_L}{1 + \tau^c},$$

where τ_L is the income tax rate and τ^c is the consumption tax rate.

In constructing such tax factor, several issues arise. First, the tax rates calculated by McDaniel 2006 are average tax rates, while theory indicates that the relevant tax rate be the marginal tax rate. Unfortunately, it is almost impossible to collect accurate data on marginal effective tax rates across countries. However, given that the analysis relies on changes in tax rates over time within a country, this issue will not be so pressing as long as the relation between marginal and average tax rates is stable over time within countries, even if it differs across countries. Second, although the results reported in the article are based on effective tax rates as calculated by McDaniel 2006, the findings are virtually identical if we instead use tax rates calculated according to different procedures (see, for example, Mendoza and others 1994 or OECD).

Institutional variables used in our regressions are taken from Nickell-Nunziata Labor Market Institutional database (2001).

- *Employment protection.* This variable is higher the stricter the employment protection legislation, with range {0, 2}.
- *Net union density.* This variable measures the fraction of workers that were union members over the sample period covered.
- *Bargaining coordination.* These indices are increasing in the degree of coordination in the bargaining process on the employers' as well as on the unions' side. Both indices have range {1, 3}.
- *Benefit replacement rates.* This variable measures the percentage of (average before tax) earnings covered through unemployment and social insurance programs.
- *Benefit duration.* This variable is a proxy for the duration of unemployment benefit specified above. A value of zero indicates that the unemployment benefit provision stops within the first year. A value of one indicates that unemployed receive the amount defined in BRR for five years.

Finally, data on government social programs comes from the OECD Social Expenditure Database (Policy Area: Family–Child allowances and credits, childcare support, income support during leave, and sole parent payments).

Section III makes use of regression analysis to investigate which factors display a strong empirical correlation with hours of work in the data. More specifically, a panel regression is performed using the following specification:

$$\ln(H_{i,t}) = \alpha_i + \beta \ln(\tau_{i,t}) + \gamma' X_{i,t} + \varepsilon_{i,t},$$

where $H_{i,t}$ is the time series of hours of work in country i , α_i is a country fixed effect, $\tau_{i,t}$ is the tax rate used in our analysis above, and $X_{i,t}$ includes the institutional variables. Data limitation on institutional variables restricts the sample to the period 1960-1995 and reduces the number of OECD countries from 21 to 15.

ENDNOTES

¹See for example Aguiar and Hurst 2007 for a discussion of these trends.

²In fact, many economic models assume that income and substitution effects generated by changes in wages cancel out, implying no long-run changes in leisure.

³See the appendix for more details about the dataset.

⁴The calculation for the time-series standard deviation refers to the business cycle component of hours worked and is obtained applying the Hodrick-Prescott filter to the original series.

⁵See Rogerson 2006 for greater discussion of this issue.

⁶The R^2 measures the proportion of variation in the dependent variable (in our case, the logarithm of hours worked) that is accounted for by the variation in the independent variables (constant and time trends). It lies between zero and one. One indicates that there is a perfect linear relationship among variables.

⁷Recent work by Prescott 2004 suggests that taxes account for most of the variation in labor supply across G7 countries during the periods 1970-1974 and 1993-1996.

⁸The appendix provides details on the construction of the tax measures.

⁹Aguiar and Hurst 2007 show that, in the 1980s, there was a large increase in hours of market work by women, together with a smaller increase in leisure. This is consistent with the idea that there was an additional economic force of interest operating in the U.S. during this time period, whose effect was to reallocate work from home activities to market activities. This force could have been either technological in nature (that is, the market became relatively better at producing services that were previously provided in the home), or preference based (that is, preferences for either market work relative to home work or market consumption relative to home produced consumption changed). Regarding the 1990s, recent work by McGrattan and Prescott 2006 shows that rapid technological increases in sectors that produce intangible capital, such as information technology, and are not properly measured in national accounting statistics can explain the large temporary boom in market hours of work during the last decade.

¹⁰This statistical analysis uses indices for the labor market institutions collected by Nickell and Nunziata in the "Labour Market Institution Database," available at the CEPR. The reader may consult the original source for issues related to the construction of such indices. The appendix briefly explains the variables used in the regressions.

¹¹Other studies, such as Burda, Hamermesh, and Weil 2006, find that Europeans do enjoy more leisure than Americans. The sample they consider includes younger (20-25) as well as older cohorts (55-74) of the population. Nevertheless, the overall difference in leisure remains small compared to the large differences in the market work.

¹²Most of the difference originates from one outlier, Italian men, which reports only 8.2 hours allocated to home activities and more time allocated to personal use and leisure. If we exclude Italy, the numbers for European and American men are very much alike.

¹³For interesting work on the link between taxes, social policies, and labor supply, see also Olovsson 2004 and Ragan 2005.

¹⁴The Lisbon European Council (March 2000) encouraged EU countries to consider as a priority the promotion of family policies with the goal of boosting female employment rates above 60 percent by 2010.

REFERENCES

- Alesina, Alberto, Edward Glaeser, and Bruce Sacerdote. 2005. "Work and Leisure in U.S. and Europe: Why So Different?" National Bureau of Economic Research, *Macro Annual*, pp. 1-64.
- Blanchard, Olivier, and Justin Wolfers. 2000. "The Role of Shocks and Institutions in the Rise of European Unemployment: The Aggregate Evidence," *Economic Journal*, vol. 110, pp. 1-33.
- Freeman, Richard B., and Ronald Schettkat. 2005. "Marketization of Household Production and the EU-US Gap in Work," *Economic Policy*, vol. 20, pp. 6-50.
- McDaniel, Cara. 2006. "Effective Tax Rates for 15 OECD Countries: 1950-2003," Arizona State University, mimeo.
- Ohanian, Lee, Andrea Raffo, and Richard Rogerson. 2006. "Long-Term Changes in Labor Supply and Taxes: Evidence from OECD Countries, 1956-2004," National Bureau of Economic Research, Working Paper no. 12786.
- Olovsson, Conny. 2004. "Why Do Europeans Work So Little?" Stockholm School of Economics, mimeo.
- Prescott, Edward C. 2004. "Why Do Americans Work So Much More than Europeans?" *Federal Reserve Bank of Minneapolis Quarterly Review*, vol. 28, pp. 2-13.
- Ragan, Kelly. 2005. "Taxes, Transfers, and Time Use: Fiscal Policy in a Household Production Model," University of Chicago, mimeo.
- Rogerson, Richard. 2007, forthcoming. "Taxation and Market Work: Is Scandinavia an Outlier?" *Economic Theory* (Special Issue in Honor of Edward Prescott).
- _____. 2006. "Understanding Differences in Hours Worked," *Review of Economic Dynamics*, vol. 9, pp. 365-409.