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# Understanding differences in hours worked

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**Abstract**

This paper documents the large differences in hours of work across OECD countries, and presents evidence on how they have evolved over time. It argues that changes in technology and government are promising candidates to explain the broad changes over the period 1956–2003.


*JEL classification:* E24; J22

*Keywords:* Hours worked

## 1. Introduction

The manner in which economists address macroeconomic issues has changed dramatically over the last forty years. One striking change concerns the role of labor supply in macroeconomic analyses. Forty years ago the standard assumption was that desired hours of work in the economy (i.e., labor supply) was a constant determined solely by the size of the population, and independent of everything else, including wage rates, tax rates and government transfer programs. Today, variation in labor supply plays a central role in most macroeconomic analyses. The initial impetus to this change can largely be attributed to the seminal work of Lucas and Rapping (1969), that analyzed the role of labor supply in accounting for changes in aggregate hours of market work in the US from 1929 to 1965.

Given the dramatic change in the way economists think about labor supply, it should come as no surprise that the last forty years has witnessed a virtual explosion in work on various aspects of the aggregate labor market, spanning data collection, data analysis, model development and

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policy analysis. In thinking about the theme for this paper I considered trying to summarize and synthesize some of what has been learned in this process. But instead, I have decided to focus on one particular issue—understanding differences in aggregate hours of work across countries. The motivation for this stems from the realization that the analysis of specific issues serves a key role in organizing knowledge in economics. For example, statements about whether a particular model feature is important can usually only be made in the context of studying a specific issue. The more central the issue, the greater role it will play in organizing knowledge. In this sense I would say that certain observations or issues can be said to be *focal observations* because of the role they play in organizing knowledge. Prominent examples include the set of moments that Kydland and Prescott (1982) used to summarize business cycle fluctuations, and the cross-country output per worker numbers from such sources as the Penn World Tables. In the context of aggregate labor market outcomes, I cannot think of a more basic statistic than aggregate hours worked, and as a result I believe that the issue of understanding differences in hours worked has the potential to serve an important role as an organizing device for knowledge about labor supply. Having said this, let me present the basic observation on which I will focus.

## 2. A motivating observation

This section lays the groundwork for the rest of the paper. In the first subsection I document the large differences in hours of work across countries. In the second subsection I argue that these differences may be associated with large welfare differences. The third subsection lays out the research agenda suggested by these first two pieces of evidence, and the fourth subsection describes how the remainder of this paper fits in that agenda.

### *2.1. Cross-country differences in hours of work*

In this subsection I present cross-country measures of aggregate hours of market work for a cross section of 21 OECD countries in 2003. Given that countries have different populations, one must normalize aggregate hours of work by some measure of size to make meaningful cross-country comparisons. While one could rationalize different normalizing factors, I choose to normalize by the size of the population aged 15–64. Given that in the 21 countries considered, most individuals under age 15 are full time students and do not engage in market work, and most individuals over the age of 65 are retired from market work, this seems a reasonable choice.

The data that I use come from two sources. Data on employment and population aged 15–64 come from the OECD Labor Market Database. Data on annual hours of work per person in employment comes from the GGDC Total Economy Database. Aggregate hours of work is simply the product of employment and annual hours of work per person in employment. Readers are referred to the associated sources for details regarding data construction, but here I mention a couple of points. First, annual hours worked per person in employment should not be interpreted simply as a measure of the workweek. In addition to variation in the workweek it includes variation in vacation time, statutory holidays, days of work lost due to strikes, and sick time. Since available evidence suggests that differences in vacation days, for example, are quantitatively significant, it is important to incorporate such differences. Second, since there are clearly some important measurement issues regarding the construction of such a measure for a single country at a point in time, there are potentially even larger issues in producing reliable cross-country comparisons over time. However, having made this qualification, these data seem to be the best available, and in what follows I will take them at face value.

Table 1
Aggregate hours worked relative to US (2003)

| < 0.75 | (0.75, 0.85) | (0.85, 0.95) | > 0.95 |
|---|---|---|---|
| Belgium | Austria | Denmark | Australia |
| France | Finland | Greece | Canada |
| Germany | Ireland | Portugal | Japan |
| Italy | Netherlands | Sweden | New Zealand |
| | Norway | UK | Switzerland |
| | Spain | | |

Table 1 shows the distribution of hours of market work per person of working age relative to the US for 20 other OECD countries in 2003. The differences reported in Table 1 are enormous. To put the magnitude in perspective I compare these differences with those that correspond to movements of hours worked over the business cycle. Using the same data for the US over the period 1956–2003, if one defines the business cycle component by looking at the deviations from a trend defined by the HP filter with smoothing parameter equal to 100, the largest positive deviation from trend in any year is equal to 4.27% and the largest negative deviation from trend is equal to 3.82%. It follows that the maximum cross-country discrepancies are almost an order of magnitude larger than those found at business cycle frequencies in the post WWII US data. Given the large amount of effort devoted to understanding fluctuations in hours of work over the business cycle, it seems that these cross-country differences also merit serious attention.

### 2.2. *Hours worked and welfare*

While the above comparison suggests that the differences in hours worked are large, as economists we would also like to know if these differences might be important from a welfare perspective. I next describe a simple exercise that serves as a first pass at assessing the potential welfare importance of these differences, under the presumption that the differences do not reflect differences in technology or preferences. I carry out this calculation using the version of the standard neoclassical growth model that has become the workhorse model of modern macroeconomics.

Although the details of this model are likely familiar to all readers, I include them for completeness. There is a constant returns to scale aggregate production function that uses capital ($k_t$) and labor ($h_t$) to produce output ($y_t$) given by:

$$y_t = F(k_t, h_t).$$

Output in period $t$ can be used either as consumption ($c_t$) or investment ($i_t$), and capital is accumulated according to:

$$k_{t+1} = (1 - \delta)k_t + i_t$$

where $0 < \delta < 1$ is the depreciation rate.

There is an infinitely lived representative consumer who is endowed with one unit of time each period and has preferences defined over streams of consumption and leisure $(1 - h_t)$ given by:

$$\sum_{t=0}^{\infty} \beta^t u(c_t, 1 - h_t)$$

where $0 < \beta < 1$ is the discount factor.

For the calculations that follow I adopt standard functional forms:

$$F(k,h) = k^{\theta}h^{1-\theta}, \qquad u(c,1-h) = \alpha \log c + (1-\alpha)\frac{(1-h)^{1-\gamma}-1}{1-\gamma}.$$

I consider several values of $\gamma$ but in each case I assume that the values $\beta = 0.96$, $\theta = 1/3$, and $\delta = 0.08$ remain the same, whereas the value of $\alpha$ is adjusted as $\gamma$ varies so that in steady state a Social Planner would set $h = 1/3$. These values are all typical of those used in the literature if a time period is chosen to be one year.

Let $c^*$, $k^*$, and $h^*$ represent the steady state solutions that correspond to the Social Planner's problem for this economy. To assess the welfare consequences associated solely with departures of $h$ from its efficient level, I next consider a restricted Social Planner's problem in which the Social Planner faces one additional constraint: $h_t = \bar{h}$. Let $\bar{c}$, $\bar{k}$, and $\bar{h}$ be the steady state solutions for this social planner's problem. Assuming that the economy starts in the restricted steady state, I compute the increase in welfare associated with removing the restriction $h_t = \bar{h}$, and letting the economy move optimally to the (unrestricted) steady state in which $h = h^*$. If $\{c_t\}$ and $\{h_t\}$ are the optimal paths for $c$ and $h$ following the removal of the hours restriction, then the increase in welfare is captured by the value of $\lambda$ in the following equation:

$$\sum_{t=0}^{\infty}\beta^t u\big((1+\lambda)\bar{c}, 1-\bar{h}\big) = \sum_{t=0}^{\infty}\beta^t u(c_t, 1-h_t).$$

The interpretation is that $\lambda$ is the fraction by which consumption would have to be increased each period relative to the restricted steady state in order for the representative consumer to be indifferent to having the hours restriction removed. Table 2 shows the results of this exercise.

Since these calculations assume that all decisions other than hours worked are optimal given the time allocation decision, the values in this table reflect the pure costs of having an inefficient allocation of time to market work. The conclusion that I draw from this table is that these costs can be quite large. For example, if $\gamma = 1$ then the welfare cost of having market work equal to two thirds of the efficient level is roughly 10%.[1] Note that as $\gamma$ increases, so too do the welfare costs. However, the flip side of this observation is that as $\gamma$ increases it takes much larger driving forces in order to generate a given difference in hours worked.

The above calculations assumed that the efficient allocation of time to market work was $h = 1/3$. The main message is not sensitive to this value. With $\gamma = 1$ and $\bar{h}/h^* = 0.75$, the welfare cost is 0.044 if the efficient choice was assumed to be $h = 0.25$, versus a cost of 0.052 if the efficient choice was assumed to be $h = 0.4$. The implied costs are increased substantially if one

Table 2
Welfare costs of time misallocation

| $\bar{h}/h^*$ | $\gamma = 0$ | $\gamma = 1$ | $\gamma = 5$ |
|---|---|---|---|
| 0.65 | 0.077 | 0.102 | 0.185 |
| 0.75 | 0.035 | 0.048 | 0.091 |
| 0.85 | 0.012 | 0.016 | 0.033 |
| 0.95 | 0.001 | 0.002 | 0.004 |

[1] The calculations have been presented in a way to suggest that some countries have inefficiently low levels of market work as opposed to the alternative in which some countries have inefficiently high levels of market work. In either case the welfare effects are sizeable.

assumes the efficient allocation is $h = 0.4$ and interprets the US as being $h = 0.33$. In this case, with $\gamma = 1$ a country that has $h$ equal to 0.75 of the US level will suffer a welfare loss of 0.11 relative to the US. However, as noted earlier, these calculations are only meant to be a first pass at assessing welfare consequences, and so the key point is simply that these calculations suggest sizeable welfare costs associated with the misallocation of time to market work.

### *2.3. The research agenda*

The material presented in the previous two subsections suggests an obvious research agenda: To determine which factor(s) can account for such large differences in hours of work across countries. The potential welfare effects provide one obvious motivation. But given the pervasive role of the labor market in modern macroeconomic analyses, a second motivation is that understanding which factors give rise to such large differences in hours of work across countries will presumably help us to better understand what factors are quantitatively important in shaping hours of work more generally.

What does it mean to "understand" the differences in hours of work across countries? It is useful to distinguish between two different levels of understanding. The first level consists of a *qualitative* understanding. This involves naming what are the key factors that differ across countries and describing the economic mechanism by which differences in these factors are translated into differences in hours of work. The second level of understanding entails a *quantitative* understanding. This involves measuring the differences in the key factors that differ across countries, writing down a model that is explicit about individual decision problems and equilibrium that formalizes the economic mechanism linking driving forces with outcomes, choosing functional forms and parameter values consistent with empirical evidence to quantify this mechanism, and then using the quantitative model to evaluate the quantitative effects of the measured differences in factors. When I say that we want to understand the differences in hours worked across countries, I am referring to a quantitative understanding.

I think it is important to note that the search for quantitative explanations of economic phenomena tends to be an ongoing process, rather than one with a definitive end. Several factors contribute to this situation. First, it is often difficult to definitively quantify the economic mechanism implicit in a given model, thereby leading to some ambiguity in the model's quantitative predictions. For example, different observations may imply very different estimates of key parameters. Quantifying a specific economic mechanism naturally becomes an ongoing process, as researchers evaluate the various methods and sources that can be used to obtain parameter values. Second, any quantitative understanding of the form described above takes place in the context of a given model. Changing features of the model, or including some features that were originally abstracted from may change our assessment of the model's quantitative implications. Again, the result is an ongoing process as researchers assess the role of various model features. Third, issues may arise when alternative implications of the quantitative mechanism are examined, perhaps leading us to question the original assessment of the mechanism. And finally, just because one quantitative explanation has been found does not mean that other alternative quantitative explanations that stress different driving forces and different mechanisms cannot be found. If this happens, additional work is needed to distinguish between the two.

Although it is challenging to reach absolute conclusions when assessing quantitative explanations, this is the goal that we must pursue if we are to make headway. While there is a desire among many economists to conduct reduced form empirical analyses that are seemingly "model free" as a way to reach conclusions that are independent of model-specific details, these methods

are ultimately of very limited value. First, these methods only deliver correlations, and correlations are ultimately not evidence of causation. Second, such exercises can never isolate specific economic mechanisms. Third, they also cannot tell us what features of the underlying economic environment are important in shaping the quantitative properties of the mechanism. Fourth, one cannot make assessments of welfare without specifying the underlying economic primitives.

### *2.4. This paper*

Having laid out the goal of the research agenda in the previous subsection, I now describe the plan for the rest of this paper and how it fits within this research agenda. The objective here is modest. While I will report on some quantitative work that has been carried out, the bulk of this paper will be devoted to describing features of the data that I think are useful in guiding the choice of which factors we should be evaluating in our quantitative models, and what elements those models should contain. The theme of the paper will be that a fairly broad and systematic look at the data reveals several informative patterns.

There are three dimensions that characterize the data analysis that I carry out, and it is useful to note how each can add discipline to the exercise. The first concerns the scope of the exercise in terms of number of economies considered. It is quite possible that an explanation looks promising in the context of a single country, or a small number of countries, but looks much less so when one considers a larger group of countries. The second dimension concerns the time horizon considered. While several explanations may look promising to explain a given outcome at a specific point in time, this may no longer be the case when we ask that these explanations also account for the changes in that outcome over time. The third dimension concerns the level of aggregation. While the issue of interest in this paper relates directly to differences in economic aggregates, there is often a lot of additional useful information generated when one disaggregates the data along various dimensions. For example, if aggregate hours of work are less in economy 1 than in economy 2, it would seem to be potentially important to know if hours of work in economy 2 were uniformly lower across all individuals of if the differences were concentrated among a specific group of individuals.

## 3. Patterns in aggregate time series

Knowing how the differences in hours of work have changed over time is likely to be valuable in assessing candidate explanations regarding the differences that we see at any point in time. With this in mind, in this section I document some key patterns found in the aggregate time series data. Using the same sources as for the 2003 cross section I construct series for hours worked per person of working age running from 1956 to 2003.[2] Because our interest will lie in the lower frequency movements in these data, I have used an HP filter with a smoothing parameter of 100 to identify the trend component for each country, and unless otherwise stated the analysis will focus on the trend components.

[2] There are a few notes on data construction. First, there are a few cases of missing values. In all cases I filled them in via linear interpolation. Second, in some cases the employment data in the OECD database is not available, so I used employment data from the Groningen data base. Finally, I made an adjustment to employment in Portugal for all years prior to 1974, since there is a permanent 10% increase in employment at that date. The data on hours and employment as well as documentation is available upon request.

### *3.1. Time series properties of the distribution*

Prior to considering the time series changes for individual countries it is of interest to note a few properties of the distribution of hours worked and how it has changed over time. In particular, this subsection presents evidence to document the following three properties of how the distribution has changed over time:

**Property 1.** *Although the magnitude of variation in hours worked across countries has varied over time, it has been large throughout the entire period covered by our data.*

**Property 2.** *Mean hours worked across countries has decreased markedly over the period considered, and the decrease has been at a fairly steady rate through to the mid 1980s.*

**Property 3.** *There has been substantial movement of countries within the distribution over time.*

We next examine each of these in turn. There are various statistics that one might report to measure the dispersion of hours worked across countries at a point in time. Here I compute the standard deviation of log hours worked, where hours worked is as defined earlier. Figure 1 shows the time series for this measure. As a point of reference, the dashed line shows the standard deviation of the cyclical component of log hours for the US, computed using the HP filter with a smoothing parameter of 100. The figure shows that dispersion remains relatively constant until the mid 1970s, at which point it experiences a 10–15 year period of increase, followed by a moderate decrease. In 2003 the dispersion is about 20% greater than in 1956. However, while dispersion in the cross section has varied over time, the key comparison to note is that the disper-

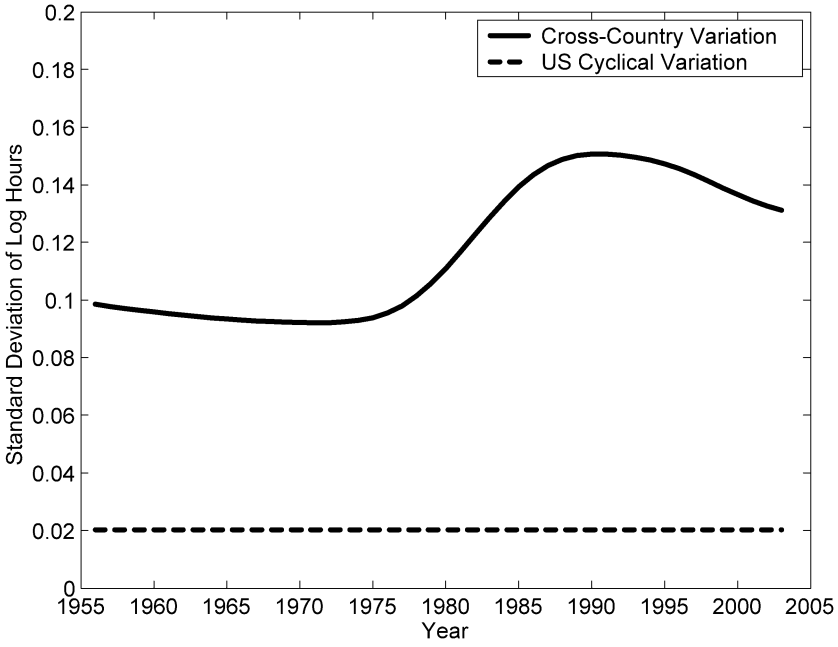


Fig. 1. Cross-sectional variation in hours worked.

sion in the cross section is always at least 5 times higher than the cyclical dispersion in the US time series. A simple point to take away from this is that dispersion in hours worked across this set of countries is not a recent phenomenon.

Next we consider the change in mean hours worked over time. Figure 2 displays the time series for this measure. It shows that mean hours worked has decreased at a fairly steady rate from 1956 though to the mid 1980s, at which point it basically levels off. Mean hours worked in 2003 is just under 83% of its value in 1956, so the decrease is very large.

Lastly I consider the movement of countries within the distribution. One simple way to see this is to look at the correlation between the cross section values at different points in time. Table 3 shows the cross-correlations between the values at 1956, 1970, 1980, 1990 and 2003.

This table indicates that the correlation between the 1956 and 2003 values is close to 0, suggesting that there has been a lot of movement in the distribution. The table also suggests that this change is concentrated in the earlier part of the time period—whereas the correlation between the values in 1956 and 1980 is 0.44, the correlation between 1980 and 2003 is 0.78. Similarly, if one looks at the elements directly beneath the diagonal in the above table, the first two values

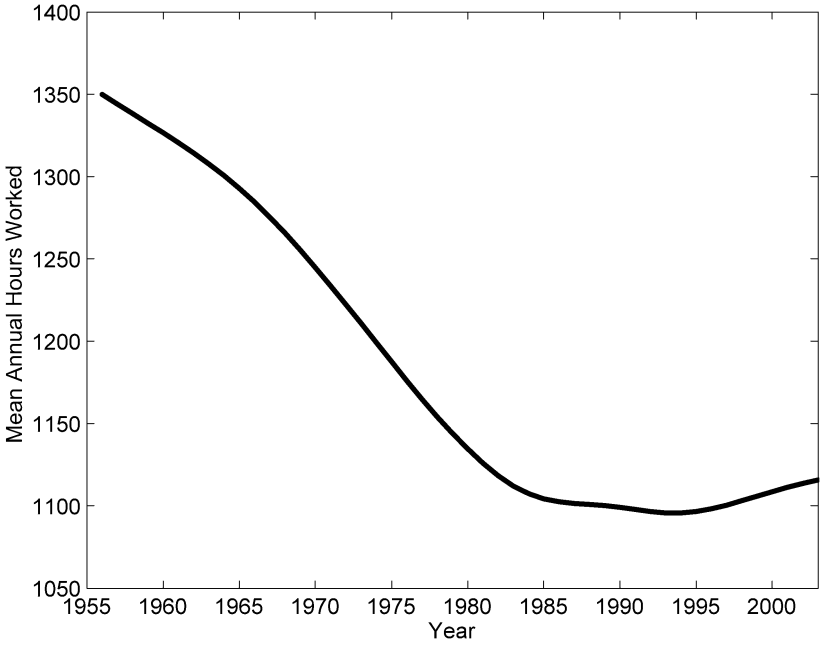


Fig. 2. Mean hours worked.

Table 3
Correlations of hours across time

| | 1956 | 1970 | 1980 | 1990 | 2003 |
|---|---|---|---|---|---|
| 1956 | 1.00 | | | | |
| 1970 | 0.73 | 1.00 | | | |
| 1980 | 0.44 | 0.76 | 1.00 | | |
| 1990 | 0.30 | 0.58 | 0.94 | 1.00 | |
| 2003 | −0.01 | 0.43 | 0.78 | 0.87 | 1.00 |

are 0.73 and 0.76, while the final two values are 0.94 and 0.87. Although the correlation between values in 1956 and 2003 is practically zero, it should be noted that hours at the country level are still highly persistent—as just noted, even during the first part of the period the correlation at ten year periods exceeds 0.75, and over the whole sample the one year correlation of the raw (i.e., unfiltered) data exceeds 0.98.

### *3.2. Country-level time series*

Next we look at the time series changes for individual countries. In what follows I will present pictures for 17 of the 21 countries. As we will see, the dynamics in the four countries not shown here—Greece, Ireland, Netherlands and Spain—follow a different pattern from the other 17 and I will return to them later in the paper. To prevent the plots from becoming too crowded I have included no more than 4 countries on each plot. Each one of Figs. 3 through 7 contains countries from a different column of Table 1, with the exception of the group with the highest hours worked, which is split in two, with Japan and Switzerland being shown separately, though I include the US in this picture to aid in comparisons.

While these figures contain information for 17 countries, a striking feature of the figures is that for virtually every country the pattern is one of hours decreasing at a fairly steady rate throughout the period and then leveling off near the end.[3] What distinguishes the countries is the

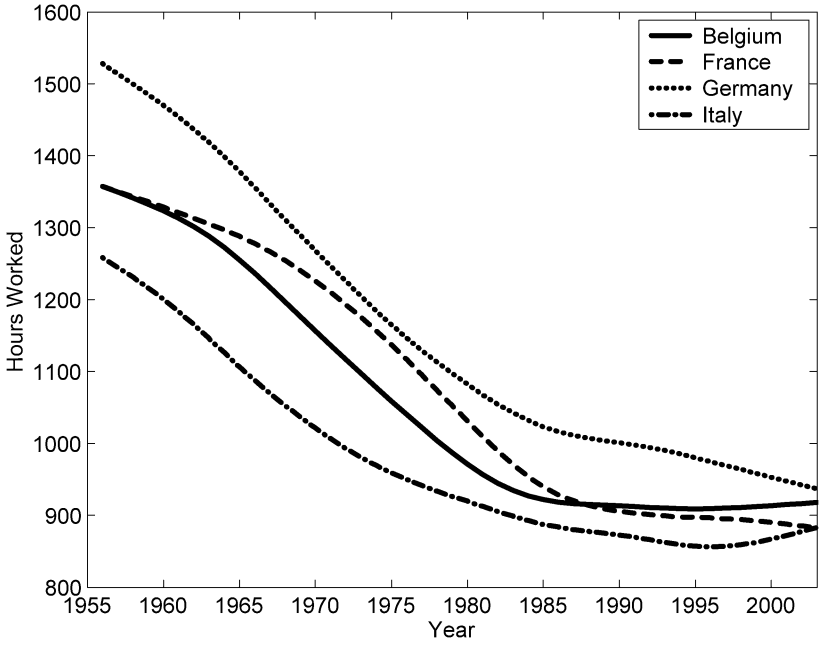


Fig. 3. Hours worked in group 1.

[3] Denmark displays unique behavior among these 17 countries since it experiences an increase over the first part of the period. I suspect that this may reflect mismeasurement, since this increase is entirely due to an increase in the intensive margin (annual hours worked per worker in employment), and Denmark is the only country in the entire sample to experience an increase in this variable.

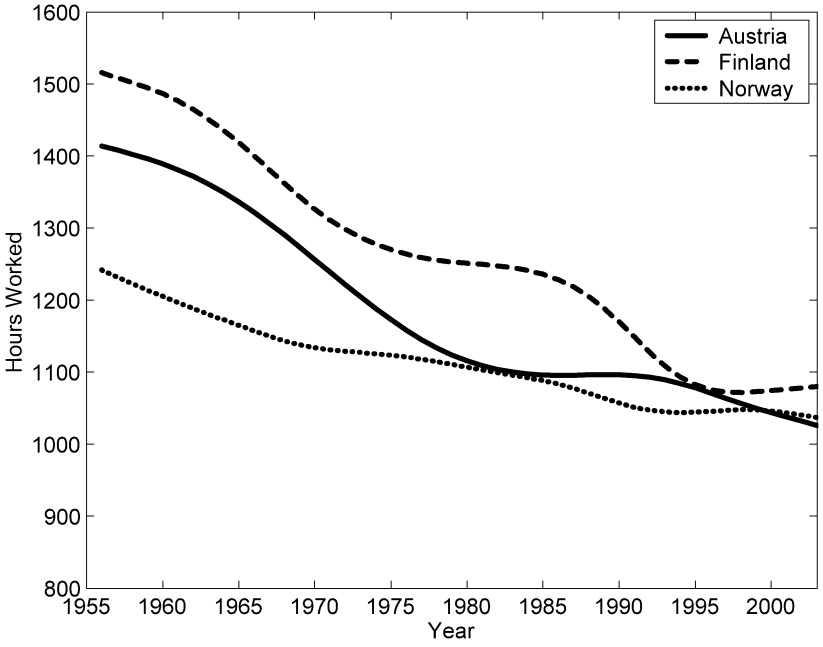


Fig. 4. Hours worked in group 2.

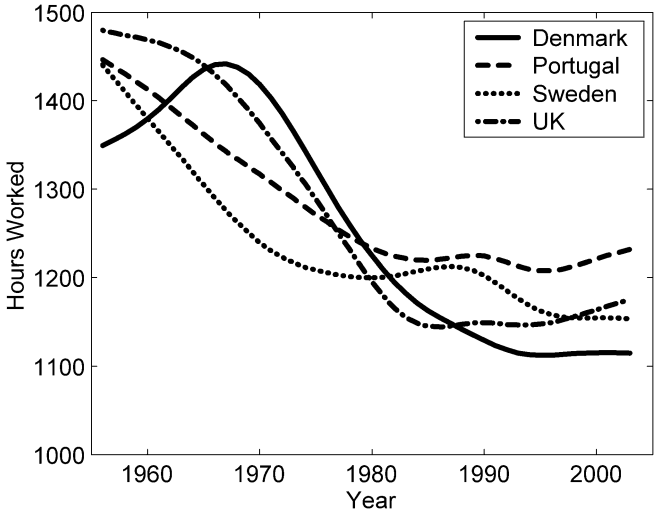


Fig. 5. Hours worked in group 3.

rate at which hours decline prior to leveling off. At one extreme are countries like the US and Canada, who actually experience a modest increase, while at the other extreme are countries like Belgium, France and Germany that experience decreases of more than 30%. To make this point

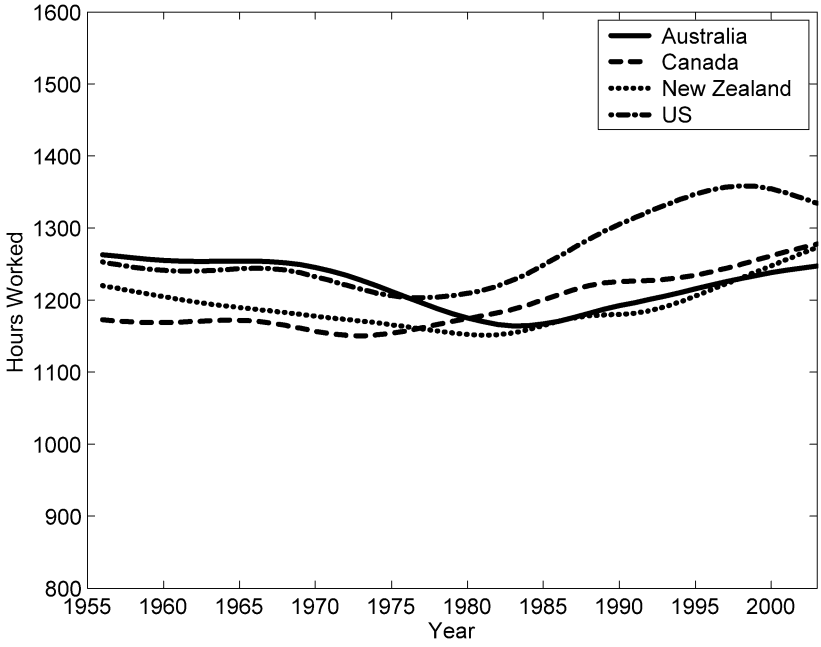


Fig. 6. Hours worked in group 4.

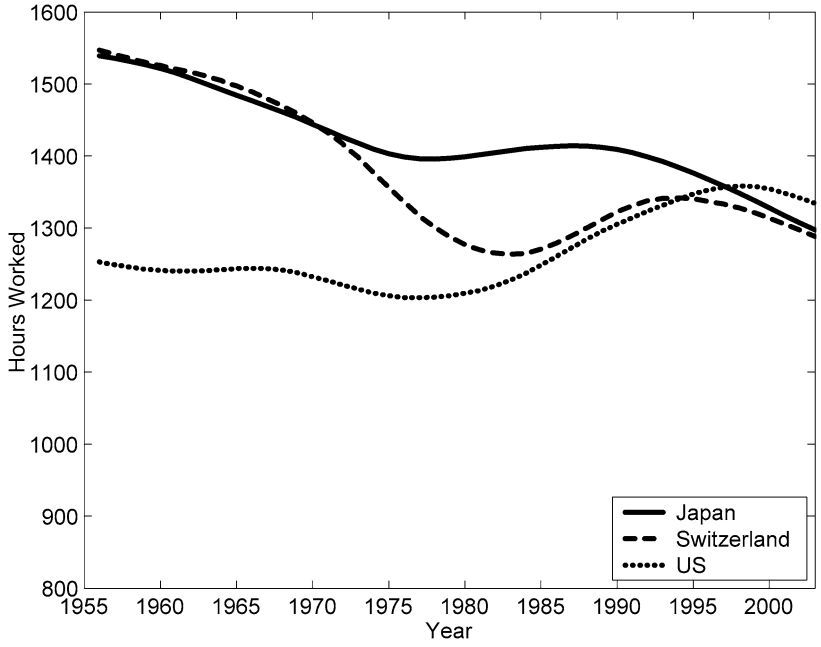


Fig. 7. Hours worked in group 4.

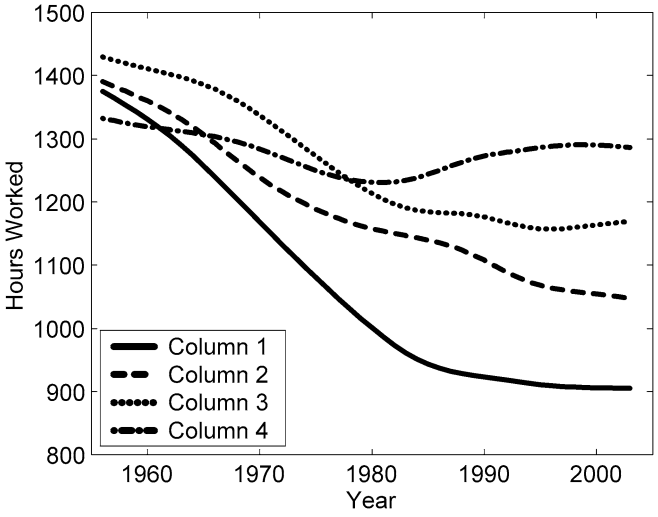


Fig. 8. Hours worked by group.

more formally I run a panel regression of log hours on a common constant term and a country specific time trend:

$$\log h_{it} = a + b_i t + \varepsilon_{it}$$

where $h_{it}$ is the trend component of hours for country $i$ in period $t$, and $t$ runs from 1 to 48. The $R$-squared from this regression is 0.78, providing formal statistical evidence to support the impression that was visually apparent from the previous figures.[4]

To summarize, the previous analysis allows us to pose our original question more sharply. Rather than simply trying to account for the large differences in hours worked in the 2003 cross section, it seems that we should be trying to account for large differences across countries in the rate at which hours decrease between 1956 and 2003. Differences in these (roughly) time invariant rates of decline across countries are the proximate cause of the large differences in the 2003 cross section.

To help summarize the preceding time series plots, Fig. 8 plots the averages for each of the first four plots. We will find it useful to refer to this figure when thinking about the key properties of the dynamics of the distribution.

## 4. A digression on unemployment

Many readers will be familiar with a large literature on the "European Unemployment Problem."[5] The key empirical motivation for this literature was the marked increase in unemployment in many European countries relative to the US. One may ask whether the preceding empirical analysis has done anything more than merely relabel the findings from this earlier analysis.

[4] If one adds a country specific intercept term the $R$-squared increases to 0.91.

[5] The literature is too large to list, but some selective references include Bertola and Ichino (1995), Blanchard and Wolfers (2000), Daveri and Tabellini (2000), den Haan et al. (2002), Ljungqvist and Sargent (1998), and Mortensen and Pissarides (1999).

The answer to this question is an emphatic "Yes," and the goal of this section is to explain why.

For completeness, I begin with a simple time series plot of the average unemployment rate in Europe, shown in Fig. 9.[6] As noted earlier, the striking fact is that the increase in unemployment in Europe is largely an increase relative to countries such as the US. Figure 10 shows the difference in unemployment between Europe and the US. In contrast, Fig. 11 shows the hours worked in this group of four European countries relative to the US. A striking qualitative difference is apparent when comparing these two figures: whereas the unemployment rate differential is roughly constant through to the mid to late 1970s, at which point it experiences a dramatic increase over a ten-year period, the decrease in relative hours worked follows a steady decline starting in 1956 and continuing through almost the entire period.

But much more striking than the qualitative difference between the two series is the quantitative difference. In particular, one can ask to what extent the growing difference in hours of work is accounted for by growing differences in unemployment. To answer this I carry out the following calculation.[7] For concreteness, consider the case of France and the US. I pick 1970 to be the reference year, which means that all changes will be expressed relative to 1970. As noted below, this choice is immaterial for the main findings. Next, consider a year different than the benchmark year, say 1980. For both France and the US I compute the change in the unemployment to population ratio between 1970 and 1980, and compute the increase for France minus the

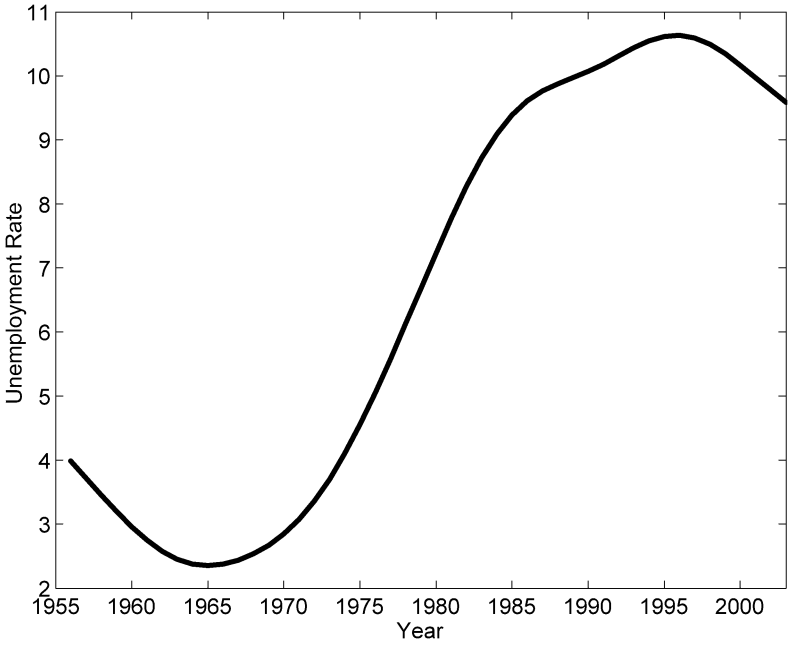


Fig. 9. Unemployment rate in continental Europe.

[6] The countries used in this plot are Belgium, France, Germany, and Italy, which are the four countries with the lowest hours worked relative to the US in 2003.

[7] In this calculation I use the raw data rather than the filtered data.

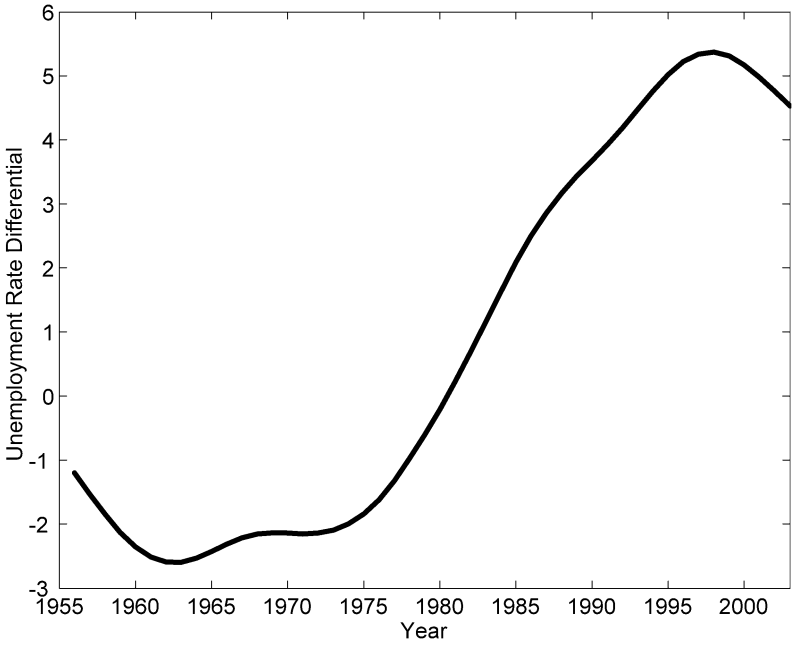


Fig. 10. Differential unemployment: Europe–US.

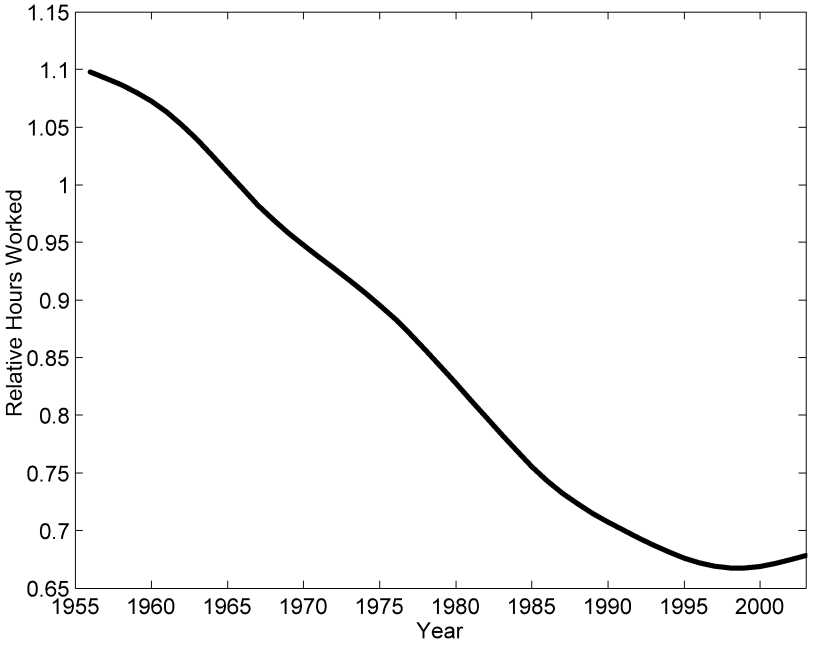


Fig. 11. Relative hours worked: Europe/US.

increase for the US. In reality, the increase in this ratio in France was 0.0267 and the increase in the US was 0.0184, so that the difference was 0.0083.

Next I consider the hypothetical in which the increase in relative unemployment in France did not happen. Instead, I assume that all of the individuals who represented the relative increase in unemployment were employed in 1980 and worked the same number of hours as the average employed person in France in 1980. This corresponds to an increase in the employment to population ratio for France of 0.83%, and each of these workers is assumed to work 1696 hours per year. This would raise hours per person of working age in France by 14.08 in 1980. Doing this for each year we can construct a time series showing the contribution of relative changes in the unemployment rate to the differential in hours of work in France and the US. Comparing this series with the actual differential of hours worked we can assess the contribution of relative changes in unemployment to relative changes in hours worked.

Figures 12 through 15 show the results of this calculation for Belgium, France, Germany, and Italy respectively. The results are striking—in each case it is clear that increases in relative unemployment are a very small part of the relative decrease in hours of work. This is true not only when we consider the entire period 1956–2003, but also when we focus on the post 1970 period that coincides with the large run-up in unemployment. Note that there is nothing special about choosing 1970 as the reference year. Changing the reference year to a different year would imply the same shape for the curve and would simply shift it up or down so that the value in the alternative reference year is zero. It should be clear from the pictures that the same conclusion emerges independent of the choice of reference year.

To summarize, the problem of accounting for the relative rise in European unemployment should be seen as a distinct problem from that of accounting for the relative decline in European

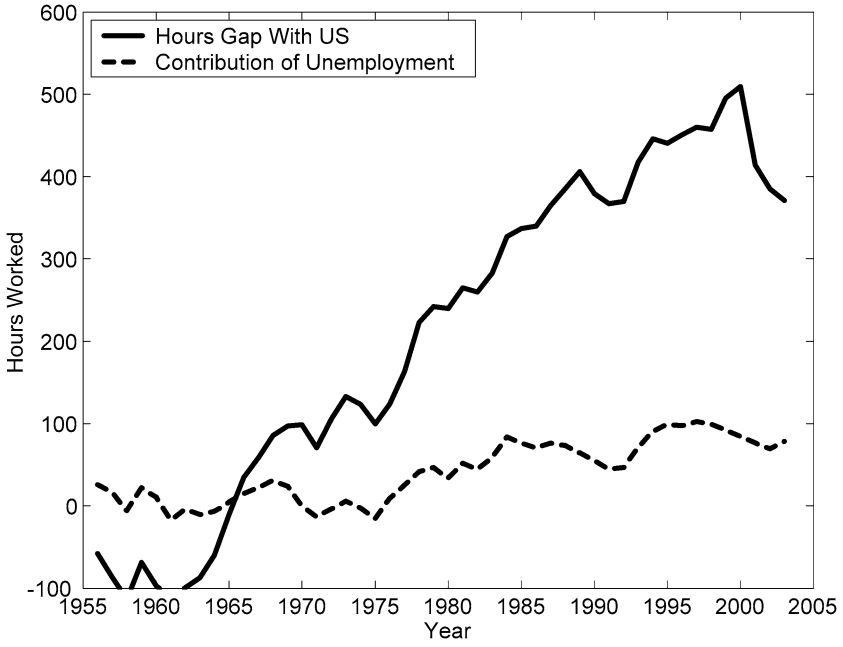


Fig. 12. Hours gap explained by unemployment: Belgium.

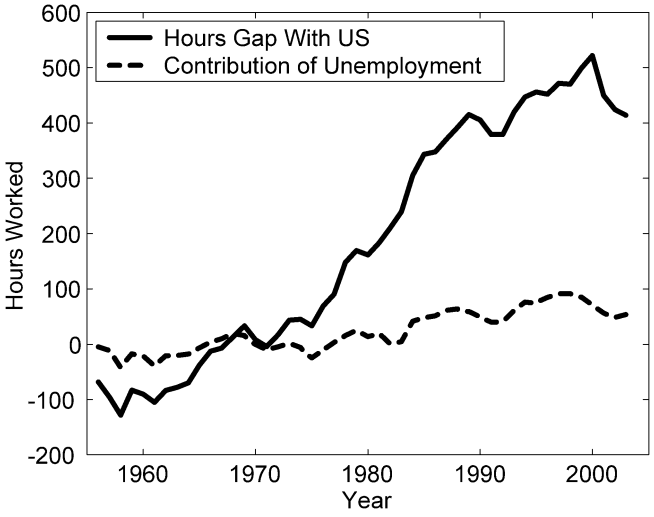


Fig. 13. Hours gap explained by unemployment: France.

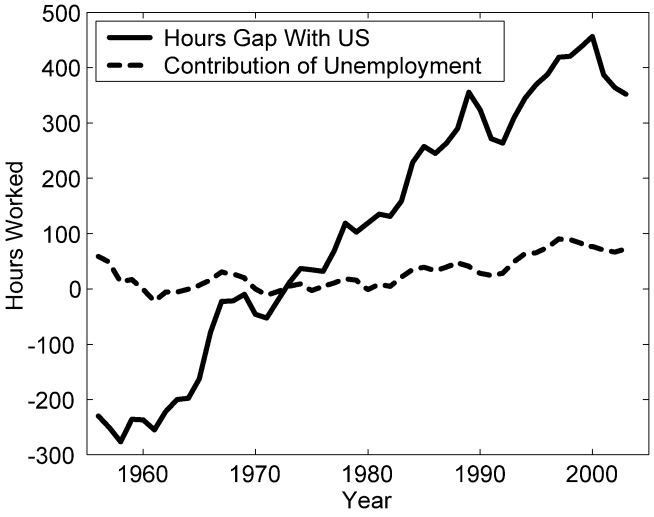


Fig. 14. Hours gap explained by unemployment: Germany.

hours of work: the qualitative patterns are clearly different.[8] But more important is the striking difference in the magnitudes of these two phenomena—once the two are measured in equivalent units, the decline in hours of work is larger by almost an order of magnitude. To me this suggests that a disproportionate amount of effort has been directed at studying the unemploy-

[8] See Pissarides (2006) for a unified account of the evolutions of both hours worked and unemployment for the US and several European countries.

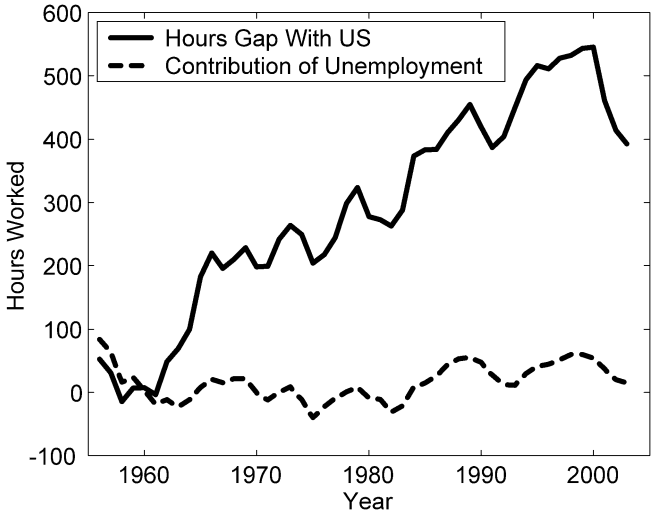


Fig. 15. Hours gap explained by unemployment: Italy.

ment differential at the expense of the much larger and more basic issue of differences in time allocations.

Since this last point is somewhat provocative, it perhaps merits additional discussion. Let me offer some additional comments on the issue of whether we should focus on differences in unemployment or differences in hours of work. As noted in the introduction, for many years the dominant paradigm in macroeconomics held that labor supply was identical across all economies and that all differences in time allocated to work were captured by differences in unemployment. In this context, understanding differences in unemployment is equivalent to understanding differences in time allocated to market work. Although it is now clear that the premise of constant labor supply across countries is not well founded, one might simply interpret the continued emphasis on unemployment rather than hours of work as evidence of intellectual inertia.

A second perspective stems from the observation that economists have long identified the existence of unemployment as puzzling when viewed in the context of standard models of market equilibrium. Loosely speaking, any observations on hours of work could be rationalized in the context of a standard demand and supply model with suitable choices for these curves, but observations on unemployment could not be accounted for within this framework for any choices of the demand and supply curves. Not surprisingly, effort was directed to the observations that seemed hard to reconcile. Viewed from this perspective, one might argue that the reason for the emphasis on unemployment as opposed to hours of work is that it is unemployment that represents the more fundamental challenge to the framework. I would offer the following reply to this argument. If it were the case that hours of work were approximately the same across countries and across time, then it might make sense to assert that understanding hours of work is not a fundamentally important problem. After all, one could argue that explaining hours of work simply amounts to backing out what preferences would have to be in order to rationalize the observed hours, and so does not present any challenge. But given that hours of work vary greatly across economies at a point in time and across time within economies, understanding hours of work would only be a non-issue if one were willing to assert that all differences represent differences in preferences across economies at a point in time and across time within an economy. If not,

then differences in hours of work must be viewed as equally puzzling as the presence of unemployment. And in this case, the quantitative magnitudes of the two "puzzles" should influence which puzzle takes precedence.

A third view is offered by the argument that differences in unemployment have larger welfare implications than differences in hours of work. While this could be true, the logic of the argument is by no means evident. First, from the aggregate perspective, what matters is the allocation of resources, and specifically how time is allocated across activities. Second, from the perspective of individuals, the presence of significant income support programs makes it very difficult to draw inference about the relative welfare of individuals across employment states. Moreover, if the return to working in a given economy is lowered sufficiently that a given individual chooses not to seek employment, it is not clear to me why this does not potentially represent a large loss of welfare at the individual level.

## 5. Two driving forces

While I will present additional patterns in the data in a later section, there is sufficient information in the preceding analysis to make it worthwhile to begin our discussion of potential driving forces. The key feature of the data that I want to emphasize in this discussion is the relatively steady decline in hours of work beginning in 1956 and extending for 30 or more years for a large number of countries. Given this pattern, there are different possibilities for driving forces that one could entertain. For example, it could be that the dynamics observed during the period 1956–2003 are the result of changes that occurred prior to 1956 but that these changes are propagated very slowly, leading to declining hours for more than thirty years. I am not aware of any explanation along these lines that has been proposed in the literature, and will not pursue it further in this paper. It is also possible that this pervasive and steady decline is the result of many time and country specific changes that aggregate to yield the observed patterns. While this is a logical possibility, it does not seem a very interesting starting point. Instead, I adopt what seems a more natural starting point, which is to look for a few common driving forces that are likely to impact on hours of work and that themselves exhibit gradual and ongoing change over the period of interest.

### *5.1. Candidate driving forces*

My initial discussion will focus on two obvious candidate driving forces that exhibit gradual ongoing change that is pervasive across economies during this time period: technology and government. As I document below, both of these factors display slow moving trends with substantial differences across countries, suggesting that differences in driving forces may play a large role.[9] My measure of technology here will be output per hour worked, and my measure of government will be current receipts of government as a fraction of GDP. While TFP might be a preferable measure of technology, I choose the simpler measure of output per hour because it avoids the need to obtain reliable measures of capital over long periods for a large sample of countries. Similarly, taxes on labor might be a preferable measure of government, but measurement issues

[9] An important theme in the European unemployment literature is whether it is differences in driving forces or differences in how a common driving force is propagated that account for the differences in unemployment evolutions. See Blanchard and Wolfers (2000) for a discussion of this point.

arise in obtaining long time series for a large set of countries.[10] Moreover, I will argue later that one should not expect any single statistic to proxy for the economically relevant aspects of government in this context, since the details of both tax and spending programs are important, and neither of these is easily summarized. In view of this, government receipts are just one simple way to measure the size of government involvement in the economy.

Figures 16 and 17 plot the time series of the cross-country means for both of these measures.[11] As can easily be seen, output per hour increases at a fairly steady pace throughout the time

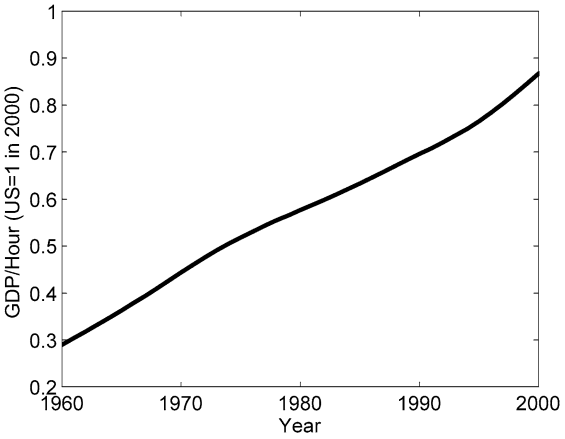


Fig. 16. Mean output per hour worked.

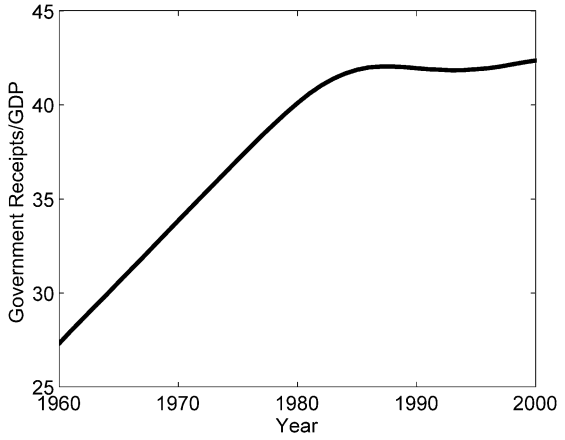


Fig. 17. Mean government receipts/GDP.

[10] Mendoza et al. (1994) have produced series for average tax rates for several countries for some of the period of interest here. Prescott (2004) produces estimates of marginal tax rates on labor for a few countries in both the early 1970s and the early 1990s.

[11] Here again I focus on trend components. Output per hour is computed by using the PWT series for real output per worker measured using PPP, and then divided by the GGDC series for annual hours of work per worker in employment. The series for current receipts of government relative to GDP is interpolated from data for 1960, 1968, 1970, and then every five years until 2000, and are taken from various issues of the OECD Historical Statistics.

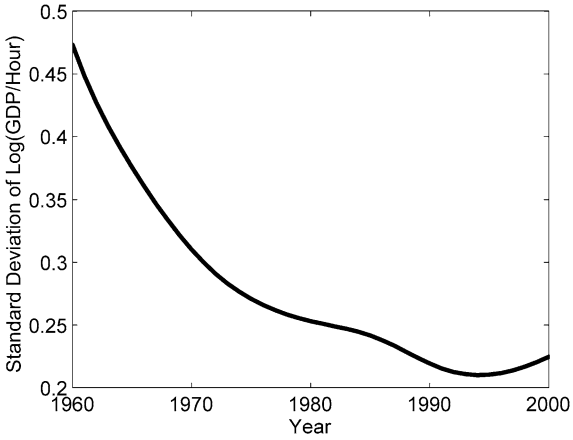


Fig. 18. Variation in output/hour.

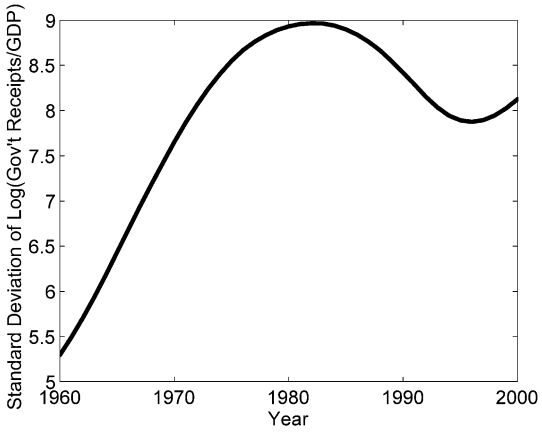


Fig. 19. Variation in government receipts/GDP.

period, with a slight slowdown beginning in the mid 1970s. Government receipts relative to GDP increases at a fairly steady rate though the mid 1980s at which point it flattens out.

Next we examine changes in the variation of these measures across countries. Figure 18 shows the standard deviation of log output per hour. This figure depicts the relatively well known observation that differences in productivity among OECD countries have diminished significantly over the last 45 years.

Figure 19 plots the standard deviation of government receipts relative to GDP. In contrast to the pattern found for output per hour, this distribution is becoming more spread out over time. There is a large increase in dispersion between 1960 and the early 1980s, after which there is a slight decrease, but overall there is a large increase between 1960 and 2000.

### *5.2. Technology and hours: the economic mechanism*

In this subsection I qualitatively describe two mechanisms through which differences in levels and growth rates in technology can produce differences in hours worked. It is common practice

Table 4
Workweek in US manufacturing

| 1850 | 1870 | 1900 | 1930 | 1970 |
|---|---|---|---|---|
| 66 | 62 | 59.6 | 50.6 | 41.1 |

for economists to assert that trend increases in productivity have no effect on hours of work. Indeed, this is what happens along a balanced growth path in the standard growth model with exogenous technological change. However, this view is largely based on looking at the behavior of the US economy in the post WWII period. A longer look tells a slightly different story. A well documented fact is that as countries develop the workweek tends to decrease. Table 4 reports evidence from Whaples (1990) for the US.

As can be seen, the workweek was almost 50% longer in 1870 than it was in 1970. The fact that this decrease in the workweek is such a pervasive part of the development process suggests that it corresponds to a very basic economic force. We also note that for some countries, such as the US, the decline in the work tends to diminish over time, with the level becoming relatively flat. Additional evidence for a larger set of countries is provided by Maddison (1995) in his series for changes in annual hours of work per worker in employment. These series display dramatic decreases over time that almost surely are dominated by changes in the workweek.

A simple way to generate this outcome in a model is to assume that preferences exhibit a subsistence term $\bar{c}$:

$$u(c_t, 1 - h_t) = \alpha \log(c_t - \bar{c}) + (1 - \alpha) \log(1 - h_t).$$

If technology is written as

$$y_t = A_t k_t^{\theta} h_t^{1-\theta}$$

then the subsistence term will generate a negative relationship between hours and output/hour. Note however, that this effect tends to zero as $A_t$ becomes larger and larger, since the effect of $\bar{c}$ becomes smaller as consumption grows. It follows that this effect will be largest at low levels of productivity. Note that this effect will be present even along a path on which $A_t$ grows at a constant rate.

A second mechanism of potential interest is the intertemporal substitution effect associated with movements of $A_t$ around a constant growth path. The qualitative effect of these movements on hours depends on the nature of the variations, but with standard preferences, periods in which an economy is catching up to the technology frontier will result in hours being above the balanced growth path level. This is potentially relevant during the period 1956–2003 since in the early part of this period many European countries lag the US in terms of output per hour, but many of them effectively close the gap by the end of the period.

### *5.3. Government and hours: the economic mechanisms*

The idea that taxes discourage individuals from market work is both an old one and a simple one. It is perhaps one of the few economic predictions that lay people would accept without challenge. Though perhaps true as a statement about reality, we all know that it is not an unambiguous prediction of economic theory. All undergraduate textbooks tell us that if a proportional tax on labor income is imposed on an individual, then holding all else constant the effect on desired hours of work is ambiguous, depending on the relative magnitude of income and substitution

effects. My goal in this section is to point out that even if one resolves this source of ambiguity in the individual decision problem, there is another critical feature to consider in the general equilibrium setting. Specifically, the impact on aggregate hours worked of a proportional tax on labor income is critically dependent upon how the government spends the resulting tax revenue.

For ease of exposition I make this point in the context of a static single household economy in which the household has preferences given by:

$$\alpha \log c + (1-\alpha)\log(1-h)$$

and technology is constant returns to scale in the single factor labor:

$$c = Ah.$$

The preferences chosen have the property that income and substitution effects are exactly offsetting, so that in the decision theory context, a proportional tax on wage income holding all else constant will have no effect on hours of work.[12] In the competitive equilibrium with no government, the equilibrium level of hours worked, denoted by $h^*$, will be $h^* = \alpha$.

Next I introduce a government into this economy and consider several different scenarios. In all of the scenarios I assume that the government levies a proportional tax $\tau$ on labor earnings. What differs across the scenarios is how the government uses the resulting tax revenues. The cases are as follows:

**Case 1.** The government uses the tax revenues to hire workers at the market wage rate, but has the workers either produce nothing, produce something that the household does not value, or produce a good (public or private) that the representative agent values but enters utility separably from $c$ and $1-h$.[13]

**Case 2.** The tax revenues are used to finance a lump sum transfer $T$ (i.e., are independent of hours of work), so that the budget equations for the household and the government are given by:

$$c = (1-\tau)wh + T \quad \text{and} \quad T = \tau wh$$

**Case 3.** Tax revenues are used to subsidize consumption at rate $s$. The budget equations are now written:

$$(1-s)c = (1-\tau)wh + T \quad \text{and} \quad sc = \tau wh$$

**Case 4.** Tax revenues are used to subsidize leisure at rate $s$. The budget equations now read:

$$c = (1-\tau)wh + s(1-h) \quad \text{and} \quad s(1-h) = \tau wh$$

Table 5 shows the implications for equilibrium hours worked in the four cases. An interesting finding from this analysis is that in Cases 1 and 3 there is no effect on hours of work. Additionally, note that Case 4 produces the largest effect. These cases are not simply of intellectual

Table 5
Government spending and hours of work

| $\tau = 0$ | Case 1 | Case 2 | Case 3 | Case 4 |
|---|---|---|---|---|
| $\alpha$ | $\alpha$ | $\alpha\frac{1-\tau}{1-\alpha\tau}$ | $\alpha$ | $\alpha(1-\tau)$ |

[12] This result is dependent on the individual having zero non-labor income.

[13] In this last case we are assuming preferences of the form $\alpha\log(c) + (1-\alpha)\log(1-h) + v(g)$ where $g$ is consumption of the good provided by the government.

curiosity. If one looks at the spending activities of governments, one sees that there are quantitatively significant spending programs that correspond to each of these cases. Case 1 might easily be associated with either some public good spending such as national defense, or with bloated bureaucracies. Case 2 might be considered appropriate for government spending programs such as primary education and health care. Case 3 is relevant for cases in which the government subsidizes the price of goods, such as transportation, housing, child care or elderly care. Finally, Case 4 is relevant for programs in which the government makes transfer payments that impose that the individual not work in order to receive the subsidy. Social security and unemployment benefits are important examples of such programs.

The key point from this is that while Cases 2 and 4 may be relevant for many government spending programs, in which case one obtains a monotonic decreasing relationship between tax rates and hours of work, one must also consider the possibility that differences in spending programs can negate this relationship. Finally, I note that one can consider additional variations that will reinforce the main point being made here. For example, consider an economy like the one described earlier, but now add a second type of individual who has no ability to produce output. Then a tax on workers used to fund a lump sum transfer to this second type of individual will have no effect on equilibrium hours worked, because the individuals receiving the transfer had zero hours of work in the zero-transfer equilibrium.

### *5.4. Qualitative effects of technology and government*

In this section I trace out the qualitative implications of the changes in technology and government that we have seen in the data in light of the above discussion about economic mechanisms. To fix ideas, consider first the situation depicted in Fig. 20, describing the TFP profiles for each of three countries, which I have labeled Rich, Middle and Poor based on their initial productivity levels. In this figure, TFP of the Rich country grows at a constant rate of 2% per year. One can think of this as a country that operates on the technological frontier for the entire period. The

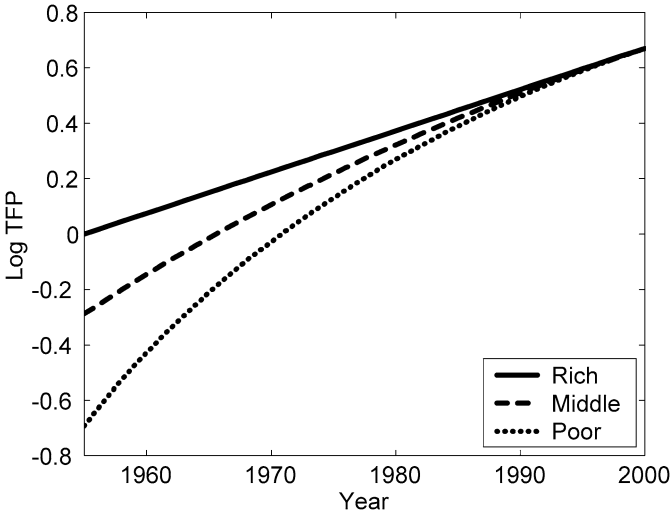


Fig. 20. Productivity profiles.

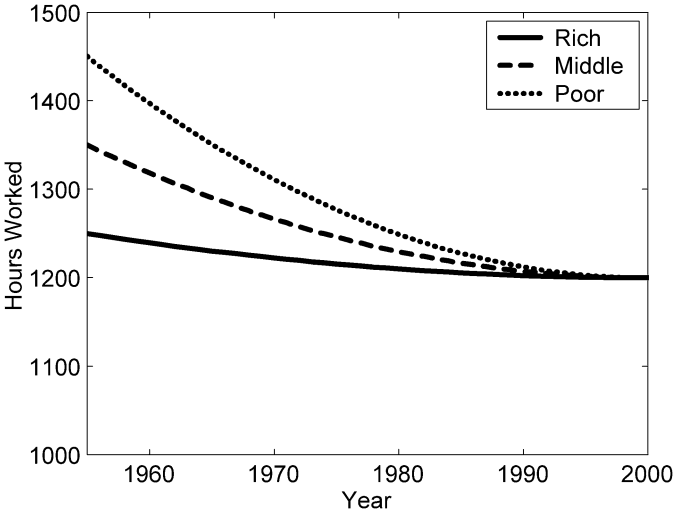


Fig. 21. Hours worked profiles.

other two countries are initially below the frontier, but reach the frontier by the year 2000. These countries differ in how far their initial productivity levels are away from the frontier.

Figure 21 shows the implied paths for hours in light of the mechanisms discussed previously. (The numbers shown on this figure have no real significance.) This figure displays two main features. First, I have drawn hours for the rich economy so that hours decrease slightly over the period, but note that hours worked are relatively flat over the last part of the period. This is motivated by the fact that the subsistence effect will disappear as productivity increases. The second feature is that initially the other two economies both have higher hours worked than the Rich economy, but that the difference converges to zero as we approach the year 2000. The difference in hours worked initially is due to a larger effect of the subsistence level, since productivity is lower in the Middle and Poor economies. The convergence is due to the fact that TFP levels converge at the end of the period shown. Also, during the catchup there will be higher market work associated with the increased incentives to accumulate capital.

Recall Fig. 8, which showed average hours worked across the four different groups in Table 1. At a qualitative level, the forces captured in Fig. 21 seem capable of accounting for some of the dynamics found in Fig. 8. Specifically, noting that Australia, Canada, New Zealand and the US were among the most productive nations in 1960, one would expect them to have relatively lower hours worked early in the period and to experience very modest decreases. Similarly, the other countries would be expected to initially have higher hours and to experience relatively larger decreases over time. Both of these patterns are found in the data. However, it is also clear that the forces depicted in Fig. 21 cannot account for some other key patterns found in the data. In particular, they do not help us understand why hours worked in many countries continue to fall significantly even after reaching the US level.

At this point it is instructive to include the effects of government in the analysis. While the analysis in the previous subsection cautioned against assuming a simple monotonic relationship between either tax rates and hours worked or government spending and hours worked, for present purposes I will assume that increases in government over time within a country are such that they are associated with lower hours of work.

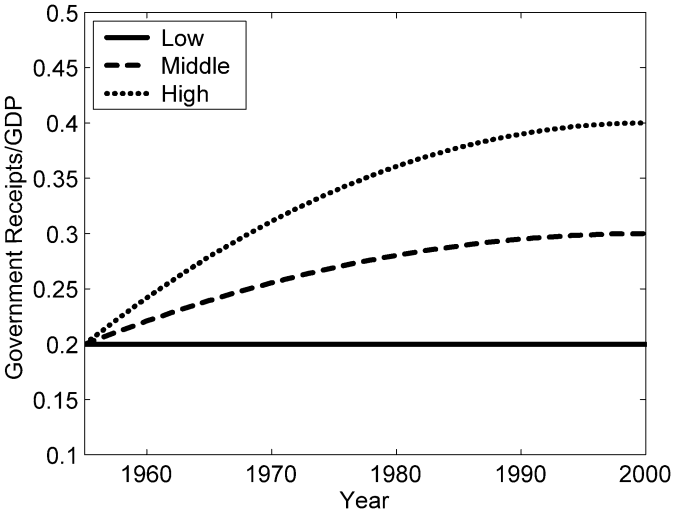


Fig. 22. Government receipts profiles.

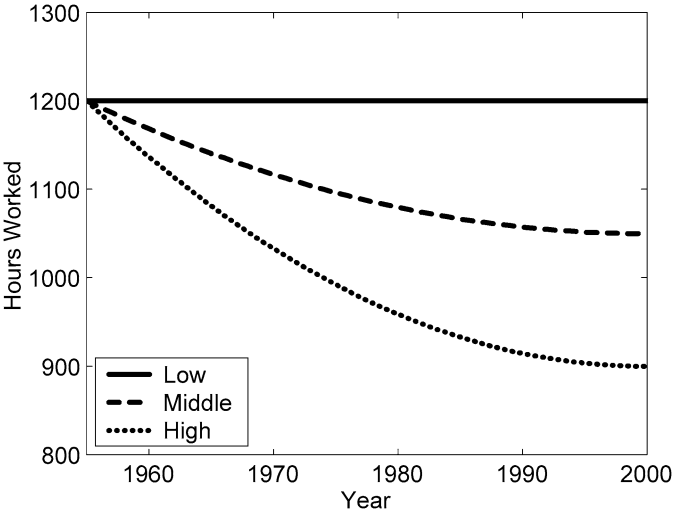


Fig. 23. Hours worked profiles.

Figure 22 is a good starting point for understanding the dynamics induced by changes in the growth in government. This figure considers three countries that begin with the same size government but subsequently experience different growth in the size of government. Figure 23 shows the implied paths for hours worked, under the previously mentioned assumption.

This picture matches the latter part of Fig. 8 but does not account for the first part in which the hours of some countries start higher. One could ask what pattern of government would be able to reproduce the entire series. Consider the paths shown in Fig. 24. The profiles for hours of work that are generated by these profiles for government are shown in Fig. 25.

This suggests that a story in which government is the dominant force might be able to account for the qualitative behavior seen in Fig. 8. As in Fig. 24, this would require that government re-

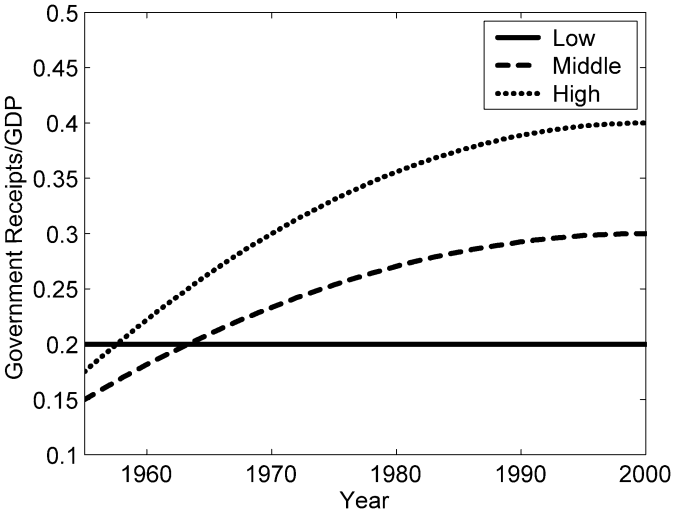


Fig. 24. Government receipts profiles.

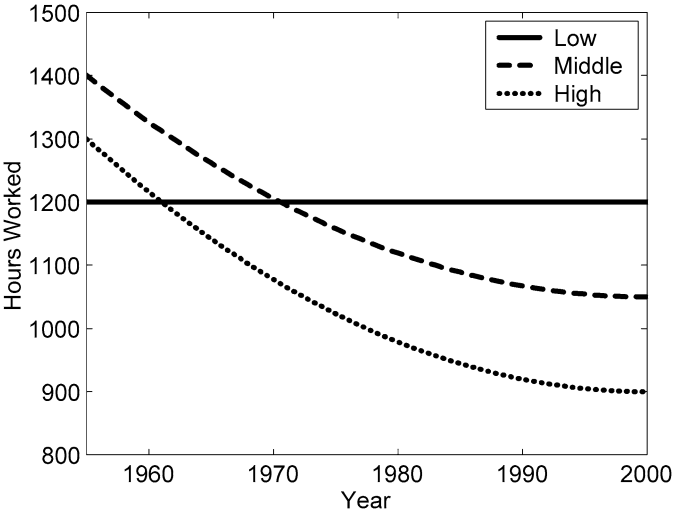


Fig. 25. Hours worked profiles.

Table 6
Current govt. receipts/GDP 1960

| Austria | Belgium | France | Germany | Italy | US |
|---|---|---|---|---|---|
| 35 | 30 | 34 | 32 | 29 | 27 |

ceipts are lower in the high hours worked countries in the early part of the period. Unfortunately, the data presented in Table 6 suggest this is not the case.

In view of this evidence, the actual paths for government are better represented as shown in Fig. 26, which implies that hours should look like those in Fig. 27. This suggests that a story

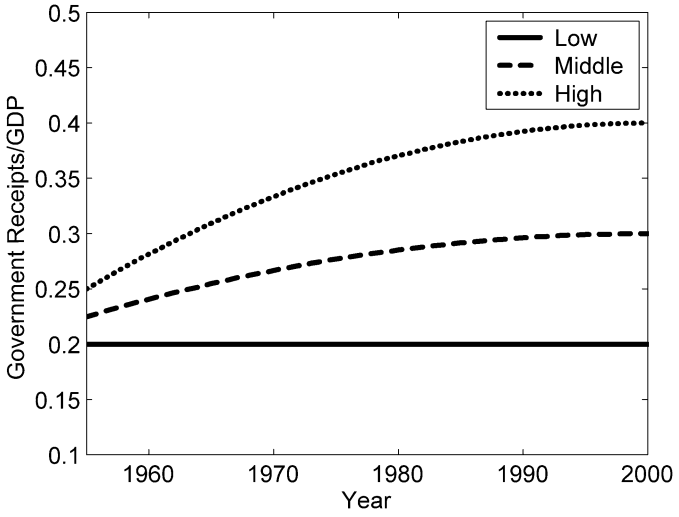


Fig. 26. Government receipts profiles.

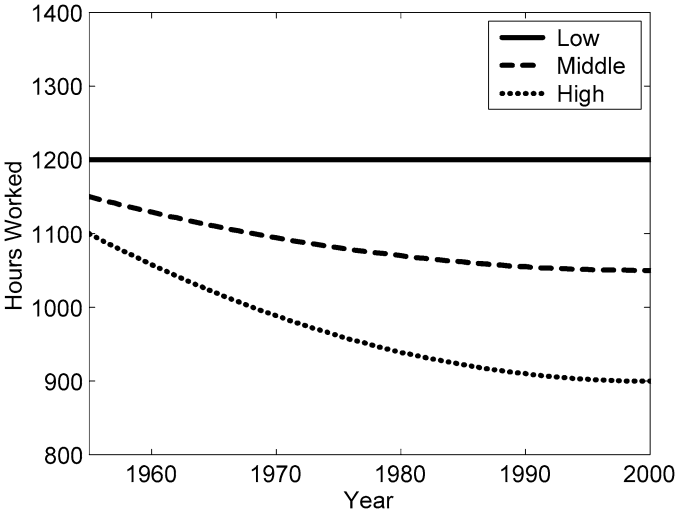


Fig. 27. Hours worked profiles.

that only stresses government is unlikely to be the whole story, though it is important to note the earlier qualification about the potential danger of assuming a monotonic relationship between government and hours worked.

While neither a technology or government story may be sufficient on its own, it should be clear to the reader that a combination of the technology and the government stories seems somewhat more promising. The general idea is that technology differences dominate in the early part of the period, while government differences dominate in the later part of the period. This fits well with the observed patterns in which technology differences shrink over time and government differences increase over time. In fact, Fig. 28 shows the correlation between government and

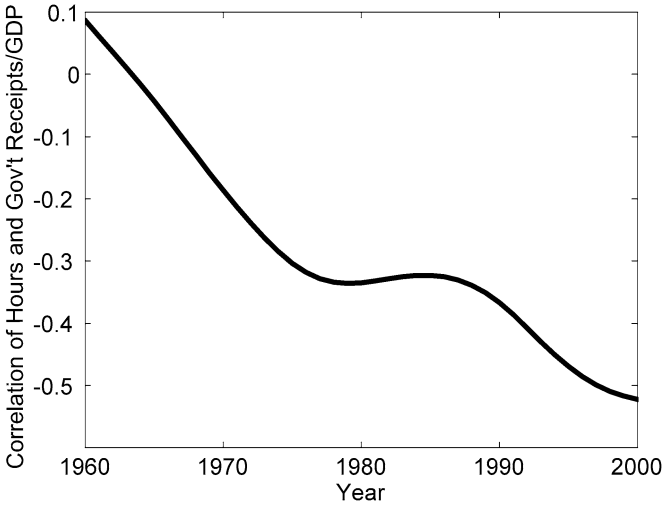


Fig. 28. Correlation of government receipts and hours worked.

hours in the cross section over time. Consistent with the above story this correlation is close to zero initially but becomes larger (in absolute value) over time.[14]

### *5.5. Other driving forces*

I have emphasized two candidates as important driving forces over the period 1956–2003. Future work may lead us to add additional factors to this list. Some have been suggested in other work. For example, based on reduced form regressions, Alesina et al. (2005) have suggested that unions and employment protection are important factors. These factors are often raised in discussions of labor market outcomes, and many find it intuitive that these factors could play a large role. I will not repeat the analysis here, but in Rogerson (2005c) I argue that an explanation based on these factors does not seem at all promising in terms of being able to account for the time series evolution of hours worked. Unionization rates are basically flat during the period of interest, and the changes in employment protection at the country level do not at all display the steady ongoing change that the series for hours worked display. While this is not to say that unions and employment protection have played no role, I conclude from the evidence that these factors are unlikely to be the dominant ones in accounting for the broad cross-country movements.

## 6. Disaggregation I: a third driving force

While the previous discussion suggested that a story emphasizing technology and government as the two main driving forces could potentially account for the key qualitative patterns found in the time series, a closer look reveals some problems with such a view. For example, it seems very difficult to reconcile this view with the observed pattern for countries such as the US, Canada, Australia and New Zealand. These countries experience a modest increase in hours worked over

[14] The correlation between productivity and hours stays in the range of $-0.1$ to $-0.2$ over most of the sample with very little trend.

the period 1956–2003, but even if one characterized hours worked in these countries as being roughly flat, the two driving forces emphasized in the previous section would still have led us to expect significant decreases in hours of work based. In particular, although the size of government increases less in these countries than in many others, it nonetheless grows quite significantly. And one would also expect a mild decrease in hours worked associated with the subsistence factor. One possible reconciliation is to appeal to the argument made earlier that the spending programs were sufficiently different in these countries as to overcome the effects of tax increases. However, in this section I argue that there is good reason to consider a third pervasive driving force whose effect serves to increase hours of market work over time.

The argument in favor of this additional driving force comes from disaggregating the aggregate hours worked data on two dimensions. The first dimension is to consider the two components of the hours worked series separately: employment relative to the size of the working age population, and annual hours worked per person in employment. The second dimension will be to consider the series for the ratio of employment to working age population by gender. Figures 29 and 30 show these two series for the US.

There are two striking features in these figures. First, we see that employment and hours per worker are moving in opposite directions since about 1965: while hours per worker drops by about ten percent, the employment ratio increases by almost twenty percent. Second, while aggregate employment increases substantially, the employment rate for men is decreasing and the employment rate for women in increasing. These two facts strongly suggest that there is an additional driving force that is quantitatively significant, and that one of the primary effects of this third driving force is to increase market work by women. I present some additional evidence below, but the fact that the increase for women more than offsets the decrease for men indicates that this is not simply a matter of reshuffling hours within households.

While I have so far only showed the picture for the US, the key patterns found in the US data are also found in the data for other countries. In the interest of space I only present the figures for two other countries: France and Norway. Figures 31 and 32 show the same series for Norway, while Figs. 33 and 34 show them for France.

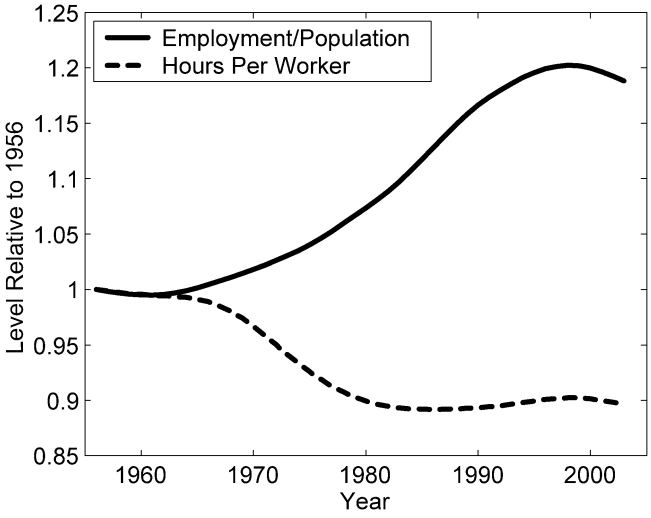


Fig. 29. Employment and hours: US.

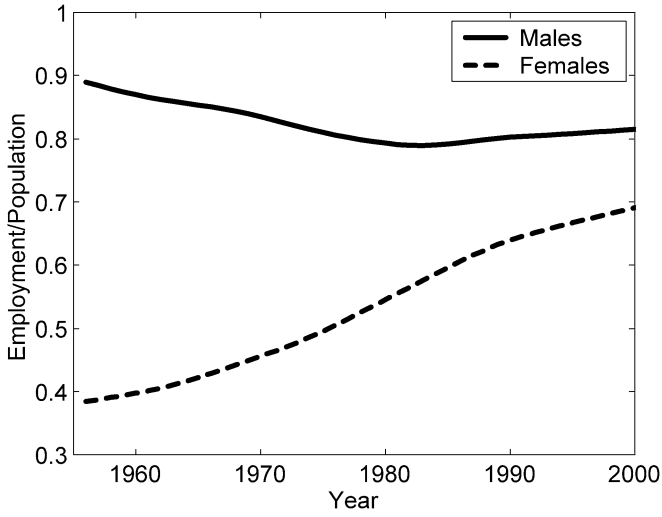


Fig. 30. Employment by gender: US.

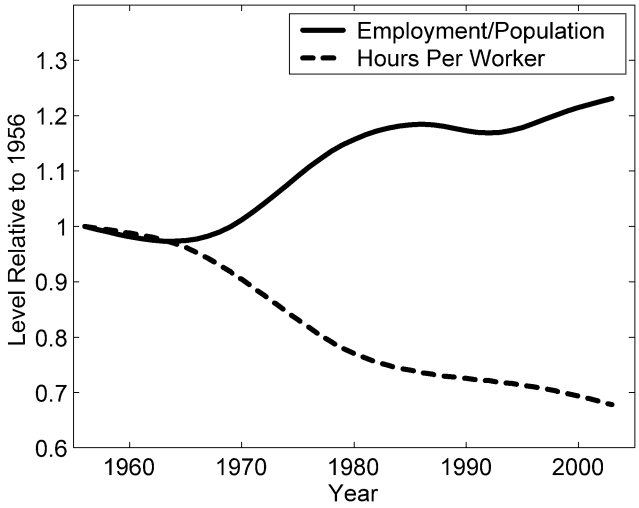


Fig. 31. Employment and hours: Norway.

Just as was true for the US, we see that in Norway, hours per person declines while the employment rate increases, and that the employment rates for men and women move in opposite directions. For France there is a slight difference: although the employment rates for men and women move in opposite directions, both the employment rate and hours per worker decrease for France. However, a weaker pattern that is common across countries is that the decrease in hours per worker is much larger than the decrease in the employment rate.

Even at a qualitative level these differences seem difficult to reconcile with the two aggregate driving forces that we previously focused on. If one were to restrict attention to the product of the male employment rate and annual hours of work per employed person, the patterns would look like those predicted by our earlier analysis. But the large increase in hours by women would then

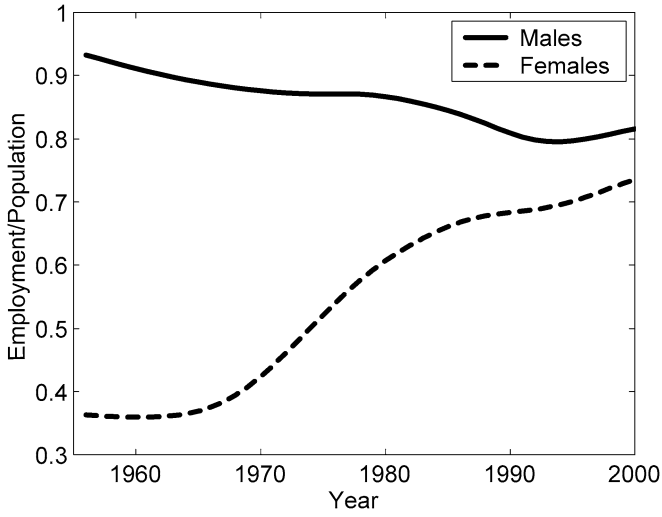


Fig. 32. Employment by gender: Norway.

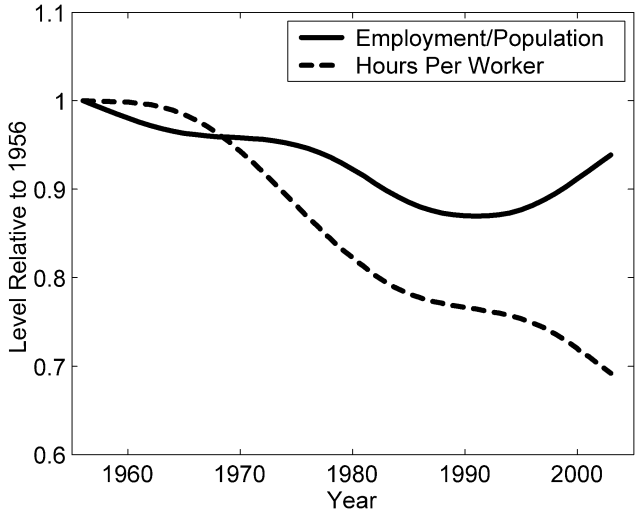


Fig. 33. Employment and hours: France.

seem puzzling. It seems that there is a third important driving force that has the effect of leading to a reallocation of time from the home sector into the market sector.

Some authors have argued that this can be understood as the effect of various aspects of technological change (see e.g., Galor and Weil, 1996; Goldin and Katz, 2002; Greenwood et al., 2005; and Olivetti, 2005), while some have argued that changing preferences may be important (see e.g., Fernandez et al., 2004), and still others have emphasized changes in discrimination (see e.g., Jones et al., 2003). There remains much work to be done to establish the quantitative importance of these and potentially other factors, but what I would like to stress here is that the phenomenon seems closely linked to development in the sense that the time series pattern for each country seems to be strongly connected with the level of technology.

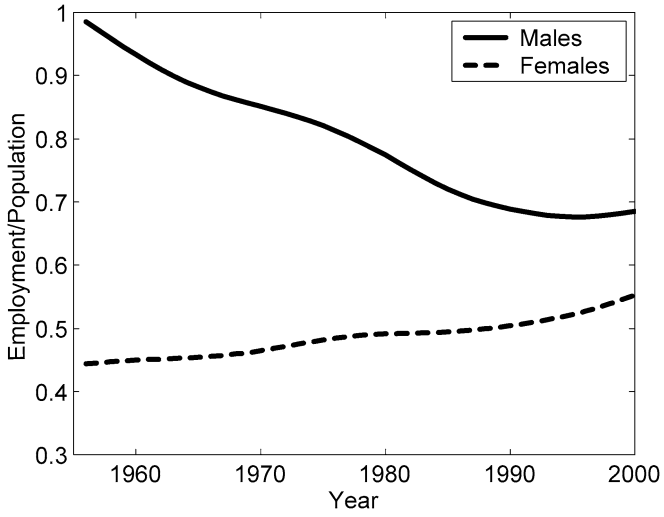


Fig. 34. Employment by gender: France.

Time series data for hours spent in home production are not available for a large set of countries, but recent work by Aguiar and Hurst (2005) and Francis and Ramey (2005) shows that in the US there has been a significant drop in hours of home production by individuals between the ages of 21 and 65 over the period 1965–2000. In particular, Aguiar and Hurst find that in the US between 1965 and 2003 the change in total work, defined as the sum of home work plus market work, is the same for both men and women, but for women there has been a large reallocation away from home work toward market work and some additional leisure, whereas for men there has been a reallocation away from market work into home work and leisure. This evidence suggests that the reallocation from home work to market work is central to understanding the increase in hours of work over time in the US.

In summary, I take the above analysis to suggest that understanding the economic forces that are leading to a reallocation of work from the home to the market is of substantial importance in understanding the cross-country patterns in hours of work. In combination with the two driving forces previously discussed, this suggests that there are three pervasive driving forces at work over this period, two of which have tended to decrease hours of market work and one which has tended to increase hours of market work. At a qualitative level it should be clear that these forces can account not only for the different trends in hours of work across countries, but also for the fact that while hours have decreased in most countries, they have increased in a few.

It is also of interest to note that there is likely to be an important interaction between increases in tax rates and the response of the economy to this third driving force, since an important effect of higher tax rates is to discourage people from purchasing items in the market that have close substitutes that can be produced at home. With this in mind we can offer a potential reconciliation of the differing patterns found between France and the US regarding changes in the employment rate and hours per worker. Specifically, the reason that the employment rate in France does not increase is that the increase in government is sufficiently large as to discourage some of the movement from the home into the market, thereby muting some of the increase in the female employment rate.

## 7. Disaggregation II: some useful questions

In this Section I present some additional evidence regarding patterns in the disaggregated data. To motivate the presentation, when faced with the evidence that aggregate hours of work are higher in one country than in another, I think there are three follow-up questions that are potentially important in helping us decide what types of explanations to pursue:

Q1: What market work is not being done?
Q2: Who is not working?
Q3: What are people doing instead of working?

I do not attempt to provide thorough and systematic answers to these questions here. But I would like to present a few pieces of evidence that provide partial answers to these questions. My analysis here will focus on four economies of Continental Europe (Belgium, France, Germany and Italy) and the US, since this is where the largest differences occur. I will argue that these pieces of evidence bolster the argument for the importance of differences in the size of government in accounting for the large differences in hours of work in the recent cross section.

### *7.1. What work is not being done?*

To answer this question I break down market work into three broad sectors: agriculture, industry and services. Time series on hours of work by sector is not generally available, so here I focus on employment, and for each sector compute the ratio of sectoral employment to the population aged 15–64. The point that I want to make here is that for those countries with low hours of work in 2003, the main discrepancy in employment comes from the service sector. To illustrate this, Fig. 35 shows time series for employment rates by sector for the average of the four economies of continental Europe (Belgium, France, Germany and Italy) relative to the US. For ease of presentation, I aggregate agriculture and industry into a single group in this figure.

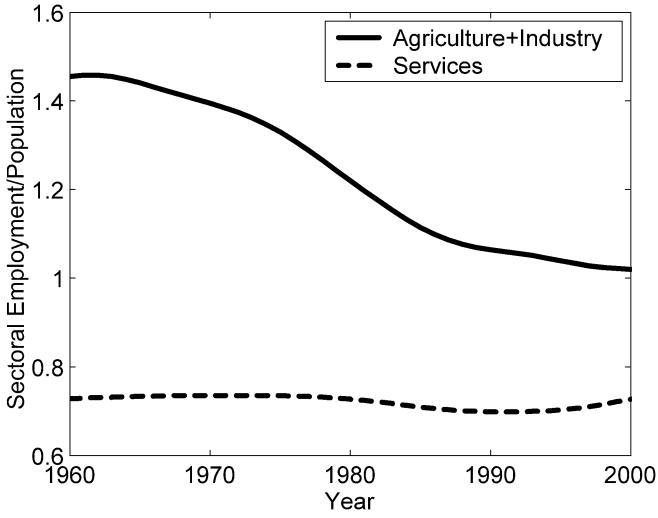


Fig. 35. European sectoral employment relative to the US.

Rogerson (2004) argues that some care needs to be taken in interpreting this figure. On the one hand, one sees that relative employment in services has been roughly constant while relative employment in agriculture plus industry has decreased markedly. One might be tempted to conclude that the key to understanding the relative decrease in employment in continental Europe is to understand the relative decline in employment in agriculture and industry. But such an interpretation would seem mistaken if one views the figure in the context of what Kuznets (1967) referred to as the process of structural transformation.

Specifically, Kuznets documented the reallocation of economic activity across sectors that accompanies the process of development, and included this reallocation as one of the six stylized facts of development. At low levels of development, most resources are allocated to agriculture. As an economy begins to develop, resources are moved out of agriculture and into industry and services. Later yet, resources are also moved out of industry and into services. It follows that one must be careful to note differences in development when comparing sectoral allocations of labor across two economies.[15]

In the current context, the economies of continental Europe lag the US in the development process as of 1956 but effectively catch up by 2000. Hence, holding all else constant we would expect that in 1956, the economies of continental Europe would have their labor allocated more to industry and agriculture and less to services relative to the US, while in 2000 the allocations should look similar. With this in mind, the striking feature of the earlier figure is not the relative decline of industry plus agriculture, since this is what we would be led to expect, but rather the lack of a relative increase in services.

### *7.2. Who is not working?*

There any many dimensions along which one might disaggregate in order to investigate this issue. Two obvious dimensions to begin with are gender and age, but others include education and various family indicators such as marital status and number of children. Here I will look only at the gender and age dimensions. Although cross-country databases provide information on employment by gender and age for most countries, there are only incomplete measures of hours of work by gender and none by age. But subject to these data limitations we can document some patterns.

We begin with comparisons by gender. The first issue we address is whether countries with lower hours of work in the aggregate display any pattern with regard to hours of work by gender. Table 7 presents evidence on female employment relative to male employment for the year 2003. I have organized the countries in the same fashion as in Table 1 to facilitate comparison.

It is apparent from the table that there are a few countries with particularly low values–specifically Italy, Spain, Ireland and Japan. However, these outliers are spread throughout the table, and the correlation between the female-male employment ratio and total hours worked is only 0.16. (The correlation between the female-male employment ratio and the aggregate employment to population ratio is higher, at 0.52, suggesting that higher employment is associated with higher relative employment of females.)

As noted earlier, data on hours of work by gender is not available in cross-country databases. However, the OECD does provide data giving the breakdown of normal weekly hours in bands of 1–19, 20–29, 30–34, 35–39 and over 40 by gender for more recent years. These data give us some

[15] Recent papers by Kongsamut et al. (2001) and Ngai and Pissarides (2004) provide models of the process of structural transformation in the context of an otherwise standard version of the growth model.

Table 7
Female employment /male employment, 2003

| Group 1 | Group 2 | Group 3 | Group 4 |
|---|---|---|---|
| France 0.87 | Austria 0.81 | Denmark 0.87 | Australia 0.81 |
| Germany 0.83 | Finland 0.93 | Portugal 0.85 | Canada 0.87 |
| Italy 0.62 | Ireland 0.73 | Sweden 0.93 | Japan 0.70 |
| | Norway 0.91 | UK 0.82 | New Zealand 0.84 |
| | Spain 0.63 | | Switzerland 0.81 |
| | | | US 0.88 |

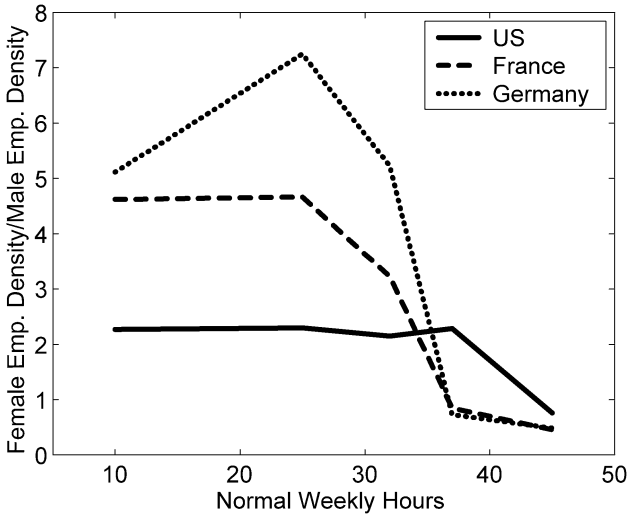


Fig. 36. Relative distribution of weekly hours by gender.

information about hours of work among employed individuals. Here I focus on a comparison of Germany and France with the US. I do this because the numbers in Table 7 suggest very little difference among these countries on the relative employment dimension even though they are at the extremes of the hours worked distribution. Figure 36 plots female employment relative to male employment by hours bands for these three countries.

The pattern that emerges from this figure is that relative to the US, normal weekly hours of women in France and Germany are skewed to the lower end of the distribution. How important is this difference quantitatively? Given the data imperfections it is hard to give a definitive answer to this question, but I can offer a rough assessment. Assuming that hours of work for each of the bands is given by 10, 25, 32, 37, and 45 hours I can compute average weekly hours per employed person. Average weekly hours for women in France and Germany relative to the US are equal to 0.87 and 0.81 respectively, while the similar figures for men are 0.92 and 0.94. This suggests a sizeable gap between hours of males and females in these countries, and in particular much more than implied by the employment numbers only. I conclude that differences in hours worked appear to be more pronounced for females than for males, but stress that additional work is needed on this point.

Next we look at patterns by age. As noted earlier, there are no data on hours by age, so I rely entirely on employment numbers. I focus on the four countries with the lowest hours relative

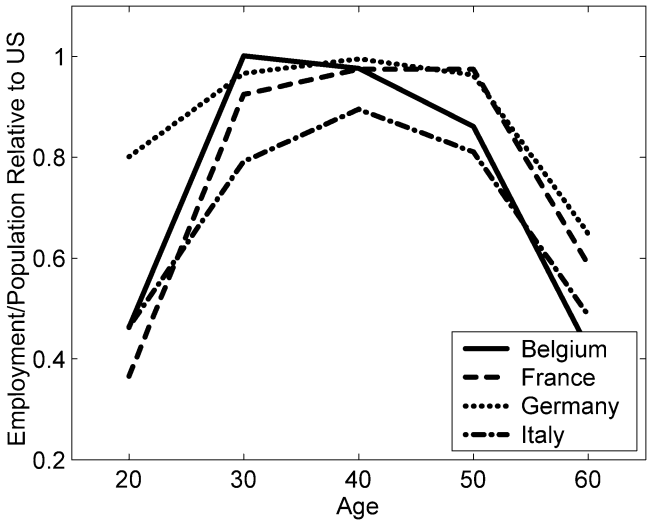


Fig. 37. Employment relative to the US by age.

to the US in Table 1, and report relative employment to population ratios by age groups, with the age groups being 15–24, 25–34, 35–44, 45–54 and 55–64. These data are for the year 2000. Figure 37 shows the results.

A striking pattern emerges. Whereas the relative employment numbers are close to one for prime aged individuals they are around 0.5 for young and old individuals. It follows that the employment differences are heavily skewed toward young and old workers.

### *7.3. What are individuals doing if they are not working?*

While there are several alternative uses of time that are potentially of interest, my discussion here will focus entirely on the dimension of home work versus market work. Time spent on educational activities would also appear to be an important candidate for analysis, but I do not consider it here. As noted earlier, cross-country time series data on time use does not exist, though recent developments imply that this situation will be different in the future. Eurostat has initiated a Harmonized Time Use Survey, and the US has now added time use questions into the regular CPS survey.

My goal here is simply to summarize some existing studies that document cross-country patterns of home versus market work. I begin with the study of Freeman and Schettkat (2002) who compare time use across German and American married couples using data from the 1990s. Their analysis yields a stark finding: they find that total work (home plus market) is roughly the same in the two countries, with Americans spending much more time in market work and much less time in home work than their German counterparts. They also looked at consumer expenditure survey data and found that German families spend less money on eating out at restaurants, consistent with the finding in the time use data the Germans spend more time preparing meals at home. In a more recent paper, Freeman and Schettkat (2005) examine the issue for a larger set of countries and again find that Europeans devote much more time to home work than do Americans.

Olovsson (2004) contrasts time use in the US and Sweden, and finds a similar result, though not quite as strong. In particular, he finds that Swedes engage in more home work than Ameri-

cans, but that the additional home work only compensates for 90% of the difference in market work. Finally, using the recent Eurostat data, Ragan (2005) compares time use patterns across several European economies and the US. She finds a similar pattern qualitatively—countries with less market work engage in more homework—but the quantitative findings are not as stark. Her numbers suggest that additional homework compensates for about one third of the difference in market work.

There are important qualifications regarding measurement issues in making the above comparisons, but subject to these qualifications the previous analyses suggest that substitution between market work and home work is an important channel in understanding cross-country differences.

### *7.4. Summary*

The evidence presented here is clearly just a first step toward providing systematic answers to the three questions that were posed. Much more work is required in order to firmly establish any patterns. Relating the patterns noted above to the previously mentioned driving forces, I would argue that they seem consistent qualitatively with taxes playing an important role. Many market services have good nonmarket substitutes and hence we would expect that as taxes increase it is these activities that would experience the largest declines. At the same time that technological catch-up should have been leading Europe to converge to US sectoral employment rates, the relative increase in taxes in Europe provided an offsetting force, resulting in a stable relative employment rate in services.

Given that taxes encourage individuals to switch from market to home production, we would also expect to see that time spent in home work is higher in high tax countries. Davis and Henreksson (2004) provide evidence in support of this effect. They categorize market activities on the basis of whether they have good nonmarket substitutes and look at the pattern of relative employment in these activities across countries and how they are correlated with tax rates. They find that countries with relatively high tax rates have disproportionately lower employment in those activities that have good nonmarket substitutes.

It also seems plausible that the employment patterns by age are consistent with tax and spending programs playing a key role. Although there is virtually no empirical work on estimating labor supply elasticities for very young workers, it seems reasonable that young workers could have a large labor supply elasticity. The rationale for this statement is that young individuals often have the choice of living with their parents, especially if they do not work, in which case they have access to all of their parents' consumption that represents a public good within a household. Fogli (2005) incorporates such a margin in an analysis of the effects of employment protection. The pattern of low employment for older workers is qualitatively what one would expect from differences in government spending as it pertains to social security, since older workers are the prime recipients of social security payments, and they are often conditional on the individual not working if the individual is less than 65.

## 8. Greece, Ireland, the Netherlands and Spain

When presenting the time series plots by country earlier in the paper, I noted that four countries were not included. In this section I now turn to these four countries. Figure 38 shows the time series for hours worked for these four countries.

Several features of this figure are worth noting. First, if we were to restrict attention to the period from 1956 until 1990, then Ireland and the Netherlands would completely fit the pattern

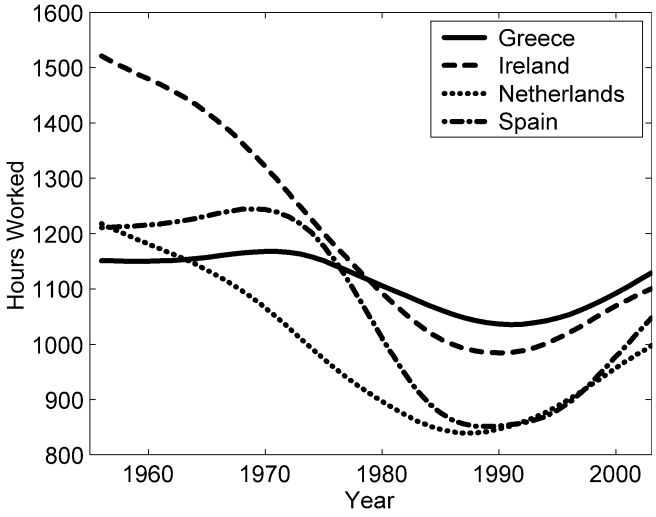


Fig. 38. Hours in Greece, Ireland, Netherlands and Spain.

that we emphasized about the other 17 countries: a steady decline for most of the period with an apparent leveling off near the end. However, what is different about these two countries from the other 17 is that they exhibit a fairly large increase in the 1990s. Ireland exhibits an increase of almost 12% after 1990, while the Netherlands experiences an increase of more than 18%.

Greece and Spain display another feature which distinguishes them from the other countries. Both of these countries experience modest increases in hours between 1956 and 1970, at which point they begin a decline that lasts for almost 20 years, followed by a period of increase. While the pattern is common across the two countries, the magnitude of the drop from 1970 to 1990 and the subsequent increase is far more dramatic for Spain. In fact, in the fifteen year period between 1973 and 1988, hours worked in Spain fall by more than 30%. No other country experiences such a rapid drop during the period under study. But almost equally as dramatic is the more than 22% increase in hours worked between 1990 and 2003. For Greece, the movements are relatively mild, and over the entire 47 year period the change in hours worked is quite small—less than 2%.

These countries present interesting cases precisely because of the fact that the hours worked series exhibit trend reversals. At a qualitative level this pattern seems promising for helping to identify driving forces: if a single driving force is playing a large role then one would expect that the driving force would also exhibit a trend reversal at a similar point in time. With this in mind, Figs. 39 and 40 plot decreases in hours worked and increases in current government receipts over GDP for Ireland and the Netherlands.

In each case we see that the reversal in the decline in hours is preceded by a reversal in increase in the size of government as measured by the ratio of government receipts to GDP. While this analysis is only being carried out at a qualitative level, this pattern certainly supports the notion that changes in taxes play a large role in causing changes in hours worked.

The other two countries show quite different patterns. Figure 41 considers the case of Spain. As can be seen, government receipts relative to GDP rise at a fairly steady rate from 1960 until around 1990, at which point they flatten out. But the large increase in hours post 1990 is not accompanied by any decrease in the measure of government. Recent work by Conesa and Kehoe (2005) is very interesting in this regard. They show that the differences in hours worked in 1970

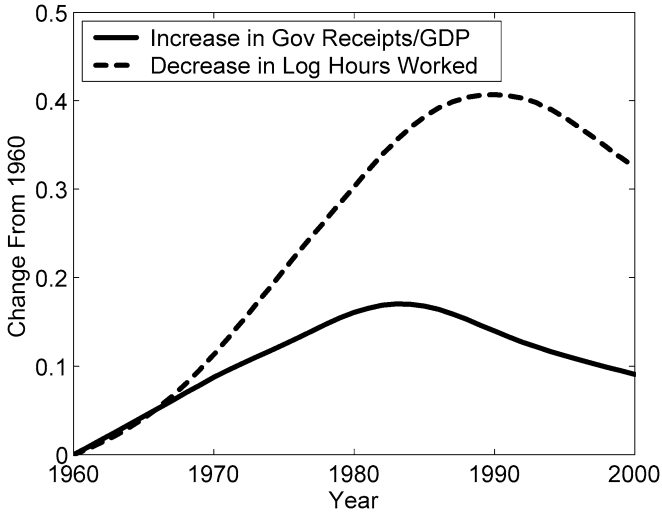


Fig. 39. Hours worked and government in the Netherlands.

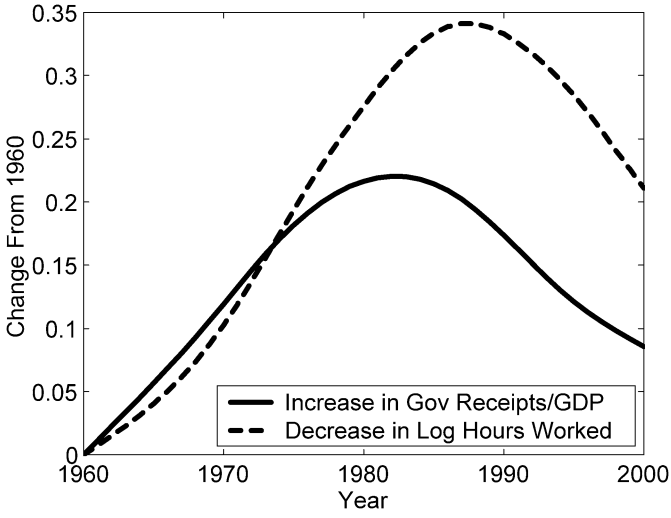


Fig. 40. Hours worked and government in Ireland.

and 2000 can be accounted for by the differences in tax rates at the two points in time. However, this leaves unexplained the issue of why hours fell so dramatically before experiencing a large rebound. One conjecture is that some aspect of the regime change associated with Franco's death led to a large temporary drop in hours that is superimposed over the changes associated with other factors.

In terms of the factors discussed in this paper, Greece too remains a puzzle. Figure 42 shows the figure for Greece. Between 1970 and 1990 the changes in government and hours worked seem basically in line with what one would expect: government increases somewhat modestly and hours decrease accordingly. However, between 1990 and 2000 there is a dramatic expansion in the scale of government receipts that is accompanied by an increase in hours of work. While

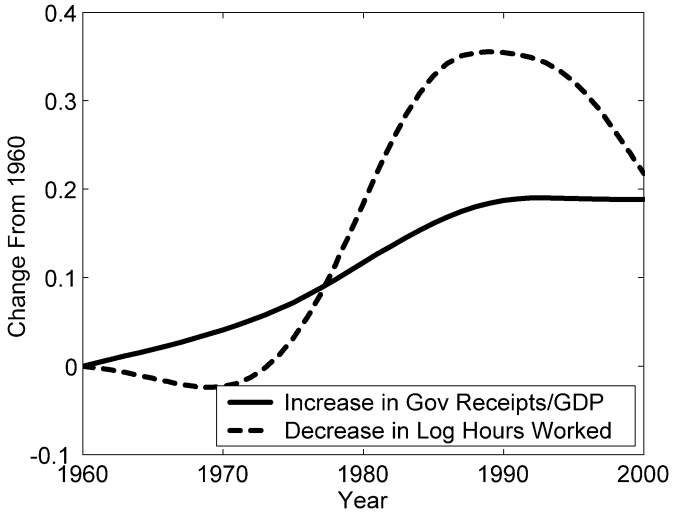


Fig. 41. Hours worked and government in Spain.

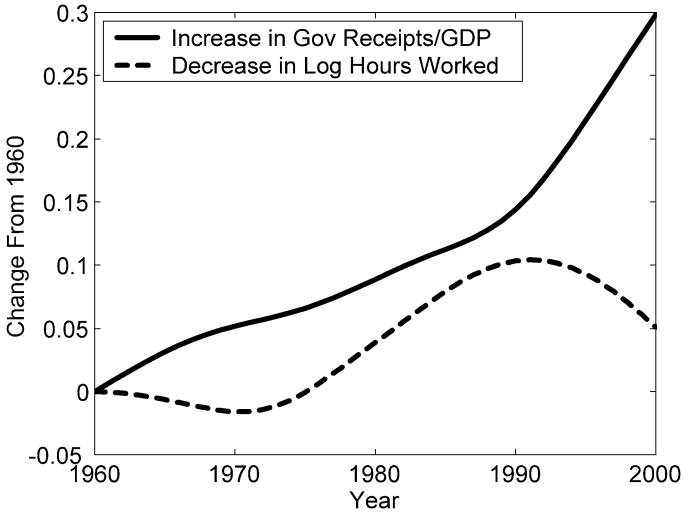


Fig. 42. Hours worked and government in Greece.

I have not pursued the issue at all, one conjecture is that the inflow of funds from the EU during the 1990 had a major impact on the nature of economic activity in Greece. It is important to emphasize just how anomalous the behavior of Greece is with regard to the previously discussed driving forces. As of 1960 Greece is one of the poorest of the economies in the sample, and hence the technology driving forces would be expected to yield a relatively large drop in hours worked. Also, the increase in government receipts for Greece over the entire period is among the largest increases in the sample, and hence we would again expect a large drop in hours worked. But instead, the change in hours worked in Greece from 1956 to 2003 is less than 2%.

Based on the above analysis of the experiences in four countries, I would draw two conclusions. First, at a qualitative level the evidence supports the notion that changes in taxes play

a key role in shaping changes in hours of work. Second, even if taxes play a dominant role, there are episodes that do not seem well captured by a story that stresses taxes and technology alone.

## 9. Where to next?

This paper began with a simple observation: differences in hours of work across OECD countries are large. I have argued that it is important for economists to understand the sources of these differences, both because the welfare implications are potentially sizeable, and because it will deepen our understanding of the important forces that shape labor market outcomes. Given the prominent role that labor supply plays in many analyses, these forces are likely to be relevant for addressing many other issues in economics. The analysis has predominantly consisted of descriptive empirical work. My hope (and belief) is that this descriptive work is useful in helping us assess where to direct our efforts in building rigorous and explicit models to account for differences in hours worked.

Several papers have begun the task of using models to account for the impact of various factors on hours of work. Space limitations preclude an exhaustive survey, but I do want to mention a few. Prescott (2004) argued that if labor taxes are used to fund lump-sum transfers, then differences in tax rates alone could account for the hours worked in the early 1970s and the early 1990s for the US and several European countries. Also assuming that taxes fund lump-sum transfers, Rogerson (2005a) showed that changes in taxes and technology between 1956 and 2000 could account for the evolutions both of aggregate hours worked and the sectoral composition of hours worked for the US and three countries from Continental Europe. As previously noted, Conesa and Kehoe (2005) analyze the evolution of taxes and hours worked in Spain between 1970 and 2000 and find that taxes can account for the level of hours at the two endpoints, but not for the dramatic fall and rise in hours that occurs in between.

The above mentioned analyses have focused on comparisons of the US with the economies of Continental Europe. Any story that stresses taxes as a key driving force in accounting for hours of work would seem to face a strong challenge in accounting for hours of work and taxes in Scandinavia and Continental Europe simultaneously, since taxes are somewhat higher in Scandinavia, but hours of work are much higher. Works by Rogerson (2005b) and Ragan (2005) show that differences in the nature of government spending across these economies can reconcile this apparent puzzle. In somewhat related work, Olovsson (2004) shows that differences in taxes can account for the differences between Sweden and the US, but the mechanism is different.

While some important progress has been made in accounting for differences in hours worked across countries, I hope that the reader will be encouraged that much work remains to be done. Here I would like to focus on four specific avenues along which further progress is needed. First, more systematic empirical work is needed to provide comparable measures of hours of work across countries over time along dimensions beyond what is currently available in cross-country databases. Of particular interest are differences in hours of work by age, marital status, and skill.

Second, a better understanding of the forces at work will require explicit analyses of actual tax and spending programs rather than the abstract specifications used in most of the work described above. This will in turn require much richer models than those used in the previously cited works. One cannot quantitatively assess the effects of differences in social security provisions across countries in a model in which there is no explicit retirement decision. And one cannot understand what factors account for the observation that differences in employment rates are concentrated among young and old workers in a model in which there are no young and old

workers. Similarly, to understand the interaction of tax systems and two-worker families, we will need explicit models of multi-member households.

Third, and related to the previous point, more country specific studies are needed. While the analysis carried out here has stressed the approach of looking for common factors that can account for the key patterns found in a large set of countries, it is almost certain that careful studies of individual countries will find a role for other factors as well. Most countries have many regulations in place that directly affect the labor market (e.g., employment protection, minimum wages), and it is quite possible that some of these have played a significant role in some instances. Recent work has also emphasized the role of product market regulations.[16] Differences in institutional features such as wage setting may also have played a role.

Fourth, additional work is required to better understand the appropriate labor supply elasticities to be used in assessing the impact of changes in aggregate factors such as tax rates. Labor supply elasticities are clearly critical in evaluating the effects of taxes on hours of work, but are also likely to be important in the evaluating the effect of any potential driving forces on hours of work. There is a voluminous literature that has sought to identify labor supply elasticities by regressing hours of work on wages in various contexts. Following the seminal work of MaCurdy (1981), many seem to hold the view that the most (if not the only) reliable estimates of labor supply elasticities to be used in quantitative analyses are those that come from individual-level data. While the idea of using micro data to uncover preference parameters is a good one, I would argue that the literature to date has overlooked some key issues that ultimately make existing estimates from micro data of little use in assessing how aggregate hours of work respond to changes in aggregate factors.

Specifically, if one is to use micro data on wages and hours of work to infer something about preferences, it is critical that one correctly specify the set of alternatives that individuals are choosing from. Virtually all estimation exercises using micro data assume that an individual can choose to work any number of hours at their observed wage rate. This assumption about choice sets seems at odds with reality.[17] One reason for this is that productivity depends on hours worked, so that firms offer workers a locus of wage-hours pairs. In general, the relationship between earnings and hours is not linear.[18]

A closely related but distinct issue is that many organizations require a significant amount of coordination of working hours among employees, so that for most individuals their existing wage comes with a single possibility for hours of work. Consider an extreme case of team production that requires all employees to be at work for exactly the same time period.[19] In this context, if a given individual gains experience and as a result contributes more to the team, he or she will receive a higher wage, but we would not expect that this would have any effect on hours of work. In the cross section, different teams may operate for different hours and offer different wages. These hours differences may, for example, reflect differences in technologies, or differences in the nature of demand for various goods and services. If one combines this with an environment such as Jovanovic (1979) in which workers will search among jobs in order to find a good match, one would expect to find lots of variation in wages and hours in micro data. But one would not expect this variation to provide much information about labor supply elasticities. If an individual

[16] See, for example, Bertrand and Kramarz (2002), Fonseca et al. (2001), Messina (2003), and Fang and Rogerson (2006).

[17] See Altonji and Paxson (1988) for discussion of this and related references.

[18] See also Prescott (2006) for additional discussion on this point.

[19] Fitzgerald (1998) develops a model of team production in which the workweek is determined in general equilibrium.

comes across a good match and is thus offered a relatively high wage there is no implication that the associated production team will have high hours of work.

Put somewhat differently, much of the literature has implicitly assumed that the response in hours worked for a given individual to some disturbance in wages is independent of whether the disturbance to wages is idiosyncratic to this one individual or whether it is common to all individuals. It is common practice for researchers interested in labor market aggregates to write down models in which the hours of work of an individual will respond similarly to both idiosyncratic wage changes and aggregate wage changes. If these models are used only to assess the consequences of aggregate shocks, this may not be a serious issue, but if the model is being used to interpret data in which idiosyncratic shocks dominate, then I suspect that such models will lead to mistaken inference.

The implication of this argument is that most existing estimates of labor supply elasticities based on micro data are probably of little use in evaluating the response of the economy to aggregate changes. Much more work is needed to better understand the relationship between hours, wages and preference parameters in settings which exhibit more reasonable assumptions about worker choice problems. Chang and Kim (2005, 2006) represent an important first step in this direction. In the context of their model they show that the elasticity obtained from standard exercises based on micro data significantly underestimate the response of the economy to an aggregate shock.

Another paper that raises a different issue about how the specification of choice sets affects estimates of labor supply elasticities is Imai and Keane (2004). They show that conventional estimates of labor supply elasticities are dramatically altered if one allows for the possibility that hours of work today influence future wages via a process of human capital accumulation. In particular, they find that the estimated elasticity of substitution is larger by an order of magnitude once this element is added to the worker's choice problem.

Finally, as described earlier in this paper, the data reveal that big differences in total hours across countries are concentrated among certain groups. In particular, we found that almost all of the differences in employment are accounted for by young and old workers. More generally, aggregate responses are likely to be dominated by the responses of "marginal" workers. Yet most estimates from micro data focus on prime aged males. Even if the existing estimates of a small elasticity for this group were taken at face value, it provides little information about whether elasticities of marginal workers are large.

In closing, let me simply say that while much good work has been done on the issue of understanding differences in hours worked across countries, there is still much more that needs to be done.

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