How Do Policies Affect the Exit Rate out of Unemployment? Disentangling Job Creation from Labour Market Frictions

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Abstract. This paper assesses the effects of labour market policies on the unemployment outflow rate while disentangling two channels, namely labour market tightness and employer–employee matching efficiency. Using a sample of 11 OECD countries over the period 1985–2007, we treat the endogeneity of market tightness with business cycle shocks and the tax wedge as instruments. We find that the replacement rate of unemployment benefits, Active Labour Market Policies as well as the tax wedge in countries with poorly representative unions, have a significant, robust, and large impact on market tightness. Employment protection has a negative but small impact on matching efficiency. Overall, policy effects appear to be mostly channeled through market tightness and job creation.

1. Introduction

Nearly 4 years after the economic crisis, unemployment rates still remain significantly above their pre-crisis level in a majority of OECD countries. With the rise in unemployment being largely concentrated among specific categories of workers, one of the main concerns in countries most severely hit is that persistently high unemployment levels eventually lead to the emergence of a substantial pool of workers trapped in a situation of quasi-permanent unemployment or with tenuous attachments to the labour market. Put differently, there is a risk that the incidence of long-term unemployment remains high — or rises further — even as employment growth picks-up. Given that the incidence of long-term unemployment is directly related to the unemployment outflow rate, this paper aims to evaluate the influence that policies and institutions may have on the latter. This is done on the basis of macroeconomic data covering 11 OECD countries over the period 1985–2007.

More specifically, the paper seeks to identify the structural determinants of unemployment outflow rates by using *matching functions*. The latter are used in labour economics to disentangle the influence of the pace of job creation or *labour market tightness* (measured as the ratio of job vacancies to unemployment) on unemployment outflows from that of the degree of labour market frictions or *matching efficiency* (Blanchard and Diamond, 1989; Mortensen and Pissarides, 1994; Petrongolo and Pissarides, 2001; Pissarides, 2000). Factors contributing

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to stimulate labour demand and jobs creation will influence outflow rates through market tightness, whereas those affecting job search intensity are expected to impact on the outflow rate through matching efficiency.

The main contributions of this paper are of both a methodological and an empirical nature. Whereas the properties of the matching function have been extensively studied (e.g. Coles and Petrongolo, 2008; Gregg and Petrongolo, 2008), to the best of our knowledge it is the first time that the outflow rate is decomposed into a system of structural equations that identifies the channels through which the latter rate is affected by labour market policies and institutions. In this regard, we find that the bulk of policy and institution impact is channelled by market tightness, that is to say, through the pace of job creation.

In practice, our system of simultaneously determined equations allows for the treatment of the endogeneity of market tightness with respect to the unemployment outflow rate. In a first stage, we instrument labour market tightness by business cycles shocks as well as labour market institutions that are deemed to have an impact on market tightness but none on matching efficiency. These policy-based instruments include the tax wedge and its interaction with the characteristics of wage bargaining systems. In a second stage, we regress the unemployment outflow rate on predicted market tightness and on other institutional variables that may influence the degree of labour market frictions and matching efficiency, namely the characteristics of unemployment benefit systems and the degree of employment protection or product market regulation. Overall, this approach delivers a credible estimation of the relationship between unemployment outflows, labour market tightness, and labour market policies.

In terms of empirical results, we find three robust and economically important effects on market tightness stemming from the replacement rate of unemployment benefits, the volume of Active Labour Market Policies (ALMPs) as well as the tax wedge (especially among countries with intermediate or sector-based wage bargaining systems). The only policy variable found to have a robust (and negative) effect on the outflow rate through matching efficiency is employment protection on regular contracts. However, the latter effect is small in terms of magnitude.

The next section presents the analytical framework that underpins the empirical model as well as the related literature. The data are presented in Section 3, which is followed by the empirical framework, the results, and a discussion. The last section concludes.

2. The relationship between unemployment outflow, market tightness, and labour market policies and institutions

In this section, we explain the relationships between the unemployment outflow rate, labour market tightness and labour market institutions with the help of a simple framework, which is a simplified version of Mortensen and Pissarides (1994) job-search theory. A more elaborate model can be found in Mortensen and Pissarides (1999). Then, we explain our identification strategy to assess the former relationships. Finally, we briefly review the literature dealing with labour market institutions and the unemployment outflow rate.

2.1 Theoretical framework

The basic features are as follows: Potential jobs can be either filled or vacant and workers can be either unemployed or employed (inactivity and job-to-job transitions are ignored). Job

creation takes place when a firm with a vacant job and a worker meet and start producing. The rate at which vacant jobs and unemployed workers meet is determined by the homogeneous-of-degree-one matching function $f(u,v)$, where u and v represent the number of unemployed workers and vacancies respectively, normalized by the size of the labour force (assumed to be fixed). The higher the number of unemployed and the higher the number of vacancies, the more matches, the more hires. The number of new hires per period is determined by a Cobb–Douglas function of vacancies and the number of unemployed:

$$f(u_t, v_t) = \phi u_t^{1-\eta} v_t^{\eta}, \qquad [1]$$

where the parameter η determines the elasticity of hires with respect to existing vacancies. The parameter ϕ is deemed to capture all the factors that affect *the efficiency of the matching process*. For instance, both a decrease in the job-search intensity of unemployed workers, or an increased mismatch between the skills of the unemployed and the skills desired by firms, lead to a decrease in ϕ.

Unemployed workers are identical and vacancies offer the highest wage, so that they are always accepted. The *unemployment outflow (or exit) rate f* is simply equal to the number of hires divided by the number of unemployed:

$$f_t = \frac{f(u_t, v_t)}{u_t} = \phi\left(\frac{v_t}{u_t}\right)^{\eta}, \qquad [2]$$

where the ratio *v/u* is commonly referred to as *market tightness*. Conversely, the probability q that an employer fills a vacancy is:

$$q_t = \frac{f(u_t, v_t)}{v_t}. \qquad [3]$$

A tax τ is levied on labour income in the form of personal income tax or social security contributions. Consider the choice between unemployment and employment. If unemployed, a worker receives $b - h$, where b is unemployment benefits and h is the private cost of being unemployed. If employed, the same worker receives $w - \tau$. Her surplus from working is therefore $w - b + h - \tau$. Conversely, if a firm employs this worker, it receives $y - w$ where y is the productivity of the match and w the wage paid to the worker. If it does not, the firm receives nothing. Thus, the firm's surplus is simply $y - w$. Adding these two surpluses, the total surplus from the match is $y - b + h - \tau$. Workers and firms bargain repeatedly over wages. Defining β as the bargaining power of the worker, the latter obtains a share β of the total surplus via Nash bargaining. Hence, the surplus V that firms extract when a vacancy is filled and producing is:

$$V_t = (1-\beta)(y - b + h - \tau). \qquad [4]$$

Firm's behaviour is as follows. There is a fixed cost c in posting a vacancy. The *ex-ante* profit of a firm when posting a vacancy is equal to $-c + q \cdot V$. Applying Mortensen and Pissarides's (1994) 'free-entry' condition that assumes the exhaustion of *ex-ante* profits, one has:

$$-c + q_t V_t = 0. \qquad [5]$$

Replacing q and V in [5] by their expressions respectively given by [3] and [4], then using [2], yields the following expression for market tightness:

$$\frac{v_t}{u_t} = \left(\frac{\phi V_t}{c}\right)^{\frac{1}{1-\eta}} = \left[\frac{\phi(1-\beta)(y-b+h-\tau)}{c}\right]^{\frac{1}{1-\eta}}. \quad [6]$$

The above relationship suggests to describe the relationship between labour market policies and institutions, market tightness and the unemployment outflow rate with the help of the following system of simultaneously determined variables:

$$\log\frac{v_t}{u_t} = \frac{1}{1-\eta}\log\phi + \frac{1}{1-\eta}\log\left[\frac{(1-\beta)(y-b+h-\tau)}{c}\right]$$
$$\log f_t = \log\phi + \eta\log\frac{v_t}{u_t}. \quad [7]$$

2.2 Identification strategy

As made clear by the above system of equations, market tightness is endogenous to the unemployment exit rate in the sense that important omitted variables (including matching efficiency ϕ) simultaneously determine the latter two variables. The identification of the effect of market tightness on unemployment outflow therefore requires an instrumental approach. Along this line, we instrument market tightness in a first stage, whereas in a second-stage, the unemployment outflow rate is regressed on predicted market tightness and a set of other variables that excludes first-stage instruments.

Our main identifying assumption is that business cycle shocks affect market tightness but have no direct effect on matching efficiency and unemployment outflow (i.e. that business cycle shocks have no effect on unemployment outflow other than the one transmitted by market tightness). To improve the quality of the first-stage regression, we consider one policy-based instrument, namely the tax wedge, which is a composite indicator of labour and personal income taxes (see Appendix S1). It is therefore assumed that the tax wedge has an impact on market tightness and job creation, but none on matching efficiency (i.e. no direct impact on unemployment outflows).

In practice, the above system of simultaneously determined equations separates out the effects of labour market policies on job creation (through market tightness) from other effects linked to labour market frictions (i.e. matching efficiency). Determining whether policies and institutions influence the unemployment exit rate mainly through job creation or through labour market frictions constitutes the main objective of this paper.

2.3 Related literature

Table 1 summarizes priors for the effects of each labour market institution on the outflow rate as reflected by existing empirical and theoretical studies. These priors are consistent with the identification strategy that was outlined above.

Unemployment insurance benefits are generally thought to have ambiguous effects on market tightness, matching efficiency, and the exit rate. Equation [6] underlines a negative effect of unemployment benefits b that may raise the reservation wage and lower the ratio v/u; however, other theoretical studies (e.g. Acemoglu and Shimer, 2000) isolate positive effects of

Table 1. Analytical priors on the relationship between institutions and the unemployment outflow rate

Institution	Parameter	Market tightness V/U	Matching efficiency $E(f \mid V/U)$	Unemployment outflow rate $E(f)$
Unemployment benefits	b	+/–		+/–
	φ		+/–	
ALMPs:				
PES and administration	φ, $1/c$	+	+	+
Employment incentives, training	φ, h	+	+	+
Employment protection	φ	+/–	–	–
Product market regulation	φ	–	–	–
Tax wedge	τ	–		–
Excess coverage of wage bargaining agreements	β	–		–
Output gap	y	+		+

unemployment insurance for the development of risky economic activities, which would imply an increase in the v/u ratio. Similarly, there is mixed empirical evidence that longer and/or more generous unemployment benefits may discourage job search (Card *et al*., 2007; Katz and Meyer, 1990; Krueger and Mueller, 2010; Petrongolo, 2009), which in our framework would translate into a decrease in ϕ.

ALMPs may increase market tightness (i.e. the ratio v/u) insofar as for instance placement services reduce the cost c of posting a vacancy (see equation [6]). Similarly, training and employment incentives may increase the private (opportunity) cost of unemployment h, hence increase market tightness. ALMPs, and in particular Placement and Employment Services (labelled as PES), may also have an impact on matching efficiency ϕ. In the empirical literature, there is mixed evidence regarding the effect of ALMPs on the probability of finding a job, as it depends widely on the type of programme or training implemented and on the time horizon over which the treatment effect is measured (see Boone and Van Ours, 2009; Card *et al*., 2010).

High degree of employment protection and product market regulation are deemed to have negative effects on the unemployment outflow rate (Cahuc and Postel-Vinay, 2002), mainly because they may lower the overall level of turnover on the labour market and reduce the degree of matching efficiency. Stricter product market regulation and employment protection are deemed to have an ambiguous impact on market tightness, as they may reduce the pace of new vacancy posting but they may also raise the number of unfilled vacancies.[1]

The tax wedge τ, as well as any institution that reduces the profit share of firms $1 - \beta$, unambiguously decrease market tightness and the unemployment exit rate as shown by equation [6] as well as by Mortensen and Pissarides (1999). In this regard, de Serres *et al*. (2012) and Murtin *et al*. (2014) provide strong empirical evidence that the tax wedge reduces outflows more strongly among countries where wage bargaining takes place at the sectoral level rather than at the firm or at the economy-wide level. The intuition behind this empirical finding is that highly centralized or highly decentralized wage bargaining systems are prone to yield wage moderation and to mitigate the adverse effect of the tax wedge.

Excess demand, as captured by the output gap y, raises firms' profits, vacancy creation and unemployment outflows.

3. The data

3.1 Vacancy and unemployment outflow

The main data set on unemployment outflow is borrowed from Murtin *et al*. (2014). It covers 11 countries (Australia, Belgium, France, Germany, Japan, Norway, Portugal, Spain, Sweden, the UK, the USA) and spans the period 1985–2007. The data frequency is annual. In addition, vacancy data are extracted from various sources [OECD, Eurostat, Job Openings and Labor Turnover Survey (JOLTS)] to construct annual series of the vacancy rate (i.e. the number of vacancies divided by the number of employed workers plus vacancies) and of market tightness (i.e. the number of vacancies divided by the number of unemployed workers). As shown by the upper part of Table 2 as well as other studies (e.g. Elsby *et al*., 2008), unemployment outflows are larger in most English-speaking and Nordic countries than in other countries. In particular, the USA appears to be an outlier as it displays a very large, albeit declining, outflow rate over time (Murtin and Robin, 2014; Robin, 2011). Countries with high outflow rates tend also to display tighter labour markets, as the correlation between outflow and market tightness equals 0.46 without the USA, and 0.82 with this country.

It is well known that the quality of vacancy data varies substantially across countries. Vacancy data usually refer to job opportunities notified by an employer to a Job Centre or Careers Office, which remained unfilled on the day of the count. Importantly, vacancies that are not notified to employment agencies are excluded, so that the vacancy figures do not represent the total number of vacancies in the economy. Moreover, national statistics differ in a number of dimensions such as the period of reference or the type of eligible position. For instance, vacancy data covers both the private and public sectors in France, whereas vacancies on government-sponsored programmes are excluded in the UK.

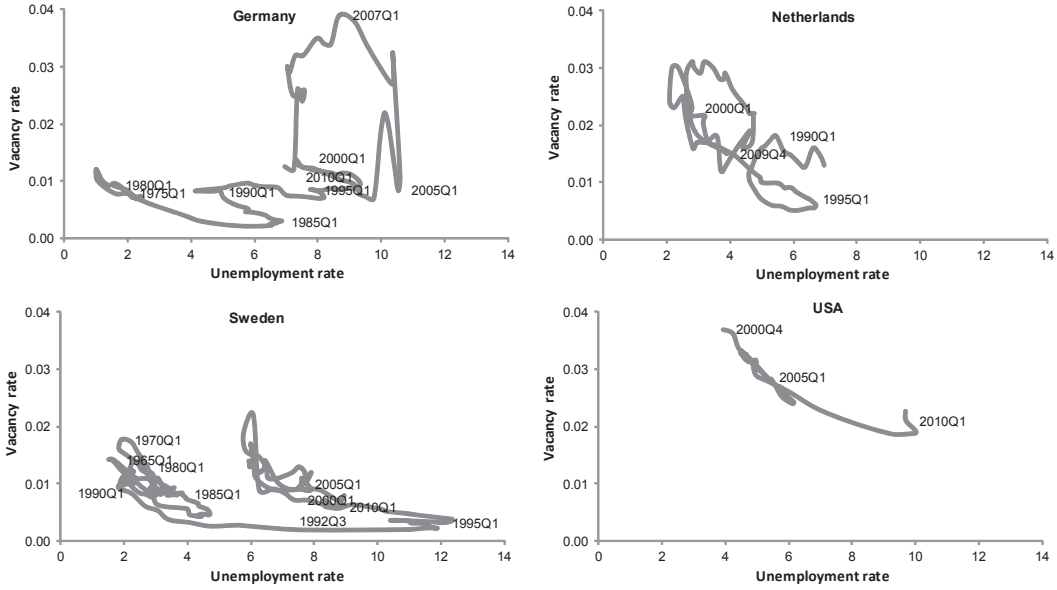
To appraise the quality of the vacancy data, we regress the log unemployment outflow rate on log market tightness country by country. If the vacancy rate is affected by measurement errors, the coefficient of log market tightness is expected to be biased towards zero and the *R*-squared of the regression to be low. The obtained results from these regressions are

Table 2. Descriptive statistics — average values 1985–2007

	AUS	BEL	DEU	ESP	FRA	GBR	JPN	NOR	PRT	SWE	USA
Unemployment variables											
Unemployment rate	7.52	8.64	8.02	16.52	10.16	7.44	3.93	4.09	6.18	5.78	5.68
Unemployment outflow rate 15+	22.60	6.77	6.61	7.90	7.90	13.92	17.66	40.23	7.83	24.94	56.73
Market tightness	0.15	0.11	0.11	0.04	0.08	0.20	0.26	0.15	0.04	0.16	0.61
Labour market institutions											
Initial replacement rate	23.34	49.09	38.45	65.43	56.49	24.98	32.87	51.55	48.16	77.94	28.20
Unemployment benefits duration	1.01	0.86	0.72	0.47	0.60	0.80	0.31	0.60	0.48	0.35	0.46
EPL regular contracts	1.26	1.70	2.70	3.10	2.39	1.01	1.87	2.25	4.46	2.87	0.17
ALMPs	0.05	0.14	0.14	0.05	0.11	0.06	0.09	0.19	0.10	0.41	0.03
Tax wedge	28.14	41.25	35.45	30.05	41.42	28.95	22.77	49.66	26.79	52.21	23.60
Excess coverage	42.21	37.43	46.94	55.76	71.99	13.99	–5.06	14.16	39.65	3.50	3.77
PMR	3.25	4.39	4.08	4.12	4.95	3.03	3.98	4.20	4.88	3.75	2.54
Observations	20	20	20	20	16	19	15	20	17	17	5

EPL, employment protection legislation.

Figure 1. Beveridge curves in four OECD countries



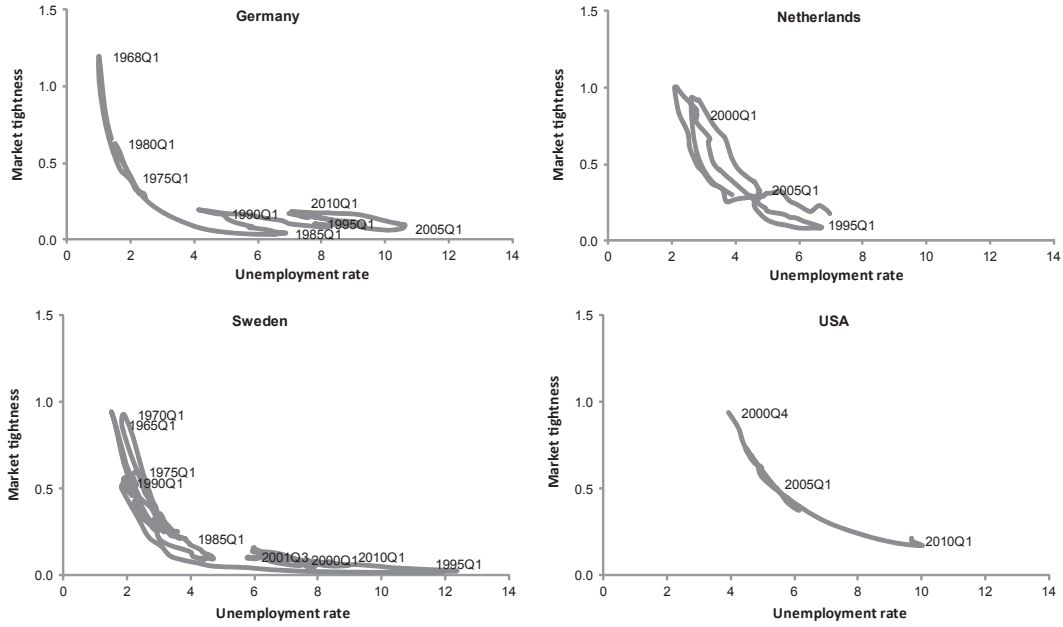
described in Appendix S1. Four countries turn out to have particularly low R^2, namely Belgium, France, Germany, and Portugal. In the robustness analysis section, the main regressions are redone after excluding the latter four countries from the sample.

For illustrative purposes, Figure 1 presents the Beveridge curves, which depict the vacancy rate with respect to unemployment, for four countries based on quarterly data. A negative correlation is expected between the two variables as a large number of unemployed workers would exhaust available vacancies. However, the relationship has generally been unstable, as for instance in Germany, the Netherlands, and Sweden. Figure 2 shows that a more stable relationship emerges when unemployment is related to market tightness instead of the vacancy rate. Indeed, market tightness relates the pool of vacant jobs to that of job-seekers, and such ratio would seem to be a better measure of job search conditions on the labour market than the vacancy rate. Indeed, the latter relates the pool of vacant jobs to that of employed workers, who do not necessarily look for another job, or do so with a lower intensity.

3.2 Labour market institutions

The data on labour market institutions include: (i) the replacement rate of unemployment benefits in the initial year of reception; (ii) the duration of unemployment benefits, as measured by the ratio of the average replacement rate during the first 5 years of reception to the initial replacement rate;[2] (iii) real spending on ALMPs per unemployed worker normalized by a proxy of average income (GDP per worker);[3] (iv) a measure of the tax wedge constructed by the OECD.[4] The tax wedge is in some cases interacted with a proxy for the degree of centralization/coordination embedded in the wage bargaining system, namely the difference (labelled as 'excess coverage of union agreements') between the share of workers covered by collective agreements (coverage rate) and union density;[5] (v) the OECD index of product

Figure 2. Market tightness and the rate of unemployment in four OECD countries



Notes: Market tightness is defined as the ratio of the number of vacancies to the number of unemployed workers. Quarterly data taken from various sources (OECD, Eurostat, JOLTS). The period covered is 1974Q1–2010Q2 for Germany, 1988Q1–2009Q4 for the Netherlands, 1961Q3–2010Q2 for Sweden, 2000Q4–2010Q2 for the USA.

market regulation (the PMR index); and (vi) the OECD index of employment protection legislation for regular contracts (labelled as EPR). The set of labour market institutions is complemented by a proxy for business cycle conditions, namely the OECD estimate of the output gap. In total, one obtains 189 usable observations for the econometric framework.

The identification of policy and institutional effects relies on the number of reforms over time. Indeed, country fixed effects will be systematically included in the panel data model. From that point of view, all indicators display a satisfactory degree of time variation as reflected by the simple decomposition of the variance between and within countries depicted in Table 3. Not surprisingly, the variance between countries is the largest component in a majority of cases with the noticeable exception of the PMR index. However, standard deviations within countries always represent significant policy changes. For instance, an increase in the replacement rate by 2.8 percentage points or an increase in the tax wedge by 2.4 percentage points are deemed to have observable consequences on labour market outcomes.

4. The policy and institutional determinants of the unemployment outflow rate

This section describes the empirical framework, which explains cross-country differences in outflow rates with the help of a matching function. The relationships between labour market institutions and two structural determinants of outflows, namely market tightness and matching efficiency, are examined. Then, a robustness analysis is proposed. Finally, the magnitude of the policy and institutional effects is assessed.

Table 3. Analysis of variance for labour market institutions — 1985–2007

	Standard deviation between countries	Standard deviation within countries
Initial replacement rate	20.30	2.80
Unemployment benefits duration		
EPL regular contracts	1.10	0.20
ALMPs	0.10	0.06
Tax wedge	10.00	2.40
Excess coverage	27.00	5.90
PMR	0.60	1.10

4.1 Empirical framework

To empirically relate cross-country differences in outflow rates to differences in the institutional environment, it is convenient to log-linearize the matching function described by equation [2]. We assume a common vacancy elasticity (parameter η) across countries[6] and we allow for cross-country differences in matching efficiency $\phi_{i,t}$ and in market tightness $\phi_{i,t} = v_{i,t}/u_{i,t}$. The econometric model is the following:

$$\log f_{i,t} = \log \phi_{i,t} + \eta \log \theta_{i,t} + w_{i,t}, \quad [8]$$

where w is a residual term. We denote as X and Y the two sets of labour market institutions that have an influence upon respectively market tightness and matching efficiency. As made clear by the 'free-entry' condition and system [7], any institutional variable affecting matching efficiency is also a determinant of market tightness, so that the set Y is included into X (and even strictly included as the tax wedge will be used as an instrument of market tightness). Moreover, business cycle shocks proxied by the output gap Z is taken as another instrument of market tightness. One has therefore the following system of equations:

$$\begin{cases} \log \theta_{i,t} = a_i^v + d_t^v + X_{i,t}\beta^v + Z_{i,t}\gamma^v + u_{i,t} \\ \log f_{i,t} = \underbrace{a_i^f + d_t^f + Y_{i,t}\beta^f}_{\log \phi_{i,t}} + \eta \log \theta_{i,t} + w_{i,t}, \end{cases} \quad [9]$$

where a_i denote country fixed effects and d_t time fixed effects. The first equation can be labelled as the market tightness equation, the second one as the outflow equation.

In practice, labour market policy and institutions Y that are deemed to influence matching efficiency are the characteristics of unemployment benefits (replacement rate and duration), the level of employment protection of regular contracts, as well as the degree of product market regulation. As mentioned, these variables must be included both in the market tightness equation and in the outflow equation. Conversely, the set of institutions X includes Y plus the tax wedge and its interaction with the excess coverage variable.

The above system is estimated with a two-stage ordinary least squares (OLS) estimator (2-SLS). In the first-stage, the first equation of the system (market tightness) is estimated. In a second-stage, the second equation (outflow) is estimated while using the predicted market tightness variable derived from stage one.

4.2 Main results

Table 4 presents the instrumental variables (IV) estimation results with the first-stage market tightness equations on columns 1, 3, 5, 7, 9, 11, 13, and 15 and the second-stage

Table 4. The institutional determinants of market tightness and matching efficiency

Policy or institution:	**Baseline**		**Average replacement rate**		**Initial replacement rate and unemployment benefits duration**		**Employment protection for regular contracts**		**Product market regulation**		**Active ALMPs**		**All**		**All**	
Procedure:	**IV**		**IV**		**IV**		**IV**		**IV**		**IV**		**IV**		**IV**	
Dependent variable:	**log *VIU* (1)**	**log *f* (2)**	**log *VIU* (3)**	**log *f* (4)**	**log *VIU* (5)**	**log *f* (6)**	**log *VIU* (7)**	**log *f* (8)**	**log *VIU* (9)**	**log *f* (10)**	**log *VIU* (11)**	**log *f* (12)**	**log *VIU* (13)**	**log *f* (14)**	**log *VIU* (15)**	**log *f* (16)**
Endogeneous variable:																
Log market tightness		0.555*** (0.058)		0.539*** (0.057)		0.539*** (0.061)		0.552*** (0.059)		0.547*** (0.059)		0.540*** (0.057)		0.554*** (0.065)		0.562*** (0.062)
Instruments:																
Output gap	0.179*** (0.019)		0.179*** (0.019)		0.166*** (0.018)		0.182*** (0.019)		0.177*** (0.019)		0.182*** (0.018)		0.158*** (0.015)		0.146*** (0.015)	
Tax wedge	–0.049*** (0.015)		–0.052*** (0.015)		–0.048*** (0.013)		–0.044*** (0.016)		–0.050*** (0.016)		–0.031* (0.016)		–0.020 (0.014)		–0.035*** (0.013)	
Tax wedge × excess coverage															–0.002*** (0.000)	
Other explanatory variables:																
Average replacement rate			0.007 (0.013)	–0.010* (0.006)												
Initial replacement rate					–0.027* (0.016)	–0.010 (0.007)							–0.060*** (0.010)	–0.004 (0.008)	–0.062*** (0.010)	–0.004 (0.008)
Duration of unemployment benefits					1.849** (0.804)	–1.257*** (0.408)							1.037 (0.648)	–1.456*** (0.419)	0.912 (0.613)	–1.462*** (0.418)
EPL regular contracts							–0.176** (0.087)	–0.087 (0.060)					0.063 (0.093)	–0.184*** (0.070)	0.154 (0.099)	–0.186*** (0.070)
PMR									0.091 (0.099)	0.021 (0.054)			0.073 (0.066)	0.043 (0.050)	0.046 (0.067)	0.042 (0.051)
Active ALMP normalized											3.490*** (0.645)	–0.556 (0.360)	4.714*** (0.602)	–0.674 (0.489)	5.280*** (0.620)	–0.714 (0.463)
Robust *F*-statistics	31.36		44.73		42.97		45.62		43.34		53.69		58.07		47.57	
Partial *R*-squared	0.43		0.43		0.42		0.43		0.42		0.47		0.47		0.51	
Sargan test of overidentifying restrictions (*p*-value)		0.22		0.44		0.37		0.38		0.22		0.12		0.46		0.68
R^2	0.9	0.91	0.9	0.92	0.91	0.92	0.9	0.92	0.9	0.92	0.91	0.92	0.94	0.92	0.95	0.92
Time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	189	189	189	189	189	189	189	189	189	189	189	189	189	189	189	189

*/**/*** for the 10/5/1 per cent confidence levels respectively.

outflow equations on columns 2, 4, 6, 8, 10, 12, 14, and 16. Selected instruments are in all cases the output gap and the tax wedge, as well as the interaction between the tax wedge and excess coverage in column 15. The tax wedge is lagged 3 years to increase its chance of being strictly exogenous to unemployment outflow. In all IV regressions, there is no evidence of weak instruments as *F*-statistics are comfortably large. Furthermore, our two (or three) instruments always pass the Sargan test of instruments validity, as the *p*-values never reject the null assumption of instruments joint exogeneity.

Starting with the determinants of market tightness (first-stage equations), the output gap always displays highly significant coefficients with an expected positive sign (excess demand fosters vacancy creation), whereas the tax wedge (as well as its interaction with excess coverage in column 15) displays in most cases a highly significant and negative coefficient. In addition, the initial replacement rate turns out to be (in two cases out of three highly) significant and negative, whereas ALMPs are always significantly and positively associated with market tightness. Other institutional variables, including the average replacement rates, the duration of unemployment benefits, the degree of employment protection and product market regulation, do not display robust coefficients.

Moving to the institutional determinants of matching efficiency (second-stage equations displayed on columns 4-6-8-10-12 and 14), we find that the duration of unemployment benefits is unambiguously and negatively related to matching efficiency and unemployment outflows. Moreover, the degree of employment protection displays a highly significant and negative coefficient in columns 12 and 14 whereas other institutions are controlled for, but fails to be significant on column 8.

Summing up, the tax wedge, ALMPs, and the initial replacement can be viewed as significant determinants of market tightness, whereas the duration of unemployment benefits and employment protection are linked to matching efficiency. The robustness of these results are examined in the next subsection.

4.3 Robustness analysis

The sensitivity of previous results relative to the quality of vacancy data is assessed in two ways. First, we trim the sample from outlier observations, deleting about 10 per cent of the sample for which unemployment outflow or market tightness take outlier values (either at the top or at the bottom or their respective distribution). Second, we restrict the sample to the countries that display higher quality data. In practice, we exclude the four countries (Belgium, France, Germany, and Portugal) in which vacancy data explain little of the unemployment exit rate. These are the countries for which a country-specific regression of log unemployment outflow on log market tightness displays a low R^2 (see Appendix S1). In a third set of regressions, we trim the data and we exclude the above four countries. In this case, the sample has a much smaller size (only 103 observations versus 189 formerly), so it is *a priori* uncertain whether the estimation would deliver better results because of higher-quality data or poorer estimates due to a smaller sample size.

The results depicted in Table 5 largely confirm the results obtained from Table 4, while offering some nuances. Across all regressions, ALMPs and the initial replacement rate are always significant determinants of market tightness, but the tax wedge is only significant in interaction with excess coverage. As already noticed by Calmfors and Driffill (1988), Daveri and Tabellini (2000) as well as de Serres *et al*. (2012), disentangling between countries with respect to their degree of coordination in wage bargaining is important when it comes to the analysis of the relationship between unemployment, labour taxes, and wages.

Table 5. Robustness analysis

Robustness test:	**Data trimming**				**Exclusion of BEL, DEU, FRA, and PRT**				**Data trimming and exclusion of BEL, DEU, FRA, and PRT**			
Policy or institution:	**All**		**All**		**All**		**All**		**All**		**All**	
Procedure:	**IV**		**IV**		**IV**		**IV**		**IV**		**IV**	
Dependent variable:	**log *VIU*** **(1)**	**log *f*** **(2)**	**log *VIU*** **(3)**	**log *f*** **(4)**	**log *VIU*** **(5)**	**log *f*** **(6)**	**log *VIU*** **(7)**	**log *f*** **(8)**	**log *VIU*** **(9)**	**log *f*** **(10)**	**log *VIU*** **(11)**	**log *f*** **(12)**
Endogenous variable:												
Log market tightness		0.522***		0.543***		0.449***		0.433***		0.551***		0.485***
		(0.056)		(0.057)		(0.064)		(0.059)		(0.089)		(0.077)
Instruments:												
Output gap	0.145***		0.130***		0.144***		0.129***		0.128***		0.104***	
	(0.016)		(0.016)		(0.019)		(0.023)		(0.022)		(0.025)	
Tax wedge	–0.008		–0.023		–0.009		–0.043**		0.003		–0.040*	
	(0.017)		(0.015)		(0.017)		(0.020)		(0.020)		(0.021)	
Tax wedge × excess coverage			–0.002***				–0.002**				–0.003***	
			(0.000)				(0.001)				(0.001)	
Other explanatory variables:												
Initial replacement rate	–0.064***	0.004	–0.066***	0.006	–0.035**	–0.003	–0.045***	–0.003	–0.042***	0.009	–0.058***	0.005
	(0.010)	(0.008)	(0.009)	(0.008)	(0.015)	(0.007)	(0.015)	(0.007)	(0.015)	(0.010)	(0.014)	(0.009)
Duration of unemployment benefits	0.871	–1.134***	0.696	–1.153***	2.104**	–0.495	1.794*	–0.458	1.859*	–0.659	1.362*	–0.528
	(0.632)	(0.356)	(0.572)	(0.359)	(0.978)	(0.422)	(0.910)	(0.403)	(0.959)	(0.476)	(0.815)	(0.427)
EPL regular contracts	0.175*	–0.177**	0.290***	–0.185**	0.083	–0.140***	0.224*	–0.135***	0.189	–0.229***	0.407**	–0.199***
	(0.097)	(0.075)	(0.100)	(0.076)	(0.108)	(0.053)	(0.133)	(0.052)	(0.120)	(0.069)	(0.154)	(0.065)
PMR	0.050	0.082*	0.017	0.080	–0.143	–0.028	–0.142	–0.032	–0.215	0.077	–0.201	0.058
	(0.069)	(0.049)	(0.070)	(0.050)	(0.121)	(0.084)	(0.123)	(0.081)	(0.129)	(0.097)	(0.131)	(0.091)
Active ALMP normalized	4.956***	–0.269	6.102***	–0.388	4.344***	0.102	5.063***	0.176	4.608***	0.547	5.907***	0.817
	(1.016)	(0.633)	(1.099)	(0.606)	(0.739)	(0.420)	(0.810)	(0.383)	(1.345)	(0.718)	(1.472)	(0.609)
Robust *F*-statistics	41.31		38.41		28.15		29.48		18.07		22.42	
Partial *R*-squared	0.39		0.45		0.41		0.45		0.31		0.39	
Sargan test of overidentifying restrictions (*p*-value)	0.18		0.25		0.4		0.45		0.98		0.29	
R^2	0.95	0.94	0.95	0.94	0.96	0.94	0.96	0.94	0.96	0.93	0.96	0.94
Time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	170	170	170	170	116	116	116	116	103	103	103	103

*/**/*** for the 10/5/1 per cent confidence levels respectively.

Moreover, employment protection is always significant across outflow regressions, which highlights a robust adverse effect of employment protection on matching efficiency. In contrast, the duration of unemployment benefits loses its significance when the four countries are excluded from the sample. So the only one robust determinant of matching efficiency is employment protection.[7]

4.4 Accounting for hysteresis

The robustness of previous results is further evaluated in the light of a more general, state-dependent, matching function where time persistence in the outflow rate is introduced. Several theoretical and empirical studies point to a negative effect of the duration of unemployment spells on the probability to exit unemployment (Bover *et al.*, 2002; Dantan and Murtin, 2014; Elsby *et al.*, 2008; Machin and Manning, 1999; Pissarides, 1992; Shimer, 2008; Van Den Berg and Van Ours, 1996). Intuitively, long spells of unemployment may imply a depreciation of human capital, or lead to lower job-search intensity and to discouragement effects.

The functional form of the matching function can easily be amended to allow for the possible influence of the time spent in unemployment on the probability of exiting unemployment. Let us write the outflow rate as:

$$f_t = \phi\left(\frac{v_t}{u_t}\right)^{\eta} (D_t)^{-\rho_t}, \qquad [10]$$

where D_t is the time spent in unemployment at the beginning of period t, and ρ_t a positive coefficient that may eventually vary across countries and time. As f is expressed on a monthly basis, D represents the number of months spent in unemployment and it is strictly greater than one. Hence the larger ρ the smaller the outflow rate f. Assuming for simplicity that the time spent in unemployment can be proxied by the inverse of the *lagged* outflow rate (i.e. that $D_t = \frac{1}{f_{t-1}}$),[8] the following system of equations is obtained from the log-linearization of [9]:

$$\begin{cases} \log\theta_{i,t} = a_i^v + d_t^v + X_{i,t}\beta^v + Z_{i,t}\gamma^v + u_{i,t} \\ \log f_{i,t} = \underbrace{a_i^f + d_t^f + Y_{i,t}\beta^f}_{\log\phi_{i,t}} + \eta\log\theta_{i,t} + \rho_{i,t}\log f_{i,t-1} + w_{i,t}\,. \end{cases} \qquad [11]$$

The above system is identical to the former one except that the lagged unemployment outflow rate is introduced in the outflow equation. To estimate this new model, a two-stage procedure is adopted. In the first-stage, the market tightness equation is estimated via OLS and its predicted value is constructed. In the second-stage, the outflow equation is estimated by using the former predictor and an OLS estimator or Arellano and Bond's (1991) first-difference generalized method of moments (DIF-GMM) estimator, while retaining a common and constant autocorrelation coefficient (i.e. $\rho_{i,t} = \rho$).[9,10] To conduct this empirical analysis, we use the sample that was trimmed from outlier observations.

As shown by Table 6, the static results reported on Table 5 are relatively robust to the existence of persistence effects.[11] Regarding the determinants of matching efficiency presented on columns 2 and 3, we find that employment protection entails a robust adverse effect on

Table 6. The institutional determinants of market tightness, matching efficiency, and hysteresis effects

Equation:	**First-stage (market tightness)**	**Second-stage (matching efficiency)**		
Dependent variable:	**log *VIU***	**log *f***		
Estimator:	**OLS (1)**	**IV (2)**	**DIF-GMM (3)**	**NLS (4)**
		Conditional persistence (coefficient of log f_{-1})		
Constant		0.695***	0.277***	–1.335
		(0.042)	(0.090)	(1.212)
Initial replacement rate				0.013
				(0.012)
Duration of unemployment benefits				2.007*
				(1.027)
		Other variables (matching efficiency)		
Instrumented log market tightness		0.259***	0.314***	0.275***
		(0.051)	(0.057)	(0.053)
Initial replacement rate	–0.066***	0.011*	0.005	0.017**
	(0.009)	(0.006)	(0.008)	(0.007)
Duration of unemployment benefits	0.696	–0.623**	–0.254	0.336
	(0.572)	(0.252)	(0.321)	(0.555)
EPL regular contracts	0.290***	–0.111***	–0.224*	–0.137**
	(0.100)	(0.042)	(0.135)	(0.058)
PMR	0.017	0.024	0.085	0.023
	(0.070)	(0.033)	(0.072)	(0.034)
ALMPs	6.102***	–0.631	–0.362	–0.458
	(1.099)	(0.404)	(0.698)	(0.546)
Tax wedge	–0.023			
	(0.015)			
Tax wedge × excess coverage	–0.002***			
	(0.000)			
Output gap	0.130***			
	(0.016)			
Time effects	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes
R^2	0.95	0.98	—	0.98
N	170	170	159	170

*/**/*** for the 10/5/1 per cent confidence levels respectively.

unemployment outflows. As before, the negative effect of unemployment benefits duration is more fragile, as it is significant only in column 2.

To explore further the link between policies and persistence, the coefficient ρ can be conditioned on a set of institutional variables W. A logit functional form is used to ensure that ρ is always strictly smaller than 1. The following non-linear system can be estimated by combining the two-stage estimation approach with non-linear least squares (NLS) for the outflow equation:

$$\begin{cases} \log \theta_{i,t} = a_i^v + d_t^v + X_{i,t}\beta^v + Z_{i,t}\gamma^v + u_{i,t} \\ \log f_{i,t} = a_i^f + d_t^f + Y_{i,t}\beta^f + \eta \log \theta_{i,t} + \rho_{i,t} \log f_{i,t-1} + w_{i,t} \\ \rho_{i,t} = \dfrac{\exp(W_{i,t}\beta^\rho)}{1+\exp(W_{i,t}\beta^\rho)}. \end{cases} \quad [12]$$

As mentioned above, the higher the degree of persistence (ρ), the lower the outflow rate (as $\log f_{t-1} < 0$). Hence, variables positively linked to the coefficient of persistence can be viewed as raising the duration of unemployment spells and reducing the outflow rate.

Table 6 column 4 reports the results of this non-linear estimation. Several potential determinants of hysteresis are tested, in particular our proxy for the duration of unemployment benefits. We find that longer benefit duration increases the length of unemployment spells and the time persistence of unemployment outflows. In this regression, the significance of the adverse effect of employment protection on matching efficiency is preserved, whereas the replacement rate of unemployment benefits displays a positive sign. This may be interpreted as a positive effect of unemployment insurance on the quality of employer–employees match, or be disregarded as a statistical anomaly.[12]

Furthermore, the business cycle may affect directly the exit from unemployment over and above its effects on labour market tightness, as in a bad recession the unemployed may get discouraged and become non-employed and, in parallel, in good times non-employed people may be encouraged to come back to the labour market. Similarly, if a high tax wedge creates unemployment traps, then matching efficiency may decrease together with labour market tightness. Both views challenge the assumption that our main instruments, namely the output gap and the tax wedge, are valid and affect the outflow rate only through their effect on market tightness. To provide a quick check, we have tested for the significance of our instruments when they are included in the second-stage regression. Both failed to be significant, which supports our main exclusion restriction.

4.5 Magnitude of policy effects

To gauge the magnitude of the estimated policy effects, we calculate the variation in outflows associated with the increase in each policy indicator by one *within-country* standard deviation. We select three different specifications extracted from the various tables. We differentiate the policy effects according to the channel of transmission, namely market tightness or matching efficiency. The calculated effect on market tightness are multiplied by the estimated market tightness's elasticity in the outflow equation.

Table 7 displays the results for each policy or institution while also indicating the respective channels of transmission. We used the point estimates of each coefficient, while highlighting with significance thresholds of these estimates (denoted as */**/*** for the 10/5/1 per cent confidence levels respectively). This table offers a quick overview of the policy and institutional reforms that matter from the perspective of a policy-maker.[13]

Overall, we find that market tightness carries the bulk of policy and institutional effects. The replacement rate, ALMPs, and the tax wedge among countries with high excess coverage (intermediate wage bargaining systems) have a large effect on market tightness and unemployment outflows. Regarding matching efficiency, the effect of employment protection has a small magnitude. The adverse effect of unemployment benefits duration on matching efficiency is a bit larger, but as mentioned above, it does not always rely on robust estimates. Hence, market tightness and more generally job creation can be viewed as the main channel through which policies and institutions have an impact upon the unemployment outflow rate.

Table 7. Relative effect of one standard deviation increase in policy and institutional indicators on the unemployment outflow rate (variation expressed in percentage)

	Table 4 columns 15–16			Table 5 columns 3–4			Table 5 columns 11–12		
	Market tightness	**Matching efficiency**	**Total**	**Market tightness**	**Matching efficiency**	**Total**	**Market tightness**	**Matching efficiency**	**Total**
Replacement rate	–9.69***	1.11	–8.57	–10.31***	1.67	–8.64	–7.75***	1.39	–6.36
Duration of benefits	2.41	–6.87***	–4.46	1.84	–5.42***	–3.58	3.10*	–2.48	0.62
EPL regular	2.09	–4.50***	–2.41	3.94***	–4.48***	–0.53	4.78**	–4.82***	–0.04
ALMPs	18.40***	–4.43	13.97	21.26***	–2.41	18.86	17.76***	5.07	22.83
Tax wedge — all countries	–4.64***		–4.64	–3.05		–3.05	–4.53*		–4.53
Tax wedge — countries with high excess coverage[a]	–10.83***		–10.83	–9.24***		–9.24	–11.51***		–11.51

*/**/*** for the 10/5/1 per cent confidence levels respectively.

[a] Australia, France, Germany, Portugal, Spain.

5. Conclusion

This paper explores the policy and institutional determinants of the unemployment outflow rate using a sample of 11 OECD countries observed between 1985 and 2007. We use matching functions to identify the effects of policies or institutions on the outflow rate via two channels, namely the number of job vacancies relative to the pool of unemployed (market tightness), and the degree of employer–employee matching efficiency. We treat the endogeneity of market tightness to unemployment outflow with the help of a system of simultaneously determined equations, using business cycle shocks and the tax wedge as instruments of market tightness. We find that the replacement rate of unemployment benefits, ALMPs as well as the tax wedge in countries with intermediate or sector-based wage bargaining systems, have a large impact on market tightness. Employment protection and the duration of unemployment benefits may reduce matching efficiency, but these effects are deemed to have a smaller magnitude. Overall, the bulk of policy and institution action on unemployment outflows appear to be channeled by market tightness and job creation.

Notes

[1] The impact of employment protection on unemployment is more ambiguous. For instance, strict employment protection may lower the creation of vacancies but also the rate of job destruction, with little effect on unemployment.

[2] If the replacement rate is assumed to decrease exponentially over time, its half-life is equal to 69 per cent of the ratio used in this study.

[3] In order to remove cyclical variations in ALMPs that result from cyclical unemployment variations, we apply a Hodrick–Prescott (HP) filter to the series and use only this trend component in subsequent regressions. Thus this procedure corrects for the endogeneity that arises from the fact that ALMP spending has traditionally been relatively insensitive to *cyclical* changes in the unemployment rate. However, it does not address the endogeneity problem that may arise when the variation in ALMP spending falls short of the variation in the *structural* rate of unemployment.

[4] The OECD tax wedge is a summary index of labour and personal income taxes. It was preferred to a simple labour tax index as the latter series is affected by a break in the late 1990s. However, our main results are largely unaffected if we replace the tax wedge by labour taxes.

[5] In the presence of 'excess coverage' of collective agreements, union members receive a higher 'outside option' (fall-back income) as they have the possibility to reallocate in the non-unionized sector covered by collective agreement. This raises their bargained wage as well as unemployment, all the more so as payroll taxes are large (see Murtin *et al*., 2014). In spirit, this is the idea as in Calmfors and Driffill (1988), who argue that largely centralized (economy-wide) and largely decentralized (firm-level) wage bargaining systems lead to a lower unemployment rate relative to intermediate systems where bargaining takes place at the sectoral level. Indeed, the variable 'excess coverage' tends to be higher among intermediate systems, and lower among both centralized and decentralized ones. Hence, it can be seen as a convenient proxy for the so-called 'Calmfors–Driffill' hypothesis. With respect to *ad-hoc* indices of the degree of coordination of wage bargaining systems, it is a continuous variable that does not rely on subjective judgement.

[6] In unreported calculations we show that cross-country differences in parameter η explain little of the cross-country differences in unemployment outflows compared with cross-country differences in matching efficiency and market tightness. These calculations are available from the authors upon request.

[7] All regressions pass the overidentifying restrictions test and there is no evidence of weak instruments in first-stage regressions.

[8] Actually, unemployment duration should depend on *all* lags of the outflow rate. Introducing only the first lag aims to preserve a parsimonious model.

[9] GMM have advantages and drawbacks. They allow a stronger claim that our estimates represent causal effects under the assumption of weak exogeneity of the explanatory variables. However, DIF-GMM may suffer from weak instruments problems. To remedy for that problem, Blundell and Bond's (1998) system GMM (SYS-GMM) propose additional instruments that would hardly be valid in our context, as their use relies on the assumption that country fixed effects are independent of the unemployment's growth rate. As emphasized by Blanchard and Wolfers (2000), this is highly unlikely so we refrain from using SYS-GMM in this study.

[10] The DIF-GMM regression reported here passes the Arellano-Bond specification test for the autocorrelation of residuals as well as the Hansen test of joint exogeneity of instruments. However, the latter test is weak due to the small number of groups (countries). For the IV and NLS regressions, the autocorrelation of residuals was estimated and found to be not significantly different from zero.

[11] The market tightness equation described on Table 6 column 1 is identical to that presented in Table 5 column 3.

[12] Actually, equation [7] shows that any variable affecting matching efficiency ϕ, such as the replacement rate, should be included in both the first-stage and second-stage equations. It is therefore a bit surprising that such a variable switches sign across the two regressions. However, equation [7] also shows that this may happen if the latter variable affects structural coefficients b, h, or c in opposite direction. For instance, a higher replacement may indeed increase matching efficiency ϕ as suggested by column 4, but it may also reduce the match's surplus $y - b$ and lower market tightness overall as reported on column 1.

[13] It is recalled that we used for each simulation the within-country standard deviation of each institution, rather than its cross-country and cross-time sample standard deviation.

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Supporting Information

Additional Supporting Information may be found in the online version of this article at the publisher's web-site:

Appendix S1. Additional information on the construction of the data and data sources.