Economics Bulletin

Volume 29, Issue 2

European vs American Hours Worked: assessing the role of the extensive and intensive margins

François Langot
GAINS-TEPP, ERMES, Cepremap and IZA

Coralia Quintero-Rojas
Universidad de Guanajuato and GAINS-TEPP

Abstract

Europeans have worked less than Americans since the 1970s. In this paper, we quantify the relative importance of the extensive and intensive margins of aggregate hours of market work on the observed differences. Our counterfactual exercises show that the two dimensions of the extensive margin, the employment rate and the participation rate, explain the most of the total-hours-gap between regions. Moreover, both ratios have similar weight. Conversely, the intensive margin, measured by the number of hours worked per employee, has the smallest role.

We thank Arnaud Chéron, Jean-Olivier Hairault, Eva Moreno-Galbis, Franck Portier, Henri Sneessens and Fabien Tripier for helpful comments. We also beneficiated from discussions with the participants at the GAINS-TEPP seminar and at the XIII Workshop on Dynamic Macroeconomics.

Citation: François Langot and Coralia Quintero-Rojas, (2009) "European vs American Hours Worked: assessing the role of the extensive and intensive margins", *Economics Bulletin*, Vol. 29 no.2 pp. 530-542.

Submitted: Nov 05 2008. **Published:** April 07, 2009.

1. Introduction

Several recent contributions have focused on the decline in aggregate hours of market work in Europe, particularly relative to the United States. For instance, Prescott (2004) finds that, contrary to the 1970s, during the 1993-1996 period Americans worked 50 percent more than Germans, French, and Italians. Similarly, Rogerson (2006) finds large differences in hours of work across OECD countries from 1956 to 2003, and a sharp decline in mean hours worked over the period through to the mid 1980s. He also finds that aggregate hours worked in Continental European economies such as Belgium, France, Germany and Italy are roughly one third less than in the US (see Rogerson and Fang 2007 and Rogerson and Wallenius 2007). This growing literature is motivated by importance of the phenomenon. Why have Europeans worked less than Americans since the 1970s?

A large number of papers show that differences across countries in the work effort are mainly due to quantitatively important differences in the unemployment rate[1]. Nevertheless, according to Rogerson (2006), the *"increases in relative unemployment are a very small part of the relative decrease in hours of work"*. To him, *"this suggests that a disproportionate amount of effort has been directed at studying the unemployment differential at the expense of the much larger and more basic issue of differences in time allocations."* Prescott (2004) and Ohanian *et al.* (2008) then argue that virtually all differences between the two regions are due to differences in tax systems, *via* their effects on the average hours worked per employee.

A first limitation of these studies is that, as long as the authors focus on the average hours worked per employee, they do not disentangle the intensive from the extensive margins of total hours worked. Nevertheless, the observed dynamics of these two margins are quite different, suggesting that they result from the individuals' specific choices. The second limitation is that these papers use the basic growth model where the dynamics of aggregate hours is governed by the labor supply elasticity[2]. However, the calibration of this elasticity is hard to reconcile with micro-econometric evidence[3]. Hansen (1985) and Rogerson (1988) papers show how to match aggregate labor market fluctuations with general equilibrium models in which restrictions on preferences are in accordance with micro-econometric evidence. The crucial point of these papers is the distinction between intensive (assumed to be constant) and extensive margins. On the other hand, the policy implications of several labor market institutions are different for the employment rate than for the hours worked per employee (the intensive margin). Indeed, the rigidities induced by labor market institutions could be more relevant to explain the extensive margin dynamics, whereas labor taxes could be more relevant to explain the intensive margin dynamics[4].

This suggests that a unified theory of the total hours worked (business-cycle and long-run dynamics) must simultaneously account for both margins' dynamics in line with previous the-

[1]On this point, Jackman *et al.* (1991), Mortensen and Pissarides (1999), Blanchard and Wolfers (2000) or Ljungqvist and Sargent (2007a), (2007b) and (2008), among others, consider that the large increase in the unemployment rate observed after 1980 in European countries, is an important factor of the dynamics of total hours.

[2]This limitation is in accordance with the objective of explaining only the average hours worked.

[3]Alesina *et al.* (2005) already point out that "Prescott's argument, *i.e.* taxes explain US/Europe differences, relies critically on assumptions that ensure an elasticity of labor supply that is hard to reconcile with most standard estimates of labor supply.

[4]For a deeper discussion on this point, see Langot and Quintero-Rojas (2008).

oretical and empirical findings. In order to find an acceptable theory, a first step consists in providing some "stylized facts" on the aggregate hours dynamics and its decomposition between the intensive and the extensive margins. With this aim in mind, we address here the following questions: Do Europeans work less than Americans because their individual effort at work is lower? Do Europeans work less because they face a lower probability of being at work than Americans? Do Europeans work less because the number of labor market participants is lower than in the US? That is, we evaluate the contribution of each component of the total hours of market work to the observed differential in the total hours worked in ten major European countries relative to the US.

Our results are the following. First, in most countries the two dimensions of the extensive margin, the employment rate and the participation rate, explain together most of the total hours gap with the US. The intensive margin, measured by the number of hours worked per employee, play a small part in several countries. This suggests that the extensive margin matters to explain either the evolution of total hours of market work or the differences across countries. Second, both ratios (employment and participation rates) have similar weight in explaining the dynamics of the extensive margin.

The remaining of the paper is organized as follows. First, we present the data for the eleven countries of our sample, from 1960 to 2003. The data underlines the size and the evolution of the hours (of market work) gap between Europe and the US. Then, we measure the contribution of individual hours, employment and participation to the Europe-US gap.

2. The evolution of total hours worked and its components, 1960-2003

As in Rogerson (2006), aggregate hours of market work (H) is simply the product of employment (N) and annual hours of work per person in employment (h), normalized by the population aged 15-64 (L). This variable may be decomposed as follows:

$$H = \underbrace{h}_{\text{Hours per employee}} \times \underbrace{\frac{N}{A}}_{\text{Employment rate (n)}} \times \underbrace{\frac{A}{L}}_{\text{Participation rate (a)}} \tag{1}$$

where A denotes the active population (employment plus unemployment).

Data on employment and population come from the OECD.[5], whereas data on hours worked come from the Groningen Growth and Development Center and the Conference Board[6].

2.1 The historical data

We inspect the evolution over 1960-2003 of the aggregate hours worked, and its components for the eleven countries of our sample, taking as reference value the US in 1970. Apart from the US, our sample includes the United Kingdom (UK), and major Central and Nordic European countries: Belgium (BE), Germany (DE), Spain (ES), France (FR), Italy (IT), Austria (AT), Netherlands (NL), Finland (FI) and Sweden (SE).

The series for the total hours worked are plotted in the top panels of figure 1, whereas the hours worked per employee are plotted in the bottom panels of figure 1. We observe that over the

[5] *OECD Statistics, beta 1.0*: http://stats.oecd.org/wbos/default.aspx

[6] *Total Economy Database, January 2007:* http://www.ggdc.net

whole period, total hours worked in the US were higher than the reference value (US in 1970). Conversely, at the beginning of the period, in all European countries total hours were higher than both the US and the reference value. But then in most countries they exhibit a decreasing trend, and are very soon below the reference value. The striking few exceptions are the UK, Finland, Sweden and Spain. In the UK, total hours were 30% higher than in the US in 1960 and still higher over the whole period. Similarly, in Finland and Sweden total hours worked were respectively 30% and 15% higher than in the US, and they remained higher until 1992. Thereafter, hours fell down below the reference year. Finally, in Spain total hours increase slightly until around 1972. Then they show a sharp decline until 1985 and a steady increase afterwards.

In most countries the decline in the total hours worked seems driven by the dynamics of the hours worked per employee, as we can see from the bottom panels of figure 1. We can broadly distinguish two groups of countries. The first one includes Belgium, Germany, France, Italy, Austria and the Netherlands. In this group, individual hours are steady and continuously declining since the beginning of the period. In the second group, including the remaining countries, hours per employee were declining until around 1980 and they still roughly stable thereafter in Belgium, France and Italy, and slightly increasing in Spain, the UK and the US. Indeed, the hours per employee decline was compensated by the increase in the employment rates (top panels of figure 2) since the mid 1980s in all countries excepting France. Moreover, we also observe that all countries experienced increasing participation rates (bottom panels of figure 2) since the mid 1980s, and even since the early 1970s in Italy and the US. Finally, in Spain individual hours increased slightly from 1960 to the end of the 1980s. This is followed by a short period in which they are falling, to increase again after 1985.

2.2 The hours gap between regions

The solid line in each panel of figures 3 and 4 shows the dynamics of the total-hours-worked-differential between each European country and the US, relative to 1970. The observed gap is simply computed as:

$$\Delta_{i,t}^{obs} = H_{i \neq us,t} - H_{us,t} \tag{2}$$

Apart from Spain, the relative total hours of market work were higher in European countries than in the US until around the reference year. This is shown as a negative gap. Afterwards, the converse is true, so that the gap is positive. Moreover, for all countries the hours differential is sharply increasing until the mid 1985, consistent with the above discussion. Why the evolution of total hours worked was diverging among regions? Why have Europeans worked less than Americans since the 1970s? To shed some light on this, in the next section we assess the explanatory power of each component of the total hours to the observed transatlantic gap.

3. Measuring the contribution of individual hours, employment and participation to the hours gap

In this section we propose several counterfactuals in the line of Rogerson (2006). The goal is to assess the role of each dimension of the total hours worked, *ceteris paribus*, in accounting for the total hours gap with the US. That is, we analyze the contribution of each dimension by

assuming that it evolves independently from the two other dimensions.[7] We show that in most countries the extensive margin plays the main role. In plain words, if the employment and the participation rates were still the same in Europe as in the US, the observed gap in the total hours in these two regions would be quite small.

3.1 The contribution of the hours worked per person in employment

The counterfactual is constructed as follows. First, for each country we compute the differential in the hours worked per employee relative to the US:

$$\Delta^{h}_{i,t} = h_{i,t} - h_{us,t} \tag{3}$$

Then, we consider the hypothetical case where the change in the hours per employee in the European countries did not happen. Instead, we assume that employed workers in Europe were working the same number of hours as the employees in the US. This would rise aggregate hours in country $i \neq us$ by an amount equal to:

$$\Delta'^{h}_{i,t} = n_{i,t} \times a_{i,t} \times (-\Delta^{h}_{i,t}) \tag{4}$$

Finally, we normalize the series with respect to the reference year (so that the total hours differential is equal to zero in 1970):

$$\Delta^{H,h}_{i,t} = \Delta'^{h}_{i,t} - \Delta'^{h}_{i,1970} \tag{5}$$

The comparison of the $\Delta^{H,h}$ series with the observed differential in relative total hours (Δ^{obs}) give us an idea of the "importance" of the contribution of individual hours to the total hours worked gap. That is, the more important is the contribution of the intensive margin, the closer will be the hypothetical series (dotted lines in figures 3 and 4) to the actual ones.

3.2 The contribution of the employment rate

Now, we compute the contribution of the employment rate to the total hours gap by considering the hypothetical case where the change in country $i \neq us$'s employment rate, relative to the US ($\Delta^{n}_{i,t} = n_{i,t} - n_{us,t}$), did not happen. Instead, assume that in each country the employment rate were the same as in the US in date t. This allows us to generate the series $\Delta'^{n}_{i,t} = a_{i,t} \times h_{i,t} \times (-\Delta^{n}_{i,t})$, which measures the contribution of the employment rate to the (total) hours gap between each country and the US. Similarly, the comparison of the normalized counterfactual series $\Delta^{H,n}_{i,t} = \Delta'^{n}_{i,t} - \Delta'^{n}_{i,1970}$ (crossed lines in figures 3 and 4) with the actual ones provides a measure of the "importance" of this variable in accounting for the total hours differential between the European countries and the US.

[7] Equivalently, when constructing the counterfactuals we are neglecting the co-evolution of variables. This is further discussed below.

3.3 The contribution of the participation rate

Finally, we consider the hypothetical case where the participation rate were the same in each European country than in the US. From this we generate the series $\Delta'^{a}_{i,t} = n_{i,t} \times h_{i,t} \times (-\Delta^{a}_{i,t})$, with $\Delta^{a}_{i,t} = a_{i,t} - a_{us,t}$, which measures the contribution of the participation dimension of the extensive margin to the (total) hours gap relative to the US. The closer the normalized counterfactual series $\Delta^{H,a}_{i,t} = \Delta'^{a}_{i,t} - \Delta'^{a}_{i,1970}$ (starred lines in figures 3 and 4) are to the actual ones, the more the participation rate is "important" for explaining the observed total hours differential between the two regions.

3.4 Quantitative Results

Figures 3 and 4 show that in most countries the role of the intensive margin seems to be important before the mid 1970s. The exceptions are Italy, Austria and Finland, where the participation rate accounts for the largest part over this period. Thereafter, the contribution of the average hours per employee is very poor in all countries except from Austria and the Netherlands: the wedge between the two series is quite large. Indeed, in general, the relevance of the three variables is quite similar over the last period.

3.5 Intensive margin *vs* extensive margin

Finally, we assess how much of the transatlantic gap in the aggregate hours worked is due to the intensive margin and how much is due to the extensive margin. To this end, we compare the contribution of the additional hours that European countries would have if all employed workers were working as much as American workers ($\Delta^{H,h}_{i,t}$), versus the additional hours that European countries would have if both the participation rates and the employment rates were the same as in the United States ($\Delta^{H,n}_{i,t} + \Delta^{H,a}_{i,t}$). The bar plots in figures 3 and 4 suggest that in most European countries the observed fall in the total hours of market work, relative to the US, is largely explained by the dynamics of the extensive margin (that is, by the employment and the participation), particularly after the 1980s. Whereas in France and Germany the hours worked per employee seem to have similar weight as the extensive margin.

To get a better idea of the relative importance of each margin we conduct a simple accounting exercise in which we compare the fraction of the overall hours differential explained by each margin to one other. To this end we proceed as follows. First, we compute average values of the counterfactual series (Δ'^{j}, for $j = h, n, a$), as well as for their aggregate contribution ($\widehat{\Delta}^{obs} = \sum_i \Delta'^{j}$) over the next four subperiods: 1960-1969, 1970-1979, 1980-1989 and 1990-2003[8]. Then, for each subperiod we compute the ratio of the average individual contribution to the aggregate contribution ($\frac{\Delta'^{j}}{\widehat{\Delta}^{obs}}$). By construction, these ratios sum up to 100%. However, note that their sign is negative when the work effort is higher than in the US. Results are shown in table 1.

In spite of the diversity of the results, we can distinguish a general pattern suggesting that most of the differences in the aggregate hours worked, relative to the US, are explained by the extensive margin. For instance, in the 1960s, apart from Italy and the Netherlands, the aggregate work effort was higher in Europe than in the US (a negative gap). Moreover, in most

[8]For this exercise we do not normalize the counterfactual series to avoid distortions.

countries this was principally due to the pretty higher weight of participation rates than to the weight of the hours per employee. Similarly, over the last period the hours differential with respect to the US (a positive gap) is mainly driven by the participation rates: their weight on the accounting exercise is much more important than the weight of the hours per employee for the majority of countries. So, by adding the fraction explained by the employment rate we find that in all those countries the extensive margin matters more than the intensive margin in accounting for the overall hours differential.

3.6 The residual from the decomposition

Note that $\Delta_{i,t}^{obs} \neq \Delta_{i,t}^{H,h} + \Delta_{i,t}^{H,n} + \Delta_{i,t}^{H,a}$. That is, there is a residual between the observed gap and the contribution of the three components of the total hours worked: h, n and a. This residual corresponds to the actual covariances between the variables. Its magnitude depends on the choice of the reference year. But its sign provides a useful complementary information: a positive covariance allows us to predict that having lower hours per employee than in the US implies as well lower employment rate and lower participation rate. For instance, if for a country there is a positive gain from keeping the same hours per employee as in the US, and the covariance between this variable and the employment rate is positive, then there is an additional gain in hours coming from the differential between the employment rates.

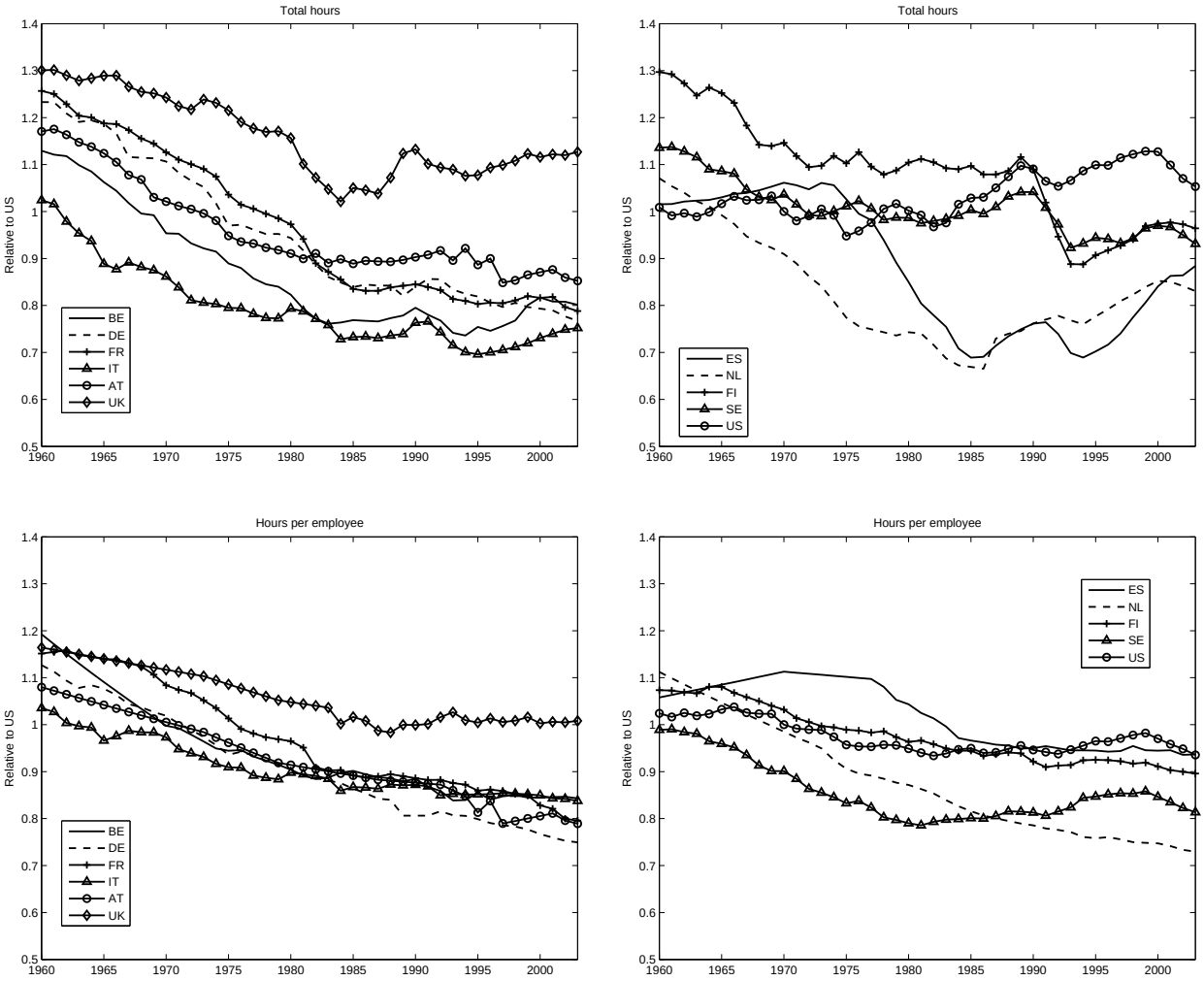
4. Conclusion

Our analysis points out that the three components of the the total hours of market work are relevant in shaping the dynamics of the total hours of market work. However, our results suggest that, in most countries, most of the differences in the aggregate hours worked, relative to the US, are explained by the extensive margin.

In terms of economic policy design, it seems very important to distinguish between the two margins of the total hours of work. The reason is that policies such as taxation affect mostly the hours worked per employee, whereas most of the effects of labor market institutions pass through employment (but not necessarily through unemployment) and the participation. We have in mind, in particular, the specific programs for elderly workers.

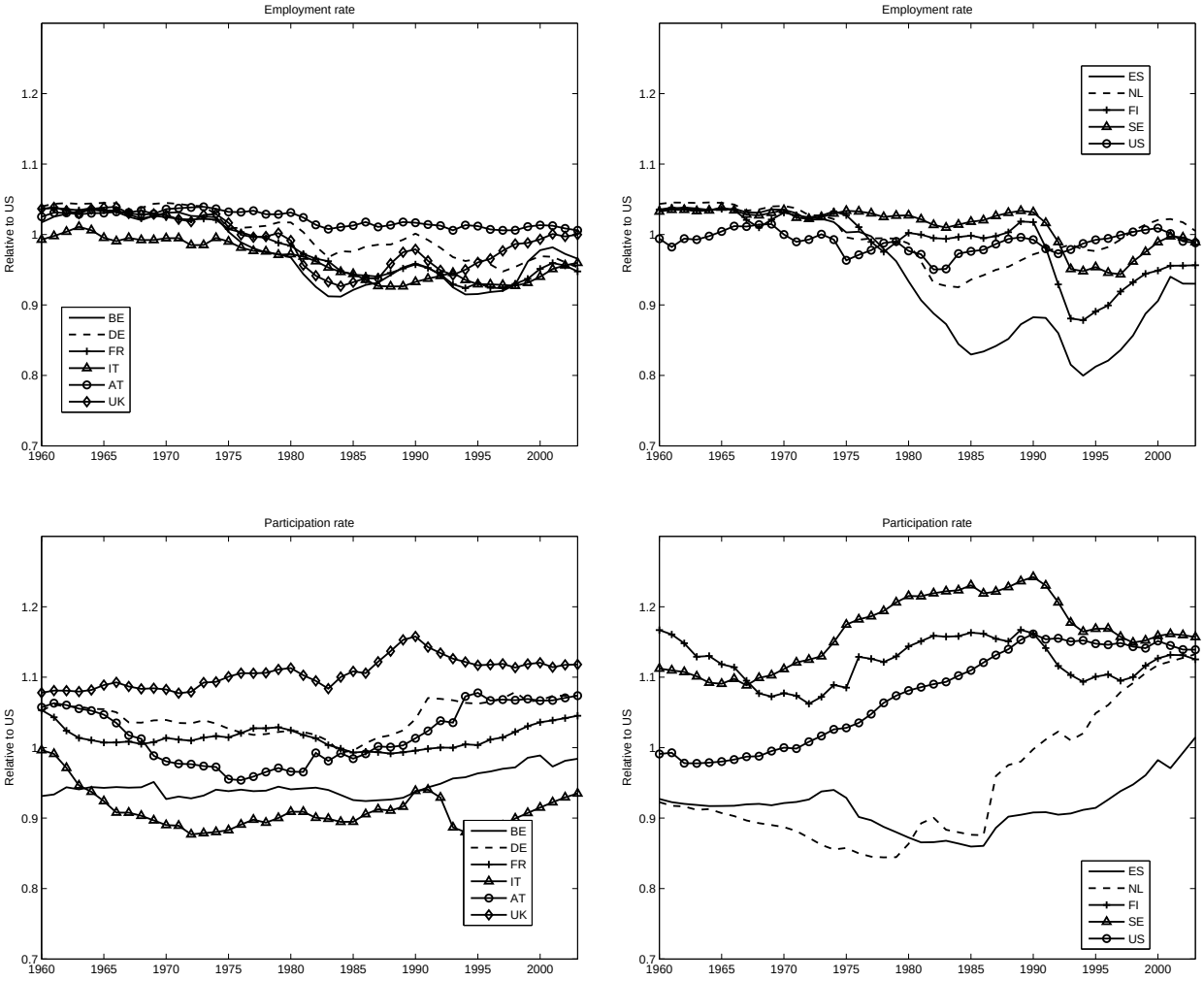
5. Figures

Figure 1: Total Hours Worked (Top) & Hours Worked per Employee (Bottom), 1960-2003.



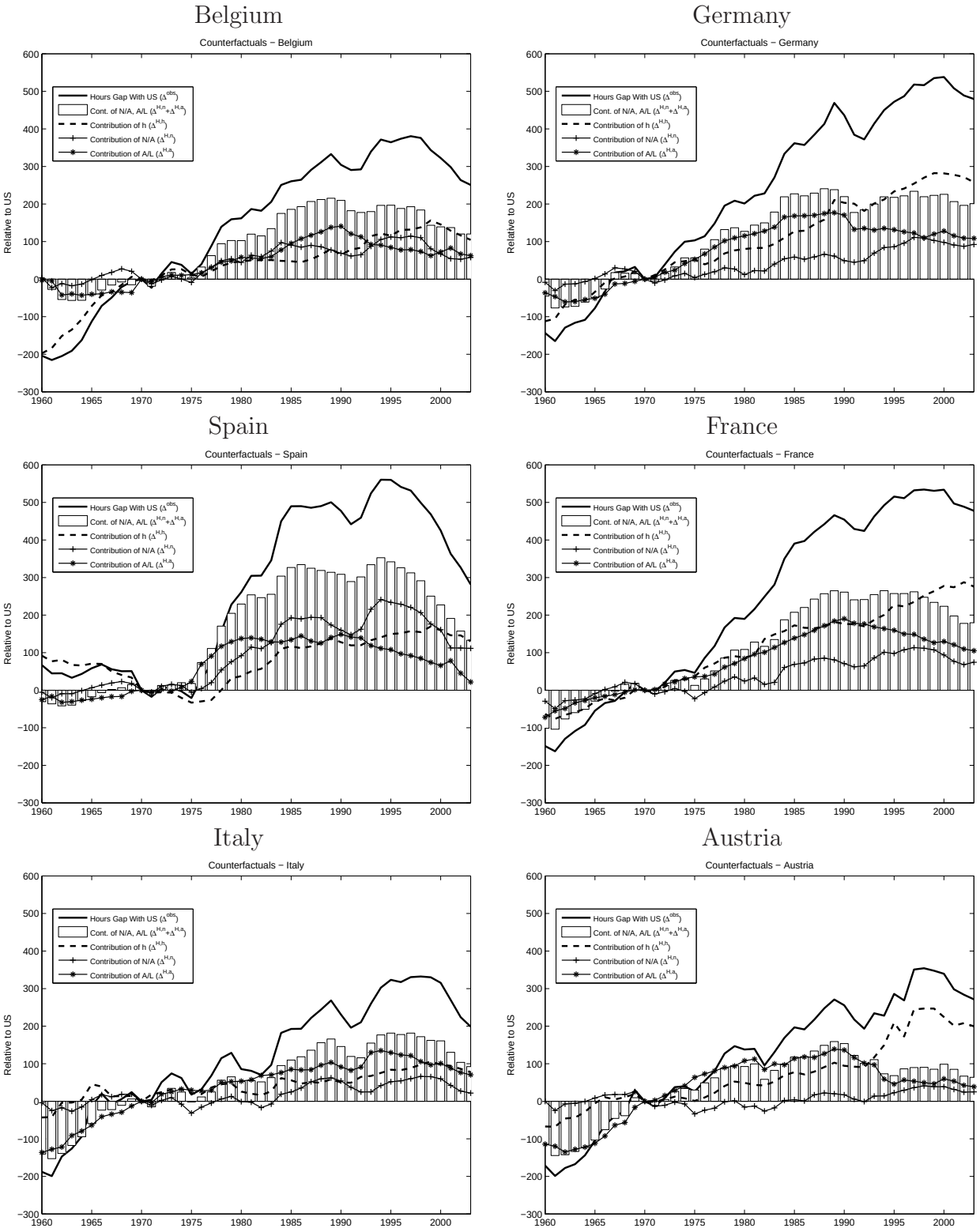
Series relative to the US in 1970.

Figure 2: Employment Rate (Top) & Participation Rate (Bottom), 1960-2003.



Series relative to the US in 1970.

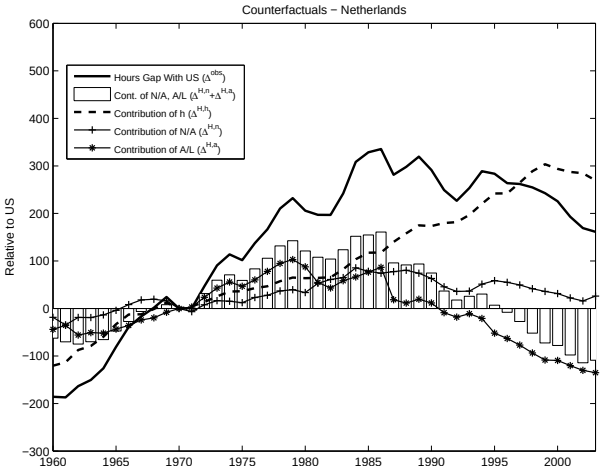
Figure 3: Counterfactuals.



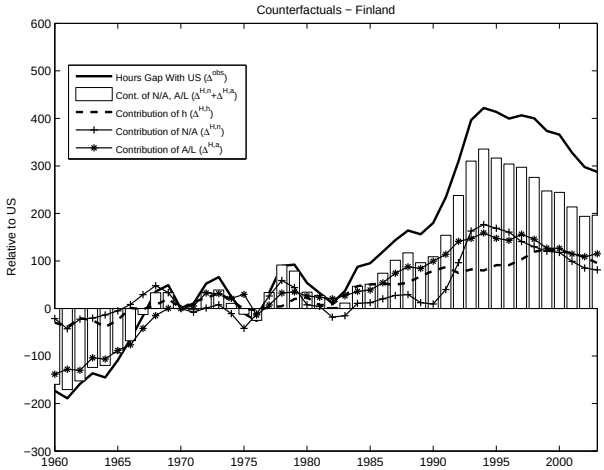
Total hours gap decomposition. Relative values (reference year = 1970). The vertical axis measures the differential between the total hours worked in each European country relative to the US, as well as the contribution of each component of total hours to this gap.

Figure 4: Counterfactuals.

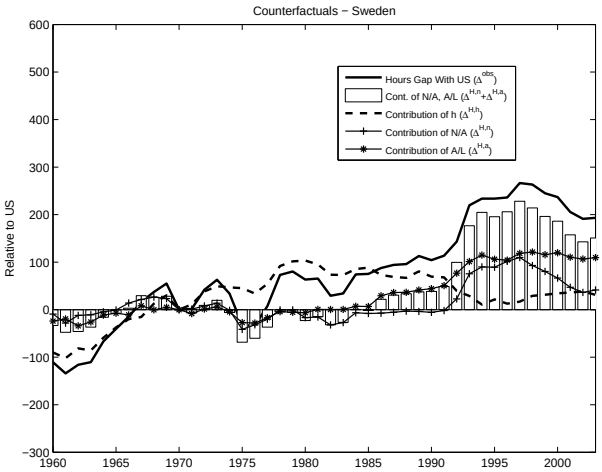
Netherlands



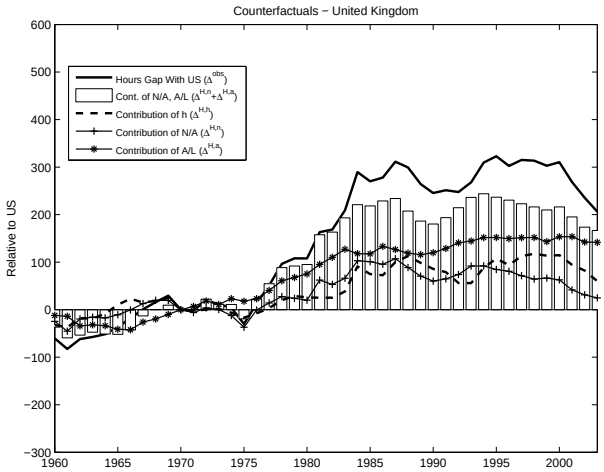
Finland



Sweden



United Kingdom



Total hours gap decomposition. Relative values (reference year = 1970). The vertical axis measures the differential between the total hours worked in each European country relative to the US, as well as the contribution of each component of total hours to this gap.

Table 1: Total-Hours-Differential Accounting

C		60-69				70-79				80-89				90-03			
		Δ'^h	Δ'^n	Δ'^a	$\widehat{\Delta}^{obs}$	Δ'^h	Δ'^n	Δ'^a	$\widehat{\Delta}^{obs}$	Δ'^h	Δ'^n	Δ'^a	$\widehat{\Delta}^{obs}$	Δ'^h	Δ'^n	Δ'^a	$\widehat{\Delta}^{obs}$
BE	mean	-90.64	-33.62	60.10	-64.15	20.26	-21.40	109.12	107.98	56.33	42.05	180.70	279.09	119.09	47.21	178.7	345.01
	rate (%)	141.28	52.40	-93.69	100	18.77	-19.80	101.05	100	20.18	15.10	64.74	100	34.51	13.70	51.79	100
DE	mean	-66.24	-55.85	-89.06	-211.16	16.22	-47.46	-0.73	-31.97	96.92	-13.05	101.40	186.26	215.49	25.61	75.61	316.72
	rate (%)	31.37	26.4	42.17	100	-50.75	148.5	2.30	100	52.31	-7	54.73	100	68.03	8.1	23.87	100
ES	mean	-66.79	-40.47	89.52	-17.74	-141.04	-25.95	153.95	-13.04	-37.36	112.30	245.17	320.11	11.70	133.86	205.48	351.06
	rate (%)	376.3	228	-504.40	100	1081.1	199	-1180.10	100	-11.7	35.10	76.60	100	3.3	38.10	58.50	100
FR	mean	-147.66	-44.61	-47.66	-239.93	-65.41	-30.47	13.13	-82.75	41.21	21.30	113.59	176.12	123.85	55.16	128.64	307.66
	rate (%)	61.54	18.60	19.86	100	79.04	36.80	-15.87	100	23.40	12.10	64.49	100	40.25	17.90	41.81	100
IT	mean	33.04	3.86	56.08	93	56.92	1.57	155.91	214.41	70.53	28.02	207.65	306.21	109.43	50.67	232.85	392.96
	rate (%)	35.53	4.20	60.30	100	26.54	0.70	72.71	100	23.03	9.20	67.81	100	27.84	12.90	59.25	100
NL	mean	-33.89	-47.87	104.18	22.41	49.47	-25.94	191.90	215.42	125.49	25.04	193.34	343.87	261.58	-2.53	74.23	33.28
	rate (%)	-151.23	-213.60	464.83	100	22.96	-12	89.08	100	36.49	7.30	56.22	100	78.48	-0.80	22.27	100
AT	mean	-27.90	-38.48	-71.32	-137.71	8.34	-54.30	73.50	27.54	61.10	-43.89	136.20	153.41	171.68	-19.20	92.98	245.45
	rate (%)	20.26	27.90	51.79	100	30.30	-197.10	266.81	100	39.83	-28.60	88.78	100	69.94	-7.80	37.88	100
FI	mean	-58.34	-42.83	-183.25	-248.43	-32.77	-35.56	-82.42	-150.75	-4.47	-33.12	-53.34	-90.94	54.75	71.36	31.27	157.39
	rate (%)	20.51	15.10	64.42	100	21.73	23.60	54.67	100	4.92	36.40	58.65	100	34.78	45.30	19.87	100
SE	mean	94.28	-40.61	-139.03	-85.37	186.38	-49.88	-135.71	0.78	219.94	-55.12	-111.82	53	172.58	17.85	-27.05	163.38
	rate (%)	-110	47.60	163	100	23652	-6330.20	-17222	100	415	-104	-211	100	106	10.90	-17	100
UK	mean	-161.28	-48.94	-142.23	-352.45	-157	-39.43	-88.91	-285.35	-92.67	35.94	-2.03	-58.75	-68.91	24.28	28.84	-15.78
	rate (%)	45.75	13.90	40.35	100	55.02	13.80	31.15	100	157.72	-61.20	3.45	100	436.52	-153.80	182.68	100

60-69: period from 1960 to 1969. 70-79: period from 1970 to 1979. 80-89: period from 1980 to 1989. 90-03: period from 1990 to 2003.
mean: mean of the counterfactual series (without normalization to avoid distortions) over each period.
$\widehat{\Delta}^{obs} = \Delta'^h + \Delta'^n + \Delta'^a$
rate= $\frac{\Delta^j}{\widehat{\Delta}^{obs}}$, for $j = h, n, a$: fraction of $\widehat{\Delta}^{obs}$ accounted by counterfactual i. Then, $\sum_i rate_i = 100$.

6. References

Alesina, A., E. Glaeser and B. Sacerdote (2005): "Work and leisure in the U.S. and Europe: Why so different?," in *NBER Macroeconomics Annual*, by M. Gertler and K. Rogoff, Eds., **20**, 1–100.

Blanchard, O. and J. Wolfers (2000): "The role of shocks and institutions in the rise of European unemployment: the aggregate evidence," *Economic Journal*, **110**, 1–33.

Hansen, G. (1985): "Indivisible Labor and the Business Cycles," *Journal of Monetary Economics*, **16**, 309–327.

Jackman, N., R. Layard and S. Nickell (1991): "Unemployment, Macroeconomic Performance and the Labour Market," *Oxford University Press.*

Langot, F. and C. Quintero-Rojas (2008): "Explaining the evolution of hours worked and employment across OECD countries: an equilibrium search approach," IZA discussion paper number 3364.

Ljungqvist, L. and T. Sargent (2008): "Two Questions about European Unemployment," *Econometrica*, **76**(1), 1–29.

——— (2007b): "Understanding European unemployment with matching and search-island models," *Journal of Monetary Economics*, (54), 2139–2179.

——— (2007a): "Understanding European unemployment with a representative family model," *Journal of Monetary Economics*, (54), 2180–2204.

Mortensen, D. T. and C. A. Pissarides (1999): "Job reallocation, employment fluctuations and unemployment", in vol. 1 of *Handbook of Macroeconomics*, chap. 18, pp. 1171–1228. North-Holland.

Ohanian, L., A. Raffo and R. Rogerson (2008): "Long-term changes in labor supply and taxes: evidence from OECD countries, 1956-2004," *Journal of Monetary Economics*, (55), pp. 1353-1362.

Prescott, E. (2004): "Why do Americans work so much more than Europeans?," *Federal Reserve Bank of Minneapolis Quarterly Review*, **28**(1), 2–13.

Rogerson, R. (2006): "Understanding differences in hours worked," *Review of Economic Dynamics*, (9), 365–409.

——— (1988): "Indivisible labor, lotteries and equilibrium," *Journal of Monetary Economics*, **22**(3), 501–515.

Rogerson, R. and L. Fang (2007): "Policy analysis in a matching model with intensive and extensive margins," NBER working paper number 13007.

Rogerson, R. and J. Wallenius (2007): "Micro and macro elasticities in a life cycle model with taxes," NBER working paper number 13017.