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Heterogeneous labor markets and generosity towards the unemployed: an international perspective

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We investigate the key differences in the distributions of European, Canadian and US labor forces to explain cross-country differences in unemployment insurance generosity in a dynamic model with indivisible labor and with constraints on borrowing. Agents differ in education leading to country-specific differences in employment probabilities and income prospects. Moral hazard is allowed to vary across countries so that it is a free parameter in our specification. We derive the degree of generosity of unemployment insurance favored by the majority of the population and contrast this with that chosen by a social planner. Calibrating the model using data allows us to predict moral hazard within each country, even though this is an otherwise unmeasurable statistic. *Journal of Comparative Economics* **33** (1) (2005) 88–106. Département des Sciences Économiques and CIRPEE, Université du Québec à Montréal, PO Box 8888, Downtown Station, Montréal, QC, Canada H3C 3P8; Department of Economics, University of Connecticut, 341 Mansfield Road, Unit 1063 Storrs, CT 06269–1063, USA.

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1. Introduction

Industrialized countries exhibit socio-economic differences that are likely to affect the design of economic policies. In this paper, we study the impact of differences in the distribution of education and labor market outcomes on the degree of generosity of unemployment insurance. The relative wage of a worker of a given skill level differs widely across countries, as do income inequality and skill-specific unemployment risk. We observe that different countries have designed different unemployment insurance programs, having differing degrees of generosity. For example, Denmark is at least twice as generous as the United States in providing unemployment insurance. In Pallage and Zimmermann (2001), we demonstrate that heterogeneity in the population affects voting for the degree of generosity of an unemployment insurance program. In particular, we show that the educational characteristics of the United States population matter in determining the type of program voters select. In the present paper, we investigate the characteristics of American, Canadian and European labor forces that may explain differences in the degree of generosity of unemployment insurance.

Abstracting from possible differences in preferences, technologies, or demographics across countries, we allow countries to differ according to the distribution of skills, the unemployment rate of each skill group, the aggregate unemployment rate, and the distribution of earnings by skill. We investigate whether those characteristics can explain the observed differences in the degree of generosity of unemployment insurance programs across the countries. In our calibration exercise, we have one degree of freedom, namely the level of moral hazard, which is unobserved but relevant to policy makers. By equating the degree of generosity from the model with that observed in the data, we infer the level of moral hazard across countries. We use the dynamic model having indivisible labor and borrowing constraints in Pallage and Zimmermann (2001). Agents are heterogeneous; they differ intrinsically in their educational attainment, their probability of finding a job, and their income prospects. Agents are also allowed to differ in their choices of self-insurance through asset holdings and their past and current employment choices. We calibrate the model to a set of countries belonging to the Organization for Economic Cooperation and Development (OECD). In every country we identify the degree of generosity of unemployment insurance (UI) favored by a majority of agents and also that chosen by a utilitarian social planner for given levels of moral hazard.

Following contributions by Baily (1978) and Flemming (1978), a large literature has evolved focusing on the quantitative assessment of the optimal level of UI benefits in the presence of moral hazard. Using a two-period search model without leisure, Baily (1978) concludes that moral hazard does not matter. Following the work of Kydland and Prescott (1982), the calibration methods became more rigorous and computing experiments developed as a credible substitute to social experiments. In addition, progress in developing models of heterogeneous agents made it possible to experiment on UI policies within calibrated models. Recent contributions by Hansen and İmrohoroğlu (1992), Zhang (1996), Wang and Williamson (1996), Valdivia (1996) and Costain (1997) reverse Baily's conclusion about the relative unimportance of moral hazard. However, Pallage and Zimmermann (2001) demonstrate that substantial moral hazard levels are required to curb the degree of UI generosity dramatically if the policy choice reflects majority preferences rather than that of a social planner.

Our research is related closely to a second strand of literature initiated by Wright (1986) who focuses on a time inconsistency in the voting behavior of agents for a UI program. The author shows that two otherwise identical individuals vote differently whether they are employed or unemployed. Hassler and Rodríguez Mora (1999) show that low turnover in unemployment has a positive impact on the generosity of the UI program chosen by the median voter. These authors use this result to explain the differences in UI generosity between Europe and the US. A third relevant strand of literature to which Lindbeck and Snower (1988), Nickell (1997), Ljungqvist and Sargent (1998) and Hassler et al. (2003) have contributed attempts to explain the European unemployment dilemma.

Building on these traditions, we analyze the voting behavior of different societies on UI benefits in the presence of moral hazard. We develop a positive theory of the differing choices made by societies such as Norway, Canada, Spain or the United States and provide a measure of actual levels of moral hazard in various countries. Lentz (2003) estimates a search model with moral hazard using Danish data and tries to compute an indicator for moral hazard. Unfortunately, his indicator is not easily interpreted as is the one we obtain. In the next section, we document differences in the distributions of labor forces across countries. In Section 3, we outline the model that we calibrate in Section 4. Section 5 presents our main findings and we conclude in Section 6 with options for future research.

2. Stylized facts

In this section, we highlight the differences in the socio-economic characteristics of the labor forces of OECD countries. Unless otherwise mentioned, all data presented are averages over the years from 1989 to 1995. The distribution of skills, measured by educational attainments, is not uniform within a country, nor is it identical across countries. The proportion of individuals ages 25 to 64 without a high school degree ranges from 16% in the US to 76% in Spain, whereas university graduates account for 8.6% of that age group in Ireland versus 24% in the US, as Table 1 indicates. Moreover, inequality in education is associated with inequality of opportunities on the job market. In the countries in our sample, unemployment rates for low-skill individuals are significantly higher than for high-skill ones, as Table 2 suggests. In Belgium, a worker without a high school degree is more than four times as likely to be jobless as a university graduate. In Spain, this likelihood is only 1.5 times higher, although the aggregate unemployment rate is twice that of Belgium. Table 3 reports another manifestation of the inequality of opportunities. The lowest educational group in the US earns on average 2.8 times less than university graduates.

The countries with low unemployment rates in our sample are Switzerland with an average rate of 2.6% between 1989 and 1995, and Norway and the US with averages of 4.2 and 5.7% respectively. Labor turnover is highest in the US. Table 4 indeed reports that the probability of exiting unemployment each month is the highest in this country at

Table 1
Education distributions, % of population 25 to 64 years of age

	Highest degree earned			
	< high school	high school	< university	⩾ university
Belgium	54.6	25	11.4	9.4
Canada	26.6	32.6	24.6	16.2
Denmark	40.2	41	6.2	12.8
France	42.6	40.8	6.8	10
Germany	18	60.6	9.6	11.8
Ireland	57.4	25.2	8.8	8.6
Norway	23	51.2	11.4	14.4
Spain	76.2	11	2.2	10.4
Switzerland	18.8	58.4	14.4	8.4
United Kingdom	30.4	50.8	7.8	11
United States	16	50.4	9.6	24

Note: The figures are averages over the years 1989 to 1995.
Source: OECD (various years).

Table 2
Unemployment rates by educational attainment for persons 25 to 64 years of age and average duration

	Unemployment rate					Average duration (months)
	< high school	high school	< university	⩾ university	aggregate	
Belgium	12.46	5.64	2.84	2.7	7.98	11.63
Canada	13.31	8.72	7.56	4.74	8.66	3.51
Denmark	14.76	8.74	5.36	4.42	10.06	4.67
France	12.51	8.00	5.02	4.86	9.04	23.81
Germany	12.14	7.34	4.82	4.48	7.38	11.11
Ireland	19.17	8.10	5.20	3.22	12.92	26.32
Norway	6.70	4.50	3.03	1.65	4.23	3.36
Spain	17.15	15.46	15.87	11.5	15.86	42.74
Switzerland	3.93	2.48	1.78	2.88	2.63	4.06
United Kingdom	11.58	7.22	3.54	3.30	7.50	10.75
United States	11.46	6.06	4.28	2.82	5.66	2.52

Notes: (1) Figures are averages over the years 1989–1995. (2) Duration measures are computed as the inverse of the monthly outflow rates.
Source: OECD (various years).

39.7%, whereas the probability of entering unemployment is also high for all skill groups compared with that of other countries. As a result an average unemployed American stays jobless for only 2.5 months. Norway, Canada and Denmark also have higher than average probabilities of exiting unemployment, with an average duration of 3.4, 3.5 and 4.7 months, respectively. The countries with high unemployment rates are Spain, with an average rate of 15.9%, Ireland (12.9%), Denmark (10%), France (9%), Canada (8.7%), Belgium (8%), the UK (7.5%), Germany (7.4%). Except for Canada and Denmark, all these countries are characterized both by very low probabilities of exiting unemployment and by very low chances of entering it, as Table 4 indicates. The average duration of unemployment is highest in Spain at almost 43 months.

Table 3
Average earnings by education for population 25 to 64 years of age

	Earning indices			
	< high school	high school	< university	⩾ university
Belgium	0.82	1.04	1.32	1.52
Canada	0.75	0.91	1.04	1.53
Denmark	0.85	1.02	1.02	1.39
France	0.78	1.01	1.28	1.68
Germany	0.71	0.94	1.11	1.63
Ireland	0.84	0.99	1.22	1.82
Norway	0.73	0.93	1.25	1.50
Spain	0.86	1.23	1.16	1.74
Switzerland	0.60	0.95	1.42	1.60
United Kingdom	0.69	0.97	1.30	1.78
United States	0.56	0.86	1.09	1.55

Note: Indices average to one in each country.
Source: OECD (various years).

Table 4
Monthly transition probabilities in and out of unemployment (%)

		< High school	High school	< University	⩾ University
Belgium	$p(e\|u)$		8.6		
	$p(u\|e)$	1.22	0.51	0.25	0.24
Canada	$p(e\|u)$		28.5		
	$p(u\|e)$	4.38	2.72	2.33	1.42
Denmark	$p(e\|u)$		21.4		
	$p(u\|e)$	3.71	2.04	1.21	0.99
France	$p(e\|u)$		4.2		
	$p(u\|e)$	0.60	0.37	0.22	0.21
Germany	$p(e\|u)$		9.0		
	$p(u\|e)$	1.24	0.71	0.46	0.42
Ireland	$p(e\|u)$		3.8		
	$p(u\|e)$	0.90	0.33	0.21	0.13
Norway	$p(e\|u)$		29.76		
	$p(u\|e)$	2.14	1.40	0.93	0.50
Spain	$p(e\|u)$		2.34		
	$p(u\|e)$	0.48	0.43	0.44	0.30
Switzerland	$p(e\|u)$		24.6		
	$p(u\|e)$	1.00	0.62	0.44	0.73
United Kingdom	$p(e\|u)$		9.3		
	$p(u\|e)$	1.22	0.72	0.34	0.32
United States	$p(e\|u)$		39.7		
	$p(u\|e)$	5.14	2.56	1.78	1.15

Source: $p(e|u)$: OECD (1995); $p(u|e) = [p(u)p(e|u)]/(1 - p(u))$.

Because countries are clearly different regarding unemployment, an ideal UI program for the US is unlikely to be appropriable for Spain. Hence, the model must be calibrated to reflect the essential differences in these societies. In addition, the model should capture the various types of heterogeneity across countries. Not only do socio-economic characteristics

Table 5
UI replacement rates (θ) in selected OECD countries

	net θ		gross θ	
	θ	θ^c	θ	θ^c
Belgium	0.59	0.62	0.42	0.45
Canada	0.47	0.63	0.28	0.53
Denmark	0.81	0.81	0.71	0.71
France	0.55	0.59	0.38	0.44
Germany	0.54	0.63	0.26	0.31
Ireland	0.37	0.38	0.23	0.27
Norway	0.62	0.70	0.39	0.62
Spain	0.49	0.51	0.32	0.34
Switzerland	0.62	0.80	0.30	0.68
United Kingdom	0.51	0.56	0.18	0.20
United States	0.16	0.35	0.12	0.27

Notes: (1) Net replacement rates are defined as after tax UI payments and housing entitlements to UI beneficiaries as a share of after tax income. (2) Gross replacement rates are before tax UI payments as a share of before tax income. (3) The figures in the column headed by θ are from Martin (1996). (4) The figures in the column headed by θ^c are those from above corrected for unemployment duration.

differ across countries, but so does the level of generosity of their UI programs. Programs vary in multiple dimensions, namely eligibility, maximum duration of benefits, and income replacement rates for various times of eligibility. Martin (1996) provides an index of generosity that adjusts the replacement rate to reflect differences in these characteristics. The author considers the replacement rates for three types on households, i.e., single and married with a working or a non-working partner, within three intervals of an unemployment spell, first year, the 2nd and 3rd years, and the 4th and 5th years. He determines the UI replacement rate for each of the nine categories and calculates their unweighted average. Net rates, defined as after tax but including housing entitlements, range from 16% in the US to 81% in Denmark. Table 5 contains Martin's figures for selected countries in the columns headed by θ. However, these figures may be misleading because proportionally fewer people are in their fourth or fifth year of unemployment in the US than in France for which $\theta = 0.55$. The second index θ^c in Table 5 corrects Martin's measure by weighting it according to the length of the unemployment spell using the transition probabilities from Table 4. Before tax, gross rates are sometimes much lower without this correction, depending on whether UI benefits are taxable or not. However, both corrected net and gross replacements still vary widely across countries.

3. The model

The model is the one in Pallage and Zimmermann (2001); we sketch the basics of the model for completeness. The discrete-time model contains several economies, denoted k, with labor markets similar to the ones specified in Hansen (1985) and Hansen and İmrohoroğlu (1992) but having no reproducible capital. Labor is indivisible, and job opportunities are stochastic following economy-specific Markov processes. A single consumption good is produced using labor only. Markets are incomplete; a storage technology is available but no credit market exists. Infinitely-lived agents within an economy are heterogeneous along several dimensions, namely asset holdings, denoted m; skill, denoted j and consisting of education achievements modeled as endowments; past realization of the job opportunity process, denoted s and indicating whether an individual was offered a job or not in the previous period; work status, denoted η and indicating whether an individual accepted a job offer in the previous period; and the current realization of the job opportunity process. In each economy, a continuum of agents of measure one is divided into four skill groups of invariant measure, denoted ν^{jk}. To keep the computations tractable, we do not allow transitions from one skill group to another, international migration, or population growth. Since countries are closed, we drop the k superscript for ease of notation. Agents value consumption c and leisure l. Indivisibility of labor implies that an individual i of skill j either does not work or works for a fixed number of hours, denoted $\hat{h}$, out of his unit endowment of time. If an individual works, he produces y^j units of output and we assume no home production.

Job opportunities, denoted s_t, follow Markov transition probabilities by $p^j(s_{t+1}|s_t)$. At the beginning of period t, an agent learns the outcome of his employment shock. He is either offered a job, i.e. $s_t = e$, or denied one, i.e. $s_t = u$. If he has a job opportunity, he may choose to accept it and receive a competitive salary given by y^j. If he refuses it, he would receive no income under perfect monitoring. In this paper, we assume that monitoring of unemployed searchers is not perfect, so that, if this agent was not working at the beginning of the period, i.e. $\eta_t^{ij} = 0$, either because he did not receive a job offer in the past or because he refused one, he may collect unemployment benefits with probability π even though he refuses a current offer. Hence π is an index of moral hazard in the economy. Quitters, i.e. individuals who were working but refuse a renewal offer, are assumed to be perfectly detectable. Eligibility for UI benefits is otherwise guaranteed to every agent without a job opportunity, i.e. $s = u$. We use the binary variable μ_t^{ij} to characterize the eligibility of an agent in a given period, i.e. $\mu_t^{ij} = 1$ if the individual is eligible and 0 otherwise).

Unemployment insurance is financed by a tax on income at the rate denoted by τ. The public unemployment insurance agency is required to balance its budget. Hence, a UI program is a pair (θ, τ) in which θ represents the replacement rate, i.e., the fraction of work income that is provided as compensation for joblessness. Neither the replacement rate nor the tax rate is differentiated across skill groups. Disposable income y_t^{ijd} for a given agent at time t is given by:

$$y_t^{ijd}\left(s_t^{ij}, \eta_{t+1}^{ij}, \mu_t^{ij}; \theta, \tau\right) = \begin{cases} y^j(1-\tau) & \text{if } s_t^{ij} = e \text{ and } \eta_{t+1}^{ij} = 1, \\ \theta y^j(1-\tau) & \text{if } \mu_t^{ij} = 1, \\ 0 & \text{if } \mu_t^{ij} = 0. \end{cases}$$

Once agents have observed their employment shock and, when applicable, have taken their labor decisions, those who work are paid y^j, those without job opportunity receive UI benefits, and those who shirk, i.e., refuse job offers, learn if they have been successful at collecting benefits. Given their disposable income and their current assets, agents choose their level of consumption and savings. The problem of agent i in group j implies choosing a consumption–leisure–savings bundle (c^{ij}, l^{ij}, m^{ij}) to maximize the following objective function:

$$\mathcal{U}\big(c^{ij}, l^{ij}\big) = E_0 \sum_{t=0}^{\infty} \beta^t U\big(c_t^{ij}, l_t^{ij}\big),$$

subject to the liquidity constraint

$$m_{t+1}^{ij} + c_t^{ij} = m_t^{ij} + y_t^{ijd}, \quad m_{t+1}^{ij} \geqslant 0,$$

where, $U(\cdot,\cdot)$ is a strictly concave and increasing function of consumption and leisure and β a discount factor.[1] The solution is characterized by a Bellman equation in which we drop the time subscript and use primes to denote future states. Denoting the vector of exogenous variables $\chi = (j, \theta, \tau, \pi)$, we have the following program for each agent:

$$[\mathrm{P}] \quad v(m, s, \eta; \chi) =$$

$$\begin{cases} \max_{m'} U(m + (1-\tau)\theta y^j - m', 1) + \beta \sum_{s'} p^j(s'|u) v(m', s', 0; \chi), \quad \text{if } s = u, \\ \max \begin{cases} \max_{m'} U(m + (1-\tau) y^j - m', 1 - \hat{h}) + \beta \sum_{s'} p^j(s'|e) v(m', s', 1; \chi), \\ \pi [\max_{m'} U(m + (1-\tau)\theta y^j - m', 1) + \beta \sum_{s'} p^j(s'|e) v(m', s', 0; \chi)] \\ \quad + (1-\pi)[\max_{m'} U(m - m', 1) + \beta \sum_{s'} p^j(s'|e) v(m', s', 0; \chi)], \quad \text{if } s = e. \end{cases} \end{cases}$$

We consider two types of equilibria, namely a majority-favored equilibrium and a utilitarian equilibrium. A majority-favored equilibrium is a steady-state allocation of work, assets, and consumption for all agents, together with a pair (θ, τ) such that

(i) agents solve their individual intertemporal problem [P], given (θ, τ);
(ii) the government balances its budget; and
(iii) no $\theta' \neq \theta$ that would be favored by a majority of agents exists.

A utilitarian equilibrium is a steady-state allocation of work, assets, and consumption for all agents, together with a pair (θ, τ) such that

(i) agents solve their individual intertemporal problem [P], given (θ, τ);
(ii) the government balances its budget; and
(iii) θ is such that no other θ' that provides higher average value exists.

Given these definitions, we now need to solve for these equilibria. Clearly a closed-form solution does not exist. We therefore have to solve numerically, which implies an adequate parametrization of the model. This also allows to obtain quantitative answers.

4. Parametrization, computations and equilibrium outcomes

We parametrize our model using the evidence about the labor markets from Tables 1–4. The four skill groups in each country are university graduates, high school graduates with

[1] The model is not *per se* a true general equilibrium model because the availability of a storage technology implies that the interest rate is implicitly fixed at zero.

some college but no university degree, high school graduates without further schooling, and individuals without a high school degree. Group measures, denoted ν^j, are given in Table 1, and group-specific productivities, denoted y^j, are taken from Table 3. Transition probabilities from an employment status to another, denoted $p^j(s_{t+1}|s_t)$, are computed in Table 4 using aggregate unemployment exit rates together with the average unemployment rate of a skill group from Table 2. We do not have data on the average duration of unemployment within a skill group in a given country. Hence, we assume average duration to be identical across groups, following Nickell (1979) for the UK, Mincer (1993, 1994) for the US, and Corak and Heisz (1995) for Canada.

With respect to preferences, we assume that individuals in all countries have the same utility function, because we do not want differences in UI programs to be attributed to differences in preferences. On the contrary, we seek to explain these differences by differences in population distributions. Therefore, we consider the following utility function for all countries and choose the parameters to fit the US, by following the literature. We take:

$$U\left(c_t^{ij}, l_t^{ij}\right) = \frac{({c_t^{ij}}^{1-\sigma} {l_t^{ij}}^{\sigma})^{1-\rho} - 1}{1-\rho},$$

with the weight of leisure in the utility function, denoted σ, equal to 0.67, which is standard in the macroeconomic literature, and the risk aversion parameter, denoted ρ, equal to 2.5 following Hansen and İmrohoroğlu (1992) and Kydland and Prescott (1982). This value for risk aversion is within the accepted range identified by Mehra and Prescott (1985). The discount factor β is set equal to 0.995, given a period length of one month. This choice of discount factor corresponds to an annual interest rate of 6%. If an individual is a worker, he works 45% of his available time as Hansen and İmrohoroğlu (1992) also assume, which corresponds to a forty four hour week, including commuting times.

Given this calibration, one free parameter remains, namely the probability of success when shirking, denoted π. Since no estimates of this measure are available in the literature, we perform simulations for values over the range from zero to 0.4 to investigate the sensitivity of our results to the parameter. For each π, we obtain the equilibrium UI benefits and compare these to the observed values of θ^c. Based on these comparisons, we infer the true value of π and consider this to be the level of moral hazard in the economy.

For a given replacement ratio (θ) and a level of moral hazard π, we iterate on the agents' value functions over a grid of state variables. The asset space is composed of 301 points between 0 and an upper bound that is never chosen by agents in our computations. We fix this upper bound at 8 following Hansen and İmrohoroğlu (1992). Other state variables include the skill group, the current job offer status, and the previous period's employment status. Since we allow no transition from one skill group to another, we can analyze each group separately and reduce the dimensions of the state space. Once the value functions and the corresponding optimal decision rules are found, the invariant distribution of the agents is obtained iteratively. Initially a tax rate is set and, given the decision rules and the invariant distribution of each skill group, the tax rate is iterated until we achieve a balanced government budget.

To assess the desirability of a UI program, we evaluate the preferences of the agents on θ, given a certain exogenous level of moral hazard. Initially, we compare the value function of the agent under the status quo replacement ratio and under some alternative. Then, we count the number of agents who favor each program. Applying simple majority rule, we characterize a majority-favored equilibrium as a replacement ratio, denoted $\hat{\theta}$, that survives such comparisons with all alternatives. In determining the equilibrium level of benefits, we do not use a median-voter theorem, because the preferences in our model are not likely to be single-peaked. By counting the votes of each individual from a heterogeneous population, we avoid the need to satisfy the conditions required for a median voter result.[2]

Whether this majority-favored equilibrium can be called a voting equilibrium is debatable because the votes that we are considering involve comparisons from steady state to steady state. Hence, agents are really asked under what system they would prefer to be born. Transitions from one system to another are not taken into account by the voters, so that the behavior may be characterized as helicopter-drop votes. The choice of a single agent to be born in one situation or another does not change the equilibrium outcome of the economy because each agent is infinitesimally small. Considering transitions between steady states as well as sequential voting, as do Krusell and Ríos-Rull (1999), would make a better voting experiment. However, this approach would be a formidable exercise in our model, due to the many dimensions of heterogeneity. Our results already represent impressive computing time so that such computations would be excessively expensive. However, to avoid misrepresenting our equilibria, we do not characterize them as voting equilibria but refer to the replacement ratio that survives all alternatives as a majority-favored policy. For comparison, we characterize the utilitarian equilibrium that results if a social planner maximizes a welfare function corresponding to the average value for all agents.

5. Predicted replacement rates and moral hazard

In panel A of Table 6 we report the replacement rates in the majority-favored equilibrium for each country as a function of the proportion of successful shirkers. For a given level of moral hazard, countries select different unemployment insurance programs. In absence of moral hazard, i.e. $\pi = 0$, $\hat{\theta}$ ranges from 60 to 100%. If the success rate of shirkers is 40%, equilibrium replacement rates range between 20 and 35%. In addition, considerable divergence is found in the attitude of countries towards moral hazard when π is below 20%. For example, Belgium would select the same replacement rate for values of π equal to 0 or 10%. Under the same circumstances, the US would reduce its equilibrium replacement rate from 100 to 70%. Typically, the generosity of UI benefits experiences its sharpest drop for values of π between 10 and 20%. In general, as π increases, equilibrium generosity is lower and average asset levels are higher. Both effects reinforce each other in that richer agents can better afford the risk of shirking. The higher the willingness to shirk and the lower UI generosity, the more agents are induced to self-insure by accumulating assets.

[2] We do not prove uniqueness of the equilibrium. Such proof is difficult without recourse to a median-voter theorem. We cannot exclude the possibility of a Laffer-curve result. However, experiments that we conducted previously did not reveal multiple equilibria in that taking a much higher tax rate initially always led to a convergence to the equilibrium tax rate. Hence, although we cannot exclude multiple equilibria, we are fairly confident that the mapping between θ and τ is one-to-one.

Table 6
Majority-favored versus optimal UI program

		A. Majority-favored UI policy Moral hazard π					B. Optimal UI policy Moral hazard π				
		0	0.1	0.2	0.3	0.4	0	0.1	0.2	0.3	0.4
Belgium	$\hat{\theta}$	**1.00**	$\boxed{\mathbf{1.00}}$	$\boxed{\mathbf{0.50}}$	**0.40**	**0.35**	**1.00**	$\boxed{\mathbf{0.70}}$	$\boxed{\mathbf{0.50}}$	**0.35**	**0.20**
	τ	0.0806	0.0806	0.0478	0.0522	0.0418	0.0806	0.569	0.0478	0.0418	0.0238
	shirkers	0.0	0.0	0.009	0.031	0.024	0.0	0.001	0.009	0.024	0.024
	workers	0.880	0.880	0.848	0.786	0.811	0.880	0.906	0.848	0.811	0.838
	$\bar{m}$	0.289	0.289	0.438	0.992	1.02	0.289	0.047	0.438	1.02	2.22
Canada	$\hat{\theta}$	**0.70**	$\boxed{\mathbf{0.65}}$	**0.45**	**0.30**	**0.20**	**0.95**	$\boxed{\mathbf{0.65}}$	**0.45**	**0.20**	**0.15**
	τ	0.0600	0.0559	0.0468	0.0351	0.0232	0.0821	0.0559	0.0468	0.0232	0.0153
	shirkers	0.0	0.0	0.009	0.018	0.018	0.0	0.0	0.009	0.018	0.008
	workers	0.910	0.910	0.849	0.836	0.855	0.878	0.910	0.849	0.855	0.885
	$\bar{m}$	0.0	0.0	0.644	1.20	1.87	0.105	0.0	0.644	1.20	2.35
Denmark	$\hat{\theta}$	$\boxed{\mathbf{0.60}}$	**0.60**	**0.35**	**0.30**	**0.20**	$\boxed{\mathbf{0.70}}$	**0.65**	**0.40**	**0.20**	**0.20**
	τ	0.0631	0.0631	0.0417	0.0413	0.0276	0.0729	0.0680	0.0494	0.0276	0.0276
	shirkers	0.0	0.0	0.006	0.017	0.018	0.0	0.0	0.009	0.018	0.018
	workers	0.896	0.896	0.857	0.825	0.840	0.896	0.896	0.839	0.840	0.840
	$\bar{m}$	0.0	0.0	0.957	1.34	2.22	0.0	0.0	0.781	2.22	2.22
France	$\hat{\theta}$	**0.60**	$\boxed{\mathbf{0.60}}$	**0.45**	**0.35**	**0.30**	**0.85**	$\boxed{\mathbf{0.70}}$	$\boxed{\mathbf{0.45}}$	**0.40**	**0.35**
	τ	0.0543	0.0543	0.0439	0.0463	0.0503	0.0762	0.0628	0.0439	0.0573	0.0463
	shirkers	0.0	0.0	0.004	0.025	0.049	0.0	0.0	0.004	0.031	0.025
	workers	0.906	0.906	0.875	0.799	0.760	0.891	0.905	0.875	0.775	0.799
	$\bar{m}$	0.0	0.0	0.216	0.946	1.28	0.230	0.008	0.216	0.965	0.946
Germany	$\hat{\theta}$	**0.65**	$\boxed{\mathbf{0.65}}$	**0.45**	**0.35**	**0.30**	**0.90**	$\boxed{\mathbf{0.70}}$	**0.45**	**0.35**	**0.30**
	τ	0.0474	0.0474	0.0386	0.0395	0.0425	0.0657	0.0506	0.0386	0.0395	0.0425
	shirkers	0.0	0.0	0.008	0.025	0.046	0.0	0.0	0.008	0.025	0.046
	workers	0.924	0.924	0.868	0.816	0.786	0.904	0.918	0.868	0.816	0.816
	$\bar{m}$	0.0	0.0	0.454	1.02	1.28	0.170	0.042	0.454	1.02	1.28

(*continued on next page*)

Table 6 (*Continued from Table 6*)

		A. Majority-favored UI policy Moral hazard π					B. Optimal UI policy Moral hazard π				
		0	0.1	0.2	0.3	0.4	0	0.1	0.2	0.3	0.4
Ireland	$\hat{\theta}$	**1.00**	**0.70**	**0.50**	$\boxed{\mathbf{0.40}}$	$\boxed{\mathbf{0.35}}$	**0.85**	**0.70**	**0.50**	$\boxed{\mathbf{0.40}}$	$\boxed{\mathbf{0.35}}$
	τ	0.1277	0.0899	0.0711	0.0754	0.0805	0.1090	0.0899	0.0711	0.0754	0.0805
	shirkers	0.0	0.0	0.006	0.029	0.054	0.0	0.0	0.006	0.029	0.054
	workers	0.826	0.863	0.820	0.741	0.703	0.842	0.863	0.820	0.741	0.703
	$\bar{m}$	0.619	0.0	0.967	0.935	1.23	0.333	0.0	0.967	0.935	1.23
Norway	$\hat{\theta}$	**1.00**	$\boxed{\mathbf{0.70}}$	**0.45**	**0.25**	**0.25**	**1.00**	$\boxed{\mathbf{0.80}}$	**0.25**	**0.15**	**0.15**
	τ	0.0411	0.0288	0.0236	0.0146	0.0204	0.0411	0.0339	0.0146	0.0074	0.0084
	shirkers	0.0	0.0	0.009	0.013	0.031	0.0	0.001	0.009	0.006	0.011
	workers	0.937	0.954	0.896	0.897	0.856	0.937	0.943	0.897	0.919	0.917
	$\bar{m}$	0.062	0.009	0.512	0.922	1.13	0.062	0.039	0.922	1.60	1.61
Spain	$\hat{\theta}$	**0.65**	$\boxed{\mathbf{0.65}}$	$\boxed{\mathbf{0.45}}$	**0.40**	**0.35**	**0.70**	**0.70**	$\boxed{\mathbf{0.50}}$	**0.45**	**0.35**
	τ	0.1083	0.1083	0.0865	0.0937	0.0976	0.1157	0.1157	0.0996	0.0865	0.0976
	shirkers	0.0	0.0	0.009	0.029	0.053	0.0	0.0	0.011	0.009	0.053
	workers	0.838	0.838	0.776	0.717	0.680	0.838	0.838	0.758	0.776	0.680
	$\bar{m}$	0.0	0.0	0.466	0.878	1.15	0.0	0.0	0.548	0.466	1.15
Switzerland	$\hat{\theta}$	$\boxed{\mathbf{0.65}}$	**0.65**	**0.45**	**0.30**	**0.20**	**1.00**	$\boxed{\mathbf{0.80}}$	**0.45**	**0.30**	**0.15**
	τ	0.0167	0.0167	0.0124	0.0272	0.0349	0.0268	0.0220	0.0124	0.0272	0.0063
	shirkers	0.0	0.0	0.002	0.033	0.057	0.0	0.001	0.002	0.033	0.014
	workers	0.973	0.973	0.971	0.836	0.798	0.961	0.965	0.971	0.836	0.924
	$\bar{m}$	0.0	0.0	0.086	1.02	1.13	0.050	0.027	0.086	1.02	1.30
United Kingdom	$\hat{\theta}$	**0.65**	$\boxed{\mathbf{0.65}}$	$\boxed{\mathbf{0.50}}$	**0.35**	**0.30**	**1.00**	**1.00**	$\boxed{\mathbf{0.50}}$	**0.35**	**0.30**
	τ	0.0465	0.0465	0.0430	0.0387	0.0418	0.0713	0.0771	0.0430	0.0387	0.0418
	shirkers	0.0	0.0	0.010	0.025	0.045	0.0	0.005	0.010	0.025	0.045
	workers	0.922	0.922	0.855	0.815	0.787	0.891	0.872	0.855	0.815	0.787
	$\bar{m}$	0.0	0.0	0.450	1.00	1.28	0.248	0.334	0.450	1.00	1.28

(*continued on next page*)

Table 6 (*Continued from Table 6*)

		A. Majority-favored UI policy Moral hazard π					B. Optimal UI policy Moral hazard π				
		0	0.1	0.2	0.3	0.4	0	0.1	0.2	0.3	0.4
United States	$\hat{\theta}$	**1.00**	**0.70**	$\boxed{\mathbf{0.45}}$	$\boxed{\mathbf{0.25}}$	**0.20**	**1.00**	**0.80**	$\boxed{\mathbf{0.45}}$	$\boxed{\mathbf{0.25}}$	**0.20**
	τ	0.0526	0.0366	0.0294	0.0174	0.0158	0.0526	0.0448	0.0294	0.0174	0.0158
	shirkers	0.0	0.0	0.009	0.011	0.019	0.0	0.003	0.009	0.011	0.019
	workers	0.917	0.940	0.879	0.890	0.881	0.917	0.902	0.879	0.890	0.881
	$\bar{m}$	0.063	0.001	0.921	0.909	1.34	0.063	0.144	0.921	0.909	1.34
Average	$\hat{\theta}$	**0.77**	**0.69**	**0.45**	**0.33**	**0.27**	**0.90**	**0.75**	**0.45**	**0.31**	**0.25**

Notes: (1) The symbol $\hat{\theta}$ is the status quo replacement ratio that survived all alternatives in a simple majority ballot. (2) The symbol $\bar{\theta}$ is the optimal replacement ratio from average value maximization. (3) Average asset holding is denoted as $\bar{m}$. (4) Boxes represent the replacement ratio closest to the net replacement ratio in the data in Table 5.

As Table 6 indicates, countries have different perspectives on the appropriate amount of generosity for their UI system. Moreover, countries respond differently to moral hazard. Hence, a uniform UI program across members of the European Union is unlikely to garner the support of a majority in all member states. Regarding the predictability of the model, Denmark appears to be at odds with the stylized facts. The UI program in Denmark is about twice as generous as the one in the US, but the computed replacement rates favored by the majority in Denmark are uniformly no larger than those in the US. However, we interpret the Denmark/US comparison to indicate that moral hazard in Denmark is substantially lower than it is in the US. Although the model indicates more generosity in the US than in Denmark for a similar level of moral hazard, the unemployment rate in Denmark is uniformly higher than the rate in the US and unemployment duration in Denmark is roughly twice that of the US, as Table 2 indicates.

Our results assume that all agents in the economy express their preferences in the majority-favored equilibrium. However, except perhaps for Belgium where voting is mandatory, not all agents in the country cast a ballot. Therefore, we investigate departures from this notion of ideal democracy by considering unequal electoral participation rates across skill groups. In the US, the participation rates are 73% for university graduates, 60% for high school graduates with some college, 49% for high school graduates and 32% for the remaining group (US Census Bureau, 1996). To examine whether unequal participation is a threat to democracy, as suggested by Lijphart (1997), we compute equilibrium replacement rates using the unequal participation rates from the US for all countries We find that even if a significant proportion of low skill agents do not exercise the right to express a preference, the majority-favored equilibrium tends to be the same as the one chosen if voting were made mandatory. Ireland and Belgium are the exceptions, with significant reductions in generosity in both countries with lower participation rates.[3] Although Belgium is not an issue because voting is mandatory, unequal participation in Ireland makes the predicted generosity of its UI program a lot closer to that of the actual Irish program. Replacement rates in Ireland are 35% for single persons and 66% for couples, over a maximum of 15 months, which is short by international standards, see OECD (1995). For France and Canada, we computed replacement rates using the measured skill-specific participation rates for the 1984 European election and the 1984 Federal election, respectively, and found no change.[4]

In panel B of Table 6, computations for the utilitarian equilibrium in which average value is maximized are reported. For low levels of π, the generosity resulting from the maximization of this utilitarian social welfare function, denoted $\bar{\theta}$ is significantly higher than the generosity in the majority-favored equilibrium in almost all countries. However, generosity decreases faster as π is increased, which is consistent with the results of Pallage and Zimmermann (2001). Moreover, predicted replacement rates under both equilibria are not considerably different if we exclude the cases of no or little moral hazard. Therefore, both equilibria can be used interchangeably for identifying the relevant levels of moral hazard.

[3] The equilibrium replacement rates for the respective values of π become 0.50, 0.50, 0.45, 0.30, 0.25 for Belgium and 0.45, 0.45, 0.40, 0.30, 0.25 for Ireland.

[4] Actual participation rates in France and Canada are less unequal than those of the US.

By definition, moral hazard is unobservable because shirking cannot be monitored. On an aggregate level, our model provides an estimate of implied moral hazard given its calibration and the actual observed outcome of UI generosity θ^c.[5] As the predicted replacement rates in Table 6 indicate, Spain, the UK, Germany and France have very similar UI generosity as a function of moral hazard and the actual generosity of their programs is also quite similar. Hence, these countries should experience the same intensity of moral hazard. A second group of countries, namely Ireland, Norway and the US, also have similar predicted replacement rates. While the actual generosities of the programs in Ireland and the US are close, Norway's program is about twice as generous indicating that the level of moral hazard in Norway is substantially lower than in the other two countries.

In Table 7, we contrast the predicted generosities to those in the actual programs to identify the implied level of moral hazard. Using net θ^c, the model predicts a success rate for shirkers between 0.1 and 0.2 for most countries except the US and Ireland. The Irish number will be revised downwards if we take account of electoral participation rates by skill-groups, as described earlier.[6] We obtain corner solutions for Denmark and Switzerland, which implies that moral hazard levels in those countries are very low. In verbal communications with administrators of UI programs, we were informed that they believe π should be between 0.1 and 0.2, which is consistent with our results for most countries.

Net replacement rates take into account the tax consequences of unemployment insurance benefits, which vary across countries. Gross replacement rates and their implied levels of moral hazard are also reported in Table 7. We regard these results as less reliable because the taxability of benefits and the availability of other tax credits are important but

Table 7
Implied moral hazard rates

	net θ		gross θ	
	θ^c	$\hat{\pi}$	θ^c	$\hat{\pi}$
Belgium	0.62	0.1–0.2	0.45	0.2–0.3
Canada	0.63	0.1	0.53	0.1–0.2
Denmark	0.81	0	0.71	0
France	0.59	0.1	0.44	0.2
Germany	0.63	0.1	0.31	0.4
Ireland	0.38	0.3–0.4	0.27	0.5
Norway	0.70	0.1	0.62	0.1–0.2
Spain	0.51	0.1–0.2	0.34	0.4
Switzerland	0.80	0	0.68	0
United Kingdom	0.56	0.1–0.2	0.20	0.5
United States	0.35	0.2–0.3	0.27	0.3

Notes: (1) Replacement rates θ^c are those in Table 5. (2) The implied values of $\hat{\pi}$ are calculated from θ^c and our simulations.

[5] It could be argued that predicting the level of moral hazard is not useful because it is not observable. Precisely because it is not observable, we think that such an estimation is useful because policy makers should be interested in even imperfect predictions.

[6] We do not want to make such a revision for Belgium, the only other country for which US participation rates would change the equilibrium outcome, because voting is mandatory in Belgium.

gross rates neglect these aspects. The values for moral hazard implied by gross benefits are considerably more diverse and some are quite high. We do not report the results for the utilitarian equilibrium, but these are very similar as can be verified by comparing the location of the boxes in both panels of Table 6.

Ranking the countries according to unemployment inequality, which we measure by the ratio of the unemployment rates for the lower skilled and higher skilled groups and reorganizing Table 6 according to that ranking, we obtain an interesting result. As Table 8 demonstrates, the ranking of countries according to this measure resembles closely the ranking by generosity of UI programs for low values of π. Hence, we investigate whether this is the key factor that makes equilibrium UI generosity differ across countries. We start by computing a benchmark based on an average distribution described in Table 9. Then, we alter one characteristic of the benchmark distribution and recompute the majority preferences. We do so for every single characteristic of our economies. In Table 10, we report the replacement rates that survive all alternatives for an economy having the benchmark characteristics except for one, which is taken from the US population.

The French majority-favored generosity from our computations in Table 6 coincides with that of the average distribution in Table 10. With the exception of the duration of

Table 8
A ranking by unemployment inequality ($\hat{\theta}$)

Unempl. Ineq.		Moral hazard π				
		0	0.1	0.2	0.3	0.4
1.4	Switzerland	0.65	0.65	0.45	0.30	0.30
1.5	Spain	0.65	0.65	0.45	0.40	0.35
2.6	France	0.60	0.60	0.45	0.35	0.30
2.7	Germany	0.65	0.65	0.45	0.35	0.30
2.8	Canada	0.70	0.65	0.45	0.30	0.20
3.3	Denmark	0.60	0.60	0.35	0.30	0.20
3.5	United Kingdom	0.65	0.65	0.50	0.35	0.30
4.1	Norway	1.00	0.70	0.45	0.25	0.25
4.1	United States	1.00	0.70	0.45	0.25	0.20
4.6	Belgium	1.00	1.00	0.50	0.40	0.35
6.0	Ireland	1.00	0.70	0.50	0.40	0.35

Note: The entries represent status quo replacement ratios that survived all possible alternatives in a simple majority ballot.

Table 9
Average distribution: benchmark economy

	$<$ High school	High school	$<$ University	$\geqslant$ University	Aggregate
Measure (%)	38.52	38.88	9.84	12.84	100
Unempl. rates	13.12	7.98	5.75	4.37	9.28
Income	0.76	0.99	1.18	1.61	1
Unempl. duration (months)	–	–	–	–	14
$p(e\|u)$ (%)	–	–	–	–	7.12
$p(u\|e)$ (%)	1.08	0.62	0.43	0.33	0.69

Note: Each characteristic of the average distribution is obtained by taking the mean over countries in Tables 1–4.

Table 10
Replacement rates ($\hat{\theta}$) from simulations: further experiments

	Moral hazard π				
	0	0.1	0.2	0.3	0.4
Benchmark	0.60	0.60	0.45	0.35	0.30
Bench. + US income ineq.	0.65	0.65	0.45	0.35	0.30
Bench. + US skill distr.	0.70	0.65	0.50	0.35	0.30
Bench. + US unempl. distr.	0.60	0.60	0.40	0.25	0.20
Bench. + US agr. unempl. rate	0.60	0.60	0.50	0.35	0.25
Bench. + US unempl. duration	0.65	0.65	0.40	0.25	0.20

Note: The entries represent status quo replacement ratios that survived all possible alternatives in a simple majority ballot.

unemployment, the French distribution is close to the average one. Thus, these experiments may explain why equilibrium generosity in the US differs so drastically from that in France. However, the results in Table 10 indicate that no single factor can explain this difference. In particular, the higher US income inequality and the less-skewed skill distribution tend to raise equilibrium benefits for low levels of moral hazard. Higher inequality of unemployment rates across skill groups in the US tends to lower benefits for high levels of moral hazard. In addition, the US aggregate unemployment rate, which is lower than in the benchmark, and the US unemployment duration, which is much smaller than in the benchmark, also lead to lower generosity as π increases. In fact, unemployment risk in the US is small and temporary. Moreover, it affects no group harshly, except for the relatively small group of people without a high school degree. Hence, low benefits are implied especially if shirking is easy. If shirking is difficult and income inequality is high, higher-skill groups favor generosity to smooth income in the unlikely event they become unemployed. However, the benefits from smoother consumption vanish rapidly as moral hazard becomes large.

6. Conclusion

In this paper, we document crucial differences in socio-economic characteristics of the labor forces of eleven OECD countries and investigate whether these factors explain the large differences in the choices of the generosity of unemployment insurance that is observed across countries. We build a dynamic model with indivisible labor, random job opportunities, and unemployment insurance. Agents differ in their country of residence, their skill, their employment transition probabilities, their income when employed, and their accumulated assets. We calibrate this model to these OECD countries and identify the optimal income replacement rates favored by the majority of agents in each country.

Differences in socio-economic characteristics matter to the generosity of UI programs. Hence, a uniform UI program for a group of countries is unlikely to be chosen by a majority of agents in each participating state. In particular, our results indicate that countries opt for different levels of generosity and have different attitudes towards moral hazard. Moreover, the implied moral hazard is relatively small in that shirkers have a 10 to 20% chance of success in most countries. In addition, these outcomes are not changed, except for Ireland, if we allow for unequal electoral participation rates according to education. Finally, no single factor explains the departure of a country's majority choice from that of another country.

Two important lessons are drawn from this analysis. First, if we disregard the possibility of differences in moral hazard across countries, our model does not predict the observed generosities of UI programs successfully. Hence, we conclude that moral hazard differs significantly across countries. Second, we can infer moral hazard levels in different countries from a simulation exercise. However, differences other than moral hazard may be important determinants of UI programs so that further refinements of the model may identify quantitatively important missing features.

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