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ORIGINAL PAPER

Labor market institutions and firms' location choices

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Abstract The paper evaluates the empirical effects of labor market institutions (LMI) on foreign direct investment (FDI) decisions using an individual dataset describing French firms' expansion strategies in OECD countries over 1992–2002. First, we provide evidence that labor market institutions do matter in location decisions. Precisely, we show that labor market rigidity significantly reduces the country's attractiveness for foreign investors. Yet, the effect is of limited magnitude compared to FDI determinants related to the country's market potential or supply access. Second, we go deeper in the precise role of various LMI dimensions. In line with the literature, we find that stringent employment protection laws have a dampening effect on the location probability. Besides, we show that this is not the only dimension that matters. In particular, we find that the generosity of the unemployment benefit system plays a significant negative role on the country's attractiveness, even once the role of employment protection is controlled for.

Keywords Labor market institutions · Foreign direct investment determinants · Firm-level data · Conditional logit analysis

JEL Classification F16 · F21 · J32

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1 Introduction

One of the most notable changes that OECD countries have experienced over the last decades is the increasing liberalization in international good and financial markets. It has notably induced a globalization of the firm production process, which is now taken on a worldwide basis. Recurrent debates have emerged in industrialized countries on the "good" way to deal with the risk of unemployment that the reorganization of firms on a worldwide basis may induce. Globalization forces policy-makers to re-think the design of labor market policies. The other way round, national labor market institutions per se are likely to affect location decisions of firms across alternative countries. If so, this link has to be taken into consideration in the design of labor market policies.

The paper takes part to the debate empirically. We focus on the way labor market institutions (LMI hereafter) affect foreign direct investments (FDI), using a database describing French firms' foreign investments over the 1992–2002 period. Our empirical strategy follows the rest of the literature that studies the determinants of firms' location decisions in a new trade framework. This literature identifies two main determinants of location choices: relative production costs in all possible locations and aggregate demands, referred to as "real market potentials" (Head and Mayer 2004a). On top of this, other dimensions have been shown to affect FDI decisions, among which the proximity to suppliers (Amiti and Javorcik 2008), the importance of mimetic behaviors (Head and Mayer 2004b) and other national economic policies, notably corporate taxation (Devereux and Griffith 1998) or the quality of governance (Wei 2000). Our paper contributes to the literature by focusing on the role of labor market regulations.

The literature on location choices features an increasing interest for the role of LMI as a determinant of firms' location decisions. In the theoretical field, previous contributions suggest that labor market rigidities reduce the incentive to locate in a country. The most obvious transmission channel is through labor costs: more rigid labor markets tend to have higher equilibrium wages, which deters firms to settle in. Depending on the theoretical framework, this direct effect can either be reinforced or counteracted by demand mechanisms or the impact that LMI have on uncertainty. Haaland et al. (2002) thus show that employment protection deters FDI inflows in a framework with investment uncertainty. Leahy and Montagna (2000) and Haaland and Wooton (2007) obtain contrasted results regarding the impact of more centralized wage-settings.[1] Münch (2003) and Picard and Toulemonde (2006) study the role of trade unions. Both papers show that powerful trade unions, by raising the negotiated wage, have a negative impact on the country's attractiveness for foreign investments. However, the direct negative effect may be mitigated by the impact of wage bargaining on aggregate demand. Finally, Méjean and Patureau (2010) and

[1] In Haaland and Wooton (2007), a more centralized wage bargaining process raises labor costs, thereby reducing the country's attractiveness for FDI. Leahy and Montagna (2000) show that the result is sensitive to interactions between goods and labor markets. When competition is sufficiently tough on the good market side, the multinational firm benefits from a more centralized bargaining process on the labor market: A higher negotiated wage indeed disfavors the local competitors if they are less productive than the multinational.

Pflüger (2004) also obtain contrasted effects when studying the impact of minimum wages and social policies such as unemployment benefits.

In the empirical field, the question is usually investigated using aggregate or sectoral data (see Dewit et al. 2009 or Görg 2005, among others). Our paper differentiates from this literature by using a firm-level dataset describing French firms' expansion strategies in a homogeneous sample of OECD countries. With these data, we are able to study the impact of various dimensions of labor market regulations on individual FDI decisions. This strategy uses the heterogeneity of investment decisions across firms and countries to identify the potential impact of LMI. Instead, aggregate empirical analysis can solely rely on the time variability, that is arguably low for labor market regulations. As a related consequence, the use of individual data allows controlling for all compositional effects that may affect aggregate FDI flows.

In that respect, our paper is closely related to Javorcik and Spatareanu (2005) and Gross and Ryan (2008) which also use individual data. Likewise, we study how non-wage labor costs embodied in labor market regulations affect location choices among otherwise roughly similar countries. Our contribution differentiates from these papers though, by broadening the range of LMI under study. While they focus on the single role of employment protection in explaining FDI flows, we enlarge the analysis to other dimensions of labor market regulations. Beside employment protection, we thus evaluate the role of minimum wage and unemployment benefits policies, as well as the degree of centralization of wage bargaining procedures.[2] Following Head and Mayer (2004a), the determinants of French firms' FDI decisions are estimated using a discrete choice model on all possible foreign locations. This allows explaining the probability for a French firm to invest in a given country by a set of country- and sector-specific variables. On top of the standard set of explanatory variables, we augment the empirical model with various measures of labor market regulations. We evaluate the model's predictions using firm-level data covering French firms' FDI in 18 OECD countries over the 1992–2002 period.

Our contribution to the literature is twofold. First, our results indicate that the design of LMI does affect the attractiveness of a country from the firm's viewpoint. Labor market rigidity is found to exert a negative impact on the country's attractiveness for (French) foreign investors. The effect is significant when considering a synthetic index of labor market rigidity as well as with specific indicators of labor market regulations. This result is consistent with the literature that underlines the negative effect of stringent employment protection regulations on FDI inflows (Javorcik and Spatareanu 2005; Gross and Ryan 2008, among others). Yet, our results indicate that the role of LMI, if significant, remains modest

[2] Another difference with Javorcik and Spatareanu (2005) and Gross and Ryan (2008) is that we focus on the probability for a country to be chosen as location. By contrast, Javorcik and Spatareanu (2005) study the location probability and the volume of FDI invested abroad, while Gross and Ryan (2008) focus on the employment consequences of foreign investments. Given the absence of any information in our database about the volume invested abroad or the induced employment, we cannot compare our results to their's along these lines.

in comparison with the role of market potential and supplier access, which role in driving FDI inflows is reaffirmed.

Second, whereas the related literature restricts the analysis to the single role of employment protection, our paper goes deeper into this result. We indeed show that other dimensions of labor market regulations do matter as well. Stringent employment protection laws, but also a generous unemployment benefit system, strong minimum wage constraints and a highly centralized wage bargaining process significantly reduce the propensity for firms to locate in a country. Not all LMI dimensions are found to be of same importance though. Our simulation results indicate that minimum wage changes have a minor effect on the probability to settle in, in comparison with other LMI dimensions. By contrast, we show that employment protection is of key importance for FDI choices. In this respect, our results confirm the relevance of related papers that solely focus on this dimension. Yet, our results also put into evidence the important role of the unemployment benefits system in location choices. A more generous benefit system is shown to significantly reduce the probability to settle in, even once the role of employment protection is controlled for.

The rest of the paper is organized as follows. Section 2 presents our empirical strategy, the dataset and the variables used to proxy the determinants of location choices. Section 3 presents estimation results. Last, Sect. 4 concludes.

2 Data and empirical strategy

2.1 Empirical strategy

Following Head and Mayer (2004a), we derive the equation explaining the determinants of FDI decisions using a partial-equilibrium framework. Conditional on investing abroad, a decision that we take as given,[3] each French firm k decides the country where to settle its affiliate among multiple location alternatives. In that decision process, the only relevant information is the ordering of profits between the various countries of the choiceset. Whenever the fixed cost of investing is not destination specific, a firm k chooses location i that offers the highest operating profit among a set Ω of all possible locations:

$$P(fdi_i(k) = 1) = P(\pi_i^{op}(k) > \pi_j^{op}(k)), \quad \forall j \neq i, j \in \Omega \tag{1}$$

where $fdi_i(k)$ is a dummy variable equal to 1 if firm k chooses location i and 0 otherwise. $\pi_i^{op}(k)$ ($\pi_j^{op}(k)$) denotes the operating profit in location i (location j).

In this setting, the determinants of location choices are those explaining heterogeneity across countries in operating profits. As standard in the literature, we assume operating profits are log-linear in marginal costs and demand:

[3] Our empirical exercise indeed takes as granted that the firm invests abroad. This is dictated by our data that only describes French firms' foreign investments. Our analysis is thus mute on the determinants of the firm's decision to invest abroad rather than to export from France, even though this may also be affected by labor market considerations. The trade-off between FDI and export is empirically studied by Brainard (1997) and Head and Ries (2003), among others.

$$\ln \pi_i^{op}(k) = a + b \ln MC_i(k) + c \ln RMP_i + \varepsilon_i(k) \quad (2)$$

where a, b and c are coefficients to be estimated. RMP_i denotes country i's "real market potential", i.e., the potential demand a firm locating in i can expect to be addressed. A high market potential is expected to raise the probability that location i is chosen by firm k. $MC_i(k)$ is the marginal cost of production in country i, that exerts a negative pressure on profits, thus on the probability that i is chosen as location. In the empirics, marginal costs are proxied by various variables, among which measures of labor market regulations. Finally, $\varepsilon_i(k)$ in Eq. (2) is a random term capturing the effect of unobserved components of operating profits.

We estimate Eq. (1) using a discrete choice model with an univariate extreme value marginal distribution of the $\varepsilon_i(k)$ errors. Investment decisions are assumed to be independent from one another in this setting. This allows us using the conditional logit model to derive the probability for each potential location to receive the French firm's investment.[4] The estimation strategy therefore assumes a structure of errors correlation that is specific to each investment and identifies coefficients using the cross-country variability. Since multiple investment decisions made by the same French firm k may induce the residuals to be heteroscedastic, we run regressions with clustered errors by firm (k). This accounts for correlations across investments within a single firm while assuming independence between firms.

2.2 Data on FDI decisions

Equation (1) is estimated using observed location decisions as the left-hand side variable. The dataset is based on a survey called *"LIFI"* conducted by the French official statistics institute (INSEE). It provides information on the creation of foreign affiliates by French firms, including the location of the new production unit and the year of investment over the 1992–2002 period. We restrict the analysis to firms that operate in the manufacturing sector and invest in 18 OECD countries. While the geographical restriction is meant to homogenize the country sample, the sample continues covering more than 55 % of investments in the initial sample. More specifically, our sample contains 2,201 investment decisions in 18 OECD foreign countries.[5] Figure 1 shows the distribution of French investments across

[4] The focus of the paper fully conditions our choice of a conditional logit model, rather than the multinomial logit model. While the multinomial logit puts emphasis on the role of individuals' characteristics in being in certain categories of a dependent variable, the conditional logit model evaluates how the characteristics of the categories affect individuals' likelihood of being in them. In that respect, it is better suited to our purpose.

[5] The 18 countries included in our sample are: Australia, Austria, Belgium, Canada, Denmark, Finland, Germany, Ireland, Italy, Japan, Norway, the Netherlands, New Zealand, Spain, Sweden, Switzerland, the United Kingdom and the United States. In a preliminary version, we included all the countries in the dataset. We obtained the result that French firms are more sensitive to cross-country heterogeneity in LMI when FDI decisions are taken within the set of OECD countries only. This result came along with the argument that variables measuring labor market regulations in developing countries may be highly imprecise, e.g., capturing various sources of inefficiencies beyond pure labor market distortions. Both arguments have convinced us to focus on a more homogeneous sample of rich countries. As mentioned, this does not come at the cost of losing too many observations. Besides, focusing on the most developed OECD countries does not deprive us of cross-country heterogeneity in LMIs, as testified in Table 2.

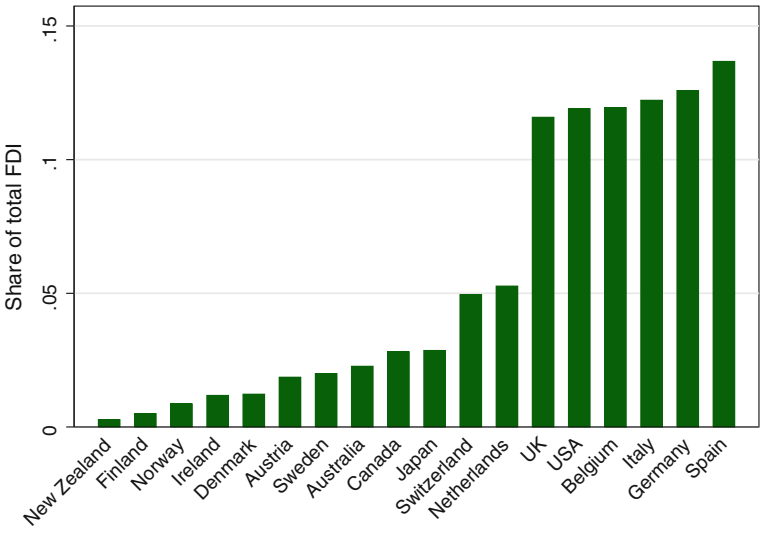

Fig. 1 Distribution of investments by country

destination countries. In our sample, the most popular FDI destination is the "core" Europe, namely Spain, Germany, Italy, Belgium and the United Kingdom. This is consistent with previous empirical evidence, notably Combes et al. (2008). Outside Europe, the United States is the recipient of the largest number of French FDIs.

As explained in Sect. 2.1, our identification strategy implicitly assumes foreign investments to be the outcome of decisions that are independent from each other. To evaluate the pertinence of the assumption, Fig. 2 (black bars) plots the number of investments taken by each single firm in our sample. Around 25 % of the investments are taken by a firm that will invest in only one location during the period of observation. Those investments can indeed be considered as independent from each other since they are the outcome of decision processes taken within totally different entities. However, a large number of firms do invest several times. On average, these are the largest firms in the sample, as illustrated by the increasing relationship between the number of investments realized by a single firm and its mean size (as measured by average employment, gray bars in Fig. 2). Those investments occurring within the same firm may not be independent from each other. For instance, a firm might decide to open several affiliates in the same country in order to locate its whole production process in the same area. On the contrary, a firm trying to diversify its foreign markets may choose to open one affiliate in one part of the world, then another one in a different continent. We account for such potential within-firm interactions between investment decisions using firm-level clusters to correct estimated standard deviations from the correlation of residuals.[6]

[6] To ensure the robustness of our results on that point, we also ran regressions on the database restricted to the sub-sample of firms that invested no more than once over the period, at the cost of a substantial reduction in the number of observations (554 FDI in 18 OECD countries). We obtain roughly similar results, which are not reported here but are available upon request to the authors.

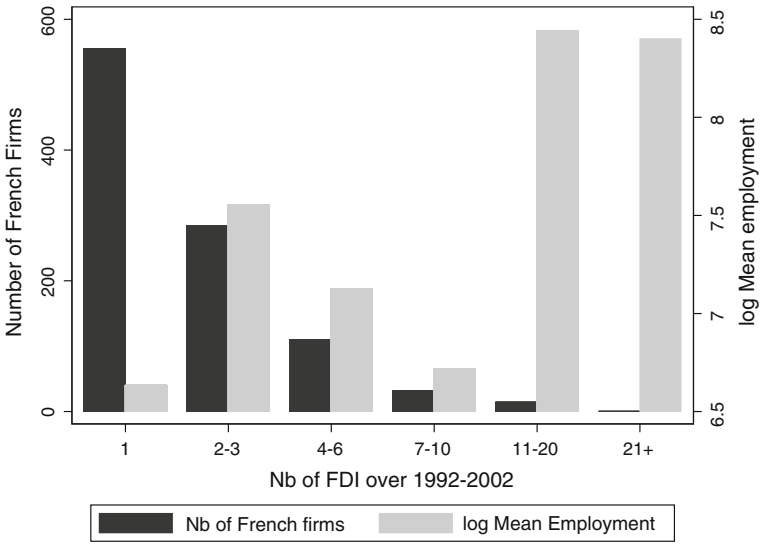

Fig. 2 Number of investments by firm

Finally, note that this data is not immune from certain caveats. In particular, if the level of details is high on the firm investing and the location where it invests, very little is known about the foreign affiliate. In particular, it is not possible to decompose the sample into different types of investments, neither greenfield against brownfield, nor vertical against horizontal. This shortcoming of the data may be detrimental to our study, if labor market regulations do not have the same impact on different types of investments. One obvious case is for horizontal versus vertical investments. In theory, horizontal investments are mostly driven by the market potential of the destination country while vertical investments is meant to optimize on the firm's cost structure.[7] As a consequence, one should expect labor market regulations to be especially detrimental in the case of vertical investments. The lack of information about the type of investment in our dataset deprives us from testing this prediction. We address the question by providing indirect evidence on such heterogeneity though. Namely, we show that labor market restrictions are slightly more important to explain location decisions in labor-intensive sectors. Provided vertical FDI is more prevalent in labor-intensive sectors, the result is consistent with the intuition.[8]

[7] See Barba Navaretti and Venables (2004) for a survey of the theoretical literature.

[8] Another indirect way to test the previous prediction would be to use the heterogeneity of results over different country sets. Namely, if vertical FDIs indeed go more often in less developed countries, as suggested by theory, we should expect investments in poor countries to be more strongly affected by labor market regulations than investments in rich countries, that are more likely to be of the horizontal type. As previously mentioned (See Footnote 5), this is not the case in our data, probably because, for the less developed countries, LMI indicators are correlated with other important determinants of location choices that counteract the direct impact of labor markets being flexible.

2.3 Standard explanatory variables

We evaluate the probability of opening a subsidiary in country *i* using standard determinants used in the literature, plus various measures of labor market regulations (detailed in the next sub-section). Before going further in the description of the explicative variables, let us make a remark of general order. Strictly speaking, firms' location decision should be related to a cross-country comparison of expected profits. Nevertheless, the determinants of FDI decisions are considered to be contemporaneous with the year of investment. This assumption is usually retained in the literature, as it prevents the econometrician from putting more constraints on the formation of firms' expectations. Since the identification of parameters uses the cross-country variability, it is sufficient to assume that determinants observed during the year of investment are correlated with the variables entering the expectation function. Details on the construction of those control variables are provided in "Standard explanatory variables" section in Appendix 1.

The most important determinant of location choices emphasized in the literature is the country's market potential (Head and Mayer 2004a). We proxy this variable using the structural measure proposed by Redding and Venables (2004). As detailed in "Standard explanatory variables" section in Appendix 1, it is built based on a gravity-type equation estimated annually between 1992 and 2002. The gravity equation makes it possible to infer from actual trade flows the "size" of any destination market in the world, a proxy for its real consumption. Based on those estimates, it is possible to quantify the total size of the market a firm can cover from any location, defined as the sum of the local market plus export destinations discounted by transportation costs. In the regressions, the variable is taken in logarithm and denoted "ln real market potential". Since the variable is generated from a first-stage estimation, its inclusion in the estimated equation makes the estimated standard errors invalid. We thus employ bootstrap techniques to correct standard errors from the noise in our measure of market potentials.

The second important determinant of location choices emphasized in the literature is the country's supplier access (Amiti and Javorcik 2008). This variable captures the possibility that firms buying intermediate goods have an incentive to locate where those inputs are the cheapest, i.e., near intermediate good suppliers. As in Amiti and Javorcik (2008), we build a country- and sector-specific measure of supplier access using information about the actual matrix of inter-industry linkages. "Standard explanatory variables" section in Appendix 1 provides details on the actual construction of the variable. The basic idea is to use information on the number of French affiliates of any given sector located in any given country observed in our data and combine it with the input–output structure of the sector the investing firm belongs to. Information on the number of affiliates by sector and country is used as an indication of the number of firms producing one particular sort of inputs in a given location. The input structure of the investing firm is approximated using input–output tables. Based on those two pieces of information, we expect firms that rely more on one particular type of inputs to locate their affiliates in countries where we know a lot of producers of this input are located. Since the supplier access variable is constructed using data on actual investments by

French firms, we lag the variable in the estimations. Using the contemporaneous value of the supplier access variable would indeed imply explaining one specific investment by a variable that has been constructed using information on that investment. The variable (taken in log) is denoted "ln (supply access −1)" in the subsequent tables and we expect a positive sign associated with it.

On top of those two determinants of location choices, we control for transaction costs affecting the "easiness" to invest in a specific country. Namely, we control for information and communication costs using distance between France and the host country. As pointed out by Head and Mayer (2004a), it is important to control for positive spillovers among French affiliates. Accordingly, we include a variable that measures the cumulated number of French subsidiaries of the same industry that have settled in the past in country *i* (denoted "# of same ind. firms −1" in the regression tables). As for the supplier access variable, this spillover variable being constructed using the same investment data as the endogenous variable, we use the 1-year-lag variable in the estimations. Note that the variable may also capture some country-specific characteristics that have been influencing location decisions in the past and nowadays, beyond "pure" spillover effects. In any case, we expect a positive sign of the coefficients associated with the variable in the regressions. Finally, we control for country *i*'s current GDP per capita. This variable is commonly used in the empirical literature on FDI determinants. As underlined by Javorcik and Spatareanu (2005) or Bénassy-Quéré et al. (2007), GDP per capita is notably correlated with high labor costs in the host country. Beyond wages, GDP per capita also captures the overall remuneration of production factors and is used as such by Redding and Venables (2004). As an alternative to GDP per capita, some specifications include unit labor costs taken from the OECD's *Main Economic Indicators*.

Last, we check the robustness of our results to the inclusion of other control variables, that have been shown to affect location choices in the related FDI literature and may arguably be correlated with LMI. Namely, we control for the quality of governance, using the indicator provided by Kaufmann et al. (2005) and notably used by Javorcik and Spatareanu (2005). We also test for the impact of corporate taxation (see, among others, Javorcik and Wei 2009; Devereux and Griffith 1998). Aggregate FDI inflows are also used as control in one regression.

Table 1 displays descriptive statistics on the above-mentioned control variables. In columns (1) and (2), we report the number of countries covered and the mean value of the variable (averaged over the period and the country sample). Columns (3) to (5) also report moments calculated in the cross-country dimension (the "between-country" statistics), using the mean value over the period for each country. Finally, columns (6) to (8) correspond to statistics computed in the time dimension (the "within-country" statistics), considering the mean value over the country sample for each year.

2.4 Labor market regulations

The previous variables are well known to matter for location choices. Our objective is to evaluate to what extent regulations in the labor market also matter. The basic

Table 1 Control variables: descriptive statistics

	# Countries	Mean	Between-country statistics			Within-country statistics		
			Std Dev	Min	Max	Std Dev	Min	Max
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ln real market potential	18	20.58	1.31	18.96	22.48	0.37	20.06	21.20
ln (# of same ind. firms −1)	18	0.70	0.47	0.16	1.64	0.78	0.00	2.13
ln (supply access −1)	18	−2.01	2.74	−5.47	2.20	0.78	−3.16	−0.89
ln GDP per capita	18	10.10	0.26	9.59	10.54	0.11	9.93	10.26
ln distance	18	7.54	1.20	6.16	9.85	0.00	7.54	7.54
Governance indicator	18	80.61	5.37	66.31	85.57	0.91	79.52	82.05
Corporate tax rate (in %)	18	35.79	7.06	27.03	52.05	2.48	31.98	38.48
Unit labor cost (in %)	17	55.96	8.20	40.99	68.54	2.82	52.16	60.76
ln overall FDI inflows	18	8.94	1.22	7.43	11.46	1.04	7.06	10.42

The "between-country" statistics are computed across countries, using the country-specific mean value of the variable over the period as reference. The "within-country" statistics are instead computed in the time-dimension, using as reference the mean across countries, for each year over 1992–2002

transmission channel underlying this intuition is conveyed by the labor market literature, which forcefully demonstrates that labor market regulations modify equilibrium wages and the incentive to hire (See Cahuc and Zylberberg 2004). By affecting the marginal cost of producing an investor anticipates to pay, one can expect labor market regulations to matter for location choices.

We measure labor market regulations using two alternative databases. One is the *Economic Freedom of the World* database (EF) constructed by the Fraser Institute (Gwartney and Lawson 2006). The different indicators contained in the database are obtained from an annual survey covering a broad array of issues, including regulation of labor, which are derived from answers to the *Global Competitiveness Report* of the World Economic Forum. As such, the information contained in the database is mostly subjective. As an alternative, we use the OECD's *Labor statistics* database that compiles legal information obtained from national sources. We view the use of the two datasets as complementary. First, the EF database contains an indicator of the overall degree of labor market rigidity, which encompasses a wide range of LMI variables. Using this synthetic variable is precious as it allows estimating the effect of the overall labor market rigidity on location choices. Second, when decomposing the effect of the overall index in its various sub-components, we can rely on both EF and OECD sources. The comparison of results obtained with both datasets provides us with a valuable robustness check. Details on the construction of LMI variables are provided in "Labor Market Institutions" section in Appendix 1.

We now come into the details of the LMI variables. As just discussed, the *Economic Freedom* database provides us with a synthetic index of the overall degree of rigidity of the labor market. This variable sums up the following dimensions of the labor market functioning: (1) the hiring and firing practices, (2)

the degree of centralization of wage bargaining, (3) the unemployment benefit system, (4) the minimum wage legislation, and (5) the use of conscripts to obtain military personnel. Except for the last dimension, these are precisely the kind of institutions we expect to matter for location choices. Figure 3 displays the mean value (over the period) of the overall rigidity index, for each country in the sample. Unsurprisingly, at the lower extremity we find the Anglo-Saxon countries and Japan, while continental and Scandinavian European countries feature the highest degrees of labor market rigidity.

Besides this synthetic indicator, we investigate the specific impact that various dimensions of labor market regulations have. First, we test for the impact of employment protection, as approximated by the Hiring and Firing Practices index of *Economic Freedom* and the OECD's Employment Protection Legislation index. Both variables are increasing in the difficulty of hiring and firing workers. We expect large values of those variables (respectively denoted "Hir. & Fir. Index, EF" and "EPL, OECD" in the tables) to increase the marginal cost of producing and thus deter firms from investing in the country. Haaland and Wooton (2007) provide a framework in which employment protection has such impact on FDI decisions.

The second indicator of labor market regulations is the degree of centralization of bargaining procedures. In the *Economic Freedom* database, the centralization index is related to the percentage share of the labor force whose wages are set by a centralized collective bargaining. In OECD data, the variable is proxied by the degree of centralization of wage bargaining, a class variable which lowest level corresponds to a regime in which wages are mainly set at the plant level, while the highest level has wages negotiated at the central level.[9] The expected effect of bargaining procedures on location decisions is rather unclear, as is its effect on negotiated wages (See Cahuc and Zylberberg 2004, Chapter 12, for a survey of the labor market literature on this topic). By exerting an upward pressure on labor costs, bargaining procedures may reduce the country's attractiveness, as in Haaland and Wooton (2007). However, Leahy and Montagna (2000) show that the result is sensitive to the extent of competition between local firms and multinationals. Which effect dominates is essentially an empirical question.

As third dimension of labor market regulations, we investigate to what extent the generosity of the unemployment benefit system influences location choices. Based on the labor market literature, we expect high unemployment benefits to deter foreign firms to enter. First, a generous unemployment benefit system is likely to be financed through high social contributions. Second, by raising the worker's outside option, generous unemployment benefits contribute to raise negotiated wages in equilibrium. In either case, we expect this dimension of labor market regulations to

[9] Being a discrete class variable, it is introduced in the regressions through binary variables that correspond to the categories defined by the OECD. These variables are denoted "Centralization = i, OECD" with $i = 1, 2, 3, 4$ and 5 and are increasing in the degree of centralization. The reference dummy corresponds to the most decentralized case ($i = 1$). We also checked that estimation results about this variable are not fundamentally different when the class variables are transformed into a continuous indicator varying between one and five. This amounts imposing a linear effect of switching from one class to the other on location probabilities. For sake of space saving, these results are not reported here but they are availabe upon request to the authors.

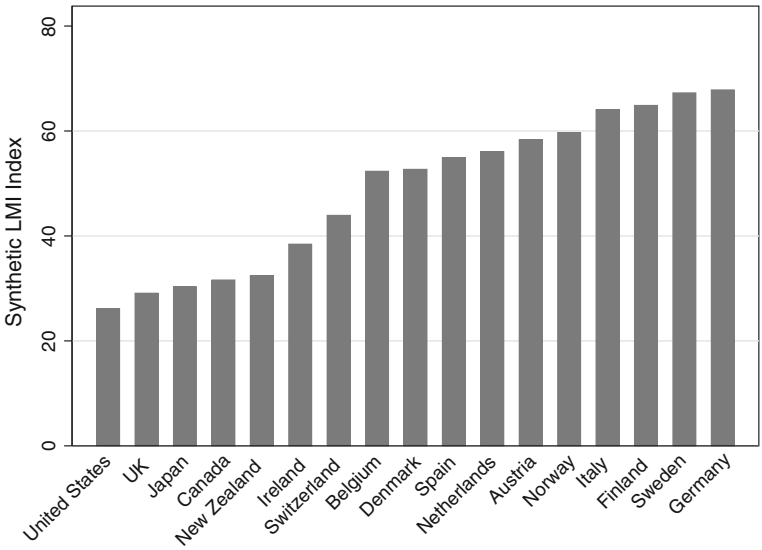

Fig. 3 Average synthetic LMI index

raise marginal costs and deter entry. It is captured by the "Unemployment Benefits" index in *Economic Freedom* and by the gross benefit replacement rate in the OECD data (respectively denoted "Unempl. benefits Index, EF" and "Benef. Repl. Ratio (in %), OECD" in the tables).

Finally, we look at the impact of the minimum wage legislation as proxied by the "Minimum wage impact" variable in *Economic Freedom* and the ratio of minimum over median wage, constructed from OECD data. Beyond minimum wage per se, those variables are meant to measure the degree of constraint that the minimum wage legislation introduces. Intuitively, we expect high minimum wages to deter firms to enter, especially those firms that are intensive in unskilled workers. It has to be noted, however, that Picard and Toulemonde (2006) and Méjean and Patureau (2010) obtain contrasted when they investigate location decisions in a framework with minimum wages, because of general equilibrium effects on aggregate demand.

Table 2 displays descriptive statistics on the LMI variables. Detailed country coverage is reported in Table 9, "Labor Market Institutions" section in Appendix 1. Again, Table 2 reports both "between-country" and "within-country" summary statistics. Since our identification strategy is mostly cross-sectional, it is important that the between-country variability is sufficient in our data. Labor market institutions indeed exhibit a substantial degree of cross-country heterogeneity (Column (3)). As expected, the variability is way larger between countries than in the time dimension (Column (6)).

3 Estimation

This section estimates the role of LMI on French firms' FDI decisions. We proceed as follows. In a first step, we estimate a baseline specification that assesses the

Table 2 LMI variables: descriptive statistics

	# Countries	Mean	Between-country statistics			Within-country statistics		
	(1)	(2)	Std Dev (3)	Min (4)	Max (5)	Std Dev (6)	Min (7)	Max (8)
Economic Freedom sources								
Synthetic LMI index	18	48.51	14.33	26.15	67.84	2.93	44.64	53.43
Centralization index	18	45.28	15.53	20.59	64.50	5.06	39.30	53.96
Unempl. ben. index	18	54.78	12.58	32.73	73.90	4.22	47.87	61.48
Hir. & firing index	18	53.83	16.33	24.74	75.05	6.65	46.58	66.07
Min. wage impact	18	51.90	9.87	36.44	70.18	9.15	38.39	63.03
OECD sources								
EPL	18	35.78	17.42	4.16	63.26	2.89	32.49	40.63
Centralization	16	2.45	1.15	1	5	0.03	2.44	2.5
Ben. Repl. ratio (%)	18	30.37	12.37	10.27	57.36	2.27	26.97	33.44
Min. wage ratio (%)	14	48.60	9.35	30.88	63.38	2.35	45.75	52.04

The "between-country" statistics are computed across countries, using the country-specific mean value of the variable over the period as reference. The "within-country" statistics are instead computed in the time-dimension, using as reference the mean across countries, for each year over 1992–2002

impact of a standard set of explanatory variables found in the related literature. This allows us to check the consistency of our data with usual findings. Then we augment the benchmark specification with a synthetic measure of labor market rigidity (Sect. 3.1). We complete the analysis with a detailed investigation of the different dimensions of labor market regulations that matters for location choices (Sect. 3.2)

3.1 FDI decisions and the overall labor market rigidity

Table 3 reports the results of the conditional logit model relative to (i°) the baseline specification (Column (1)) and (ii°) the role of the overall degree of labor market rigidity (Columns (2) to (6)).

Consider first column (1) that displays estimation results for the baseline regression excluding LMI. This confirms previous results of the literature. Namely, the probability of one country to be chosen as location is increasing in its real market potential and the supply access it offers. It is also positively correlated with the cumulated number of past investments that occurred in that country, in the same industry. This result is consistent with mimetic behaviors across French investors, for instance due to information externalities. Finally, everything else equal, French firms tend to invest in countries further away and with lower income levels. With variables in log, the estimated coefficients can be interpreted as elasticities of the mean probability of a country to be chosen as location (Train 2003). Consistent with the literature, the real market potential and GDP per capita are found to be the most important determinants of location choices.

Having confirmed that our data are broadly consistent with previous empirical evidence on location choices, we now investigate into more details how rigidities in

Table 3 The role of labor market rigidity: baseline results

	Dependent variable: chosen country					
	(1)	(2)	(3)	(4)	(5)	(6)
ln real market potential	0.526*** (0.027)	0.497*** (0.027)	0.488*** (0.024)	0.543*** (0.034)	0.467*** (0.035)	0.402*** (0.029)
ln (# of same ind. firms −1)	0.144*** (0.054)	0.095* (0.055)	0.093* (0.050)	0.092* (0.053)	0.135** (0.056)	0.038 (0.058)
ln (supply access −1)	0.142*** (0.016)	0.206*** (0.018)	0.196*** (0.017)	0.217*** (0.018)	0.258*** (0.019)	0.219*** (0.018)
ln GDP per capita	−0.987*** (0.111)	−0.971*** (0.101)	−0.915*** (0.100)	−0.969*** (0.103)		−0.796*** (0.110)
ln distance	0.118*** (0.041)	0.126*** (0.040)	0.098** (0.039)	0.181*** (0.048)	0.156*** (0.040)	0.170*** (0.036)
Synthetic LMI index, EF		−0.015*** (0.002)	−0.016*** (0.003)	−0.013*** (0.002)	−0.017*** (0.002)	−0.012*** (0.002)
Governance index			−0.007 (0.004)			
Corporate tax rate (in %)				−0.011** (0.004)		
Unit labor cost (in %)					−0.028*** (0.004)	
ln Overall FDI inflows						−0.219*** (0.0273)
Observations	39,618	39,618	39,618	39,618	35,564	38,980
# FDI	2,201	2,201	2,201	2,201	2,092	2,189
# countries	18	18	18	18	17	18
Pseudo-R^2	0.1165	0.1207	0.1209	0.1212	0.1301	0.1248
Log-pseudo L	−5,620.78	−5,593.99	−5,592.76	−5,590.93	−5,155.73	−5,516.3735

Observations clustered by firms. Bootstrapped standard errors in parentheses with ***, ** and * respectively denoting significance at the 1, 5 and 10 % levels

the labor market affect location choices. In Columns (2) to (6) of Table 3, we thus add to the list of explanatory variables a synthetic measure of how flexible the labor market is in the destination country. The index, available in the EF database, increases with the overall rigidity of the labor market. This indicator is consistently shown to be negatively correlated with the probability of one country being chosen as location: Rigidities in the labor market deter firms from investing in a country. This stands in line with the related empirical literature that obtains a negative effect of stringent employment protection on FDI inflows (Javorcik and Spatareanu 2005; Gross and Ryan 2008, among others). Moreover, the inclusion of the LMI index is shown to significantly improve the data fit in comparison with the benchmark model.[10]

Before drawing to the conclusion that labor market rigidity has a significant (dampening) effect on FDI choices, we ensure the result is robust to the inclusion of other potential determinants of location choices, that may be correlated with the synthetic LMI indicator. Namely, in columns (3) to (6), we control for the quality of governance in the destination country, the size of corporate tax rates, the unit labor cost (rather than GDP per capita) and the overall FDI inflow. While all those variables have the expected impact on the probability to settle in, they do not overturn the negative and significant effect of the synthetic LMI indicator.[11] In some respect, it may even be viewed as surprising that the coefficient on the synthetic LMI indicator remains significant when aggregate FDI inflows are controlled for (Column (6)). This variable indeed captures the impact of *all* determinants of FDI location that affect firms from *all* countries in the world in the same way. In particular, it would have been unsurprising that firms in other countries than France also find it costly to settle in a more rigid labor market, which would have created a negative correlation between the aggregate inflow of FDI and the degree of labor market rigidity. With such negative correlation,[12] the coefficient on the LMI indicator could have turned insignificant. This is not the case, which suggests this effect is not of second order.

To convincingly establish that labor market regulations (as captured by the synthetic LMI index) are a significant determinant of FDI decisions, we run a last set of estimations, that control for the robustness of the LMI impact to the sample of investments considered. Results are reported in Table 4, with column (1) being the benchmark case estimated on all 2,201 investments (i.e., identical to Table 3, Column (2)).

We first check whether the impact of LMI institutions is significantly different across sectors depending on the labor intensity of production processes. As mentioned in Sect. 2.2, one may expect firms in labor-intensive sectors to be more

[10] This is confirmed by a likelihood ratio test of model (2) versus model (1), which rejects the null assumption of model (1) having a better fit with a $\chi^2(1) = 53.59$ and an associated p value of 0.00.

[11] The quality of governance is found to have no impact on the location choice of French firms. This explains by this variable being very little heterogeneous in our sample of highly developed countries. Intuitively, we expect the quality of governance to matter more for investments in less developed countries.

[12] The correlation coefficient between the synthetic LMI index and overall FDI inflows indeed amounts to -0.231 (in the between-dimension).

Table 4 The role of labor market rigidity: sensitivity analysis

	Dependent variable: chosen country				
	(1) Benchmark	(2) Labor intensity	(3)	(4) Year-coverage	(5) Lagged variables
		Sectors with high labor intensity	Sectors with low labor intensity	1996–2002 Only	
ln real market potential	0.497*** (0.028)	0.491*** (0.039)	0.511*** (0.042)	0.425*** (0.031)	0.473*** (0 .034)
ln (# of same ind. firms −1)	0.095* (0.055)	0.135* (0.081)	0.056 (0.087)	0.228*** (0.077)	1.293*** (0.294)
ln (supply access −1)	0.206*** (0.018)	0.224*** (0.023)	0.186*** (0.025)	0.177*** (0.023)	0.144*** (0.022)
ln GDP per capita	−0.971*** (0.101)	−0.878*** (0.134)	−1.089*** (0.125)	−0.667*** (0.123)	−0.910*** (0.148)
ln distance	0.126*** (0.040)	0.100* (0.052)	0.153** (0.060)	0.091* (0.054)	0.039 (0.043)
Synthetic LMI index, EF	−0.015*** (0.002)	−0.019*** (0.003)	−0.012*** (0.003)	−0.015*** (0.003)	−0.010*** (0.003)
Observations	36,618	20,484	19,134	26,226	26,226
# of FDI	2,201	1,138	1,063	1,457	1,457
# of countries	18	18	18	18	18
Pseudo-R^2	0.1207	0.1279	0.1144	0.1148	0.1134
Log-Pseudo L	−5,593.99	−2,868.42	−2,720.87	−3,727.93	−3,733.87

Observations clustered by firms. Bootstrapped standard errors in parentheses with ***, ** and * respectively denoting significance at the 1, 5 and 10 % levels. In Column (6), the mean values of real market potential (in log), GDP per capita (in log) and the overall rigidity index over the period 1992–1995 are used as explicative variables of FDI choices made over 1996–2002

sensitive to the flexibility of the destination country's labor market. We thus use the French Input/Output tables (1995 version) to separate the set of manufacturing industries into two sub-samples: Those with a share of wages in value added above the median and those with a relatively low ratio of wages over value added. We then assign each investment to a sub-sample using the information on the industry of the investing firm. Results are displayed in Columns (2) and (3) (high labor-intensive and low labor-intensive sectors respectively). As expected, we find the impact of the LMI indicator to be more pronounced in the sub-sample of labor-intensive sectors. However, the coefficients obtained on both sub-samples are not significantly different. This suggests that the heterogeneity in the response of firms to a given level of flexibility is not that strong.[13]

As second sensitivity check, we control the robustness of our results to the way the time-dimension is treated. While our identification is mostly cross-sectional, variables are measured the year the investment takes place and may thus be sensitive to the time period under consideration. The issue of the time-dimension is especially pregnant for the cumulated number of past investments variable and the supply access. Both determinants of location choices are indeed measured using actual data on investments. This explains why they are lagged in the regressions of Table 3, since their contemporaneous value is by construction endogenous to the explained variable. This does not entirely solve the issue though. In particular, the cumulated number of past investments also suffers from a downward bias, that is especially pronounced at the beginning of the period. This is necessarily the case because our data are censored and we do not observe past investments prior to 1992. In order to see whether this affects our regression results, column (4) shows results obtained when restricting the period to 1996–2002. In this sample, the censoring of data in 1992 is less problematic, since the first cumulated number of past investments (in 1996) is calculated with at least 4 years of observed investments. The overall results are consistent to those obtained with the whole sample. As expected, the impact of cumulated past investments is increased, which suggests that it was downward biased in column (1). Most importantly for our purpose, the coefficient on the LMI variable remains significantly negative and of the same magnitude.

Finally, we check that our results are not sensitive to the structure of lags retained for the explicative variables in Column (5). In our benchmark results, we use contemporaneous values for the explanatory variables, except for two (the supply access variable and the spillover variable) which are considered with 1-year lag. The reason why we use the lag of those variables is that they are constructed using the actual data on location decisions as input which may entail a simultaneity bias in the estimates. In column (5), we test a specification that treats all explanatory variables in a homogeneous way. Namely, we run the estimation based on the sub-sample of investments that took place in the 1996–2002 period, while using the mean values of

[13] This last result may however be sensitive to the way labor intensity is measured. Namely, it is based on the French IO tables and thus refers to the labor intensity of French plants, not their foreign affiliates. If it is the case that French firms relocate the most labor-intensive activities in countries with lower wages, and perhaps more flexible labor markets, then we should observe that the labor intensity of those firms is not higher than the average. This could explain why sectors in our sample are not very heterogeneous in terms of their labor intensity.

all explicative variables computed on the previous 1992–1995 period. As clear from the comparison with Column (5), results are virtually unchanged, except for the coefficient on the cumulated number of past investments, which significantly increases.

How important is the estimated effect of labor market rigidity? While shown to be significant, one may wonder whether the effects of labor market regulations are quantitatively important. The most direct answer one can provide is based on the following experiment. Suppose that a labor market reform raises the rigidity of the labor market from the lowest to the highest level observed in our dataset (that is, from 26 (the United States) to 68 (Germany)). According to our results, this would reduce the probability to be chosen as location by 40–50 %.[14] The quantitative impact of labor market policies is not negligible. Another way to evaluate the quantitative impact of labor market rigidities is to compare it with other determinants of location choices. To that aim, we ran simulations allowing to infer the marginal effect of each explanatory variable on location choices. Table 5 summarizes the results obtained based on the model of Column (2).[15] Namely, it reports the percentage change in the probability to be chosen as location attributable to a one standard deviation increase in the host country's real market potential, its number of French affiliates, its supply access, its GDP per capita and its synthetic LMI index. Since the probability adjustment depends on the country's initial characteristics, we report the simulations results for the mean and median countries of the sample as well as for each individual country.

Results reported in Table 5 call for two main comments. First, although they confirm that the role of LMI is not negligible, they also show that the effect is modest in comparison with those of market potential and supply access. Providing a large access to final demand and input suppliers indeed appears as a key determinant of location choices. A one-standard deviation shock in those variables thus increases the probability to be chosen as location by around 4 percentage points on average. In comparison, the effect of LMI is much more modest: On average, a one-standard deviation shock in the LMI index reduces the location probability by one percentage point, a greater magnitude than that of the spillover variable. Second, Table 5 shows that the marginal impact of LMI sensibly differs among potential host countries.

[14] As detailed by Train (2003), with a variable introduced in level, the estimated coefficient can be interpreted as a semi-elasticity of the mean probability for a country to be chosen as location. For two potential locations j and k sharing the exact same characteristics but the level of their synthetic LMI index ($LMI_j \neq LMI_k$), we have:

$$\frac{P_j}{P_k} = exp[\hat{\beta}(LMI_j - LMI_k)]$$

where P_j/P_k is the relative probability for j to be chosen as location and $\hat{\beta}$ the estimated coefficient on the LMI variable.

[15] In our view, this regression indeed constitutes the core regression that establishes the role of labor market regulations in FDI choices, the regressions driven afterwards (reported in Table 3, Columns (3) to (6) and in Table 4) rather demonstrating the robustness of this result. Besides, given the relatively close order of magnitude of the coefficient associated to the synthetic LMI index throughout the various regressions (around −0.015), we are confident that the simulation exercise would deliver virtually the same interpretation as the one resulting from Table 5, would it be driven on an alternative specification.

Table 5 Simulations—assessing the role of the overall labor market rigidity

	Percentage change in the location probability due to a 1 s.d. increase in:				
	ln RMP	ln # same ind. firms −1	ln supply access −1	ln GDP per cap.	Synth. LMI index
Australia	1.692	0.156	1.465	−0.441	−0.368
Austria	1.751	0.1618	1.517	−0.456	−0.381
Belgium	10.670	1.095	9.379	−3.231	−2.683
Canada	2.200	0.204	1.907	−0.577	−0.482
Denmark	1.305	0.120	1.129	−0.338	−0.2824
Finland	0.870	0.080	0.753	−0.224	−0.187
Germany	8.928	0.894	7.821	−2.607	−2.168
Ireland	1.875	0.173	1.627	−0.489	−0.409
Italy	8.020	0.793	7.014	−2.303	−1.916
Japan	4.389	0.416	3.816	−1.187	−0.990
Netherlands	6.307	0.611	5.500	−1.758	−1.465
New Zealand	1.813	0.1676	1.570	−0.473	−0.395
Norway	0.668	0.061	0.578	−0.172	−0.143
Spain	8.975	0.899	7.864	−2.624	−2.182
Sweden	0.854	0.078	0.738	−0.220	−0.184
Switzerland	3.812	0.360	3.311	−1.022	−0.853
United Kingdom	6.936	0.677	6.056	−1.954	−1.627
United States	6.407	0.622	5.588	−1.789	−1.490
Mean	4.304	0.421	3.757	−1.215	−1.011
Median	3.006	0.282	2.609	−0.799	−0.667

Percentage change in the probability to be chosen as location attributable to a one standard deviation increase in each explanatory variable

French firms are more reactive to changes in labor market conditions in the "core" Western European countries, the United States and Japan.

3.2 The role of the specific LMI dimensions

This section goes deeper into the result that LMI matter for FDI decisions. As previously mentioned, the synthetic LMI index encompasses several dimensions of labor market regulations, which do not necessarily have the same importance for FDI decisions. In this section, we study the specific role of each dimension. This detailed analysis differentiates us from the rest of the literature that generally captures the effect of labor market regulations on FDI decisions through the single dimension of employment protection laws. We argue that investigating the role of various dimensions of LMI is important for at least two reasons. First, this is informative about the potential role of other dimensions of labor market regulation than employment protection in affecting FDI choices. Second, it allows us to assess whether the result found in the literature, that stringent employment protection discourages FDI inflows, is robust to the inclusion of other LMI dimensions.

In what follows, we thus evaluate the specific role of employment protection laws, the unemployment benefits system, the degree of centralization of bargaining procedures and minimum wage policy in affecting FDI choices. Precisely, our ambition is to identify whether there are some specific dimensions of labor market regulations that play a leading role in affecting the country's attractiveness for FDI. This amounts including all LMI variables simultaneously in the estimated equation, so as to evaluate their relative role on the propensity to settle in. This is what we do in Table 6.[16] In this exercise, one obvious concern is the multicollinearity issue. It is indeed likely that labor market regulations are substantially correlated with each other. This is confirmed by the descriptive statistics reported in Table 10 (Appendix 2): The correlation coefficients are systematically positive and high when comparing different dimensions of the labor market functioning. It is then necessary to check that this correlation is not "too" strong, which would jeopardize the reliability of the results when all labor market regulations are included simultaneously as regressors. To this aim, we run standard collinearity diagnostic tests on LMI variables (reported in Tables 11, 12 in Appendix 2, respectively for the EF and OECD data). Their results do not reveal serious collinearity problems, either regarding the set of EF labor market indices or OECD labor market variables.[17]

Table 6 reports the regression results when all LMI variables are simultaneously included as regressors. Columns (1) to (4) report the results for the labor market variables coming from the *Economic Freedom* database, while results for *OECD* variables are reported in Columns (5) to (8). In this case, notice that including all labor market variables comes at the cost of losing a non-negligible number of observations. The number of countries in the choiceset is indeed substantially reduced, to 13 countries, due mainly to missing values in the minimum wage variable, as reported in Table 9.

Consider first columns (1) and (5) that test the specification with the benchmark control variables plus all available LMI dimensions. Coefficients associated to employment protection and the unemployment benefit system are significant and

[16] We also checked that, individually, each LMI is significant and of expected sign. When the sole LMI dimension included in the regression, we find that more stringent employment protection laws, more centralized wage bargaining procedures, a more generous unemployment benefits system and a high minimum wage all deter firms from locating their affiliate in the host country. Yet, the interpretation of such results is tricky. Given the strong correlation between LMI variables (see Table 10 in Appendix 2), one cannot affirm with certainty that the significant coefficient associated to, say, EPL purely identifies the role of this dimension. Instead, it may be the case that this variable captures the role of other types of labor market regulations that are omitted in the regression. To truly evaluate the precise role of each LMI dimension, it is necessary to include all of them simultaneously in the regression. Accordingly, we do not report here regression results when each LMI dimension is included in turn in the regression. These results are available upon request to the authors.

[17] We also investigated this issue using a Principal Components Analysis over each set of LMI variables (EF and OECD datasets). In both cases, we found that the four dimensions contributed with broadly similar equal weights in building the main component (i.e., the one that minimizes the distance between all LMI variables and their synthetic representation). Otherwise said, the overall degree of labor market rigidity may be considered as an average of the four specific dimensions, with equal weights attributed to each of them. In line with collinearity checks, we interpret this result as attesting the absence of serious collinearity issue when including all LMI variables as regressors. We do not report the Principal Components Analysis for sake of space saving but it is available upon request to the authors.

Table 6 The role of different dimensions of labor market regulations

	Dependent variable: chosen country							
	EF database				OECD database			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ln real market potential	0.554***	0.580***	0.411***	0.423***	0.526***	0.546***	0.346***	0.361***
	(0.0305)	(0.035)	(0.036)	(0.038)	(0.045)	(0.044)	(0.057)	(0.058)
ln (# of same ind. firms −1)	0.032	0.031	0.055	0.054	−0.017	−0.022	−0.008	−0.022
	(0.055)	(0.061)	(0.058)	(0.059)	(0.057)	(0.065)	(0.070)	(0.067)
ln (supply access −1)	0.224***	0.233***	0.333***	0.346***	0.248***	0.241***	0.266***	0.266***
	(0.019)	(0.019)	(0.022)	(0.025)	(0.038)	(0.032)	(0.038)	(0.036)
ln GDP per capita	−1.295***	−1.280***			−1.863***	−1.717***		
	(0.102)	(0.116)			(0.167)	(0.191)		
ln distance	0.116**	0.154***	0.131***	0.173***	0.0889	0.103	−0.0484	−0.0311
	(0.048)	(0.049)	(0.045)	(0.052)	(0.077)	(0.069)	(0.070)	(0.079)
Employment protection	−0.011***	−0.010***	−0.008***	−0.008***	−0.022***	−0.018***	−0.018***	−0.017***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.004)	(0.004)
Centralization Index, EF	−0.006	−0.005	−0.011***	−0.010***				
	(0.004)	(0.003)	(0.003)	(0.004)				
Centralization = 2, OECD					0.161	0.154	0.495	0.623
					(0.212)	(0.253)	(0.358)	(0.391)
Centralization = 3, OECD					0.042	0.197	0.512*	0.710**
					(0.236)	(0.263)	(0.279)	(0.308)
Centralization = 4, OECD					0.191	0.047	−0.667	−0.665
					(0.546)	(0.483)	(0.492)	(0.531)
Centralization = 5, OECD					−0.626*	−0.687*	−0.597*	−0.635
					(0.361)	(0.378)	(0.355)	(0.398)

Table 6 continued

	Dependent variable: chosen country							
	EF database				OECD database			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Unemployment benefits	−0.009***	−0.008***	−0.013***	−0.013***	−0.012**	−0.023***	−0.026***	−0.036***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.005)	(0.007)	(0.007)	(0.007)
Minimum wage policy	0.004*	0.005**	−0.004*	-0.003	−0.012***	-0.005	−0.023**	−0.020*
	(0.002)	(0.002)	(0.002)	(0.002)	(0.004)	(0.006)	(0.011)	(0.012)
Corporate tax rate (in %)		−0.007		-0.007*		-0.017***		-0.019***
		(0.004)		(0.004)		(0.006)		(0.006)
Unit labor cost (in %)			-0.02***	-0.017***			-0.055***	-0.045***
			(0.005)	(0.004)			(0.012)	(0.010)
Observations	39,080	39,080	35,051	35,051	21,967	21,967	18,924	18,924
# Of FDI	2,196	2,196	2,087	2,087	1,883	1,883	1,774	1,774
# Of countries	18	18	17	17	13	13	12	12
Pseudo-R^2	0.1250	0.1252	0.1313	0.1315	0.0959	0.0966	0.1042	0.1051
Log-pseudo L	−5,531.47	−5,530.17	−5,114.08	−5,112.71	−4,177.32	−4,174.25	−3,756.59	−3,752.86
LR χ^2 (n)	178.62	181.23	1,013.40	1,016.14	2,886.93	2,893.07	3,728.38	3,735.84
n	4	4	4	4	7	7	7	7
p value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Observation clustered by firms. Robust standard errors in parentheses with ***,** and * respectively denoting significance at the 1, 5 and 10 % levels. LR test relative to the benchmark regression (Model (1), Table 3) for columns (1), (2), (5) and (6) and a variant of the benchmark regression where GDP per capita is replaced by the unit labor cost for Columns (3), (4), (7) and (8)

negative. This is true whatever the source of the LMI data, whether *Economic Freedom* (column (1)) or the OECD (column (5)). The impact of the centralization of wage bargaining is instead found to be insignificant with EF data and hardly significant at the highest degree of centralization with the OECD data. The ambiguity is even stronger when it comes to analyzing the impact of minimum wages. Its impact is negative and significant with the OECD variable but it turns slightly positive with the indicator of *Economic Freedom*. Note that we continue to reach the same conclusion when other variables, namely corporate tax and unit labor costs, are controlled for, in columns (2)–(4) and (6)–(8).[18] With more control variables however, the puzzling positive impact of the EF minimum wage indicator found in column (1) disappears and the variable turns out non significant.

These results suggest that, among the various dimensions of labor market regulations, employment protection laws and the generosity of the unemployment benefit system play a dominant role in the country's attractiveness for FDI. Moreover, the χ^2 statistics confirm that the introduction of LMI significantly improves the model's fit with respect to the benchmark case that does not take LMI variables into account (Column (1) in Table 3). These findings are particularly interesting and original with respect to the role of the unemployment insurance system. While the few related papers only study the role of employment protection on FDI, this result indeed points out that the generosity of the unemployment benefits system is another important dimension that affects the country's attractiveness for FDI, even once the role of employment protection is controlled for.

Again, we illustrate the quantitative effect of different LMI dimensions by running simulations based on column (1) and (5) of Table 6. Tables 7 and 8 sequentially simulate the impact of a one standard deviation increase in each LMI variable on the probability to locate in a country. The nature of the shock differs for the centralization LMI variable coming from OECD though (Table 8, Column (2)). Given this variable is a class variable (taking discrete values from 1 to 5), we adapted the exercise as follows. Simulations are run by assessing the marginal impact of switching from each class of centralization to its superior level (from Class 1 to Class 2, and so on). We then calculate the mean marginal effect, which is reported in Table 8.

Based on EF data, we find that such an increase in the Hiring & Firing index reduces the probability by 0.8 % on average. This impact is slightly lower for the unemployment benefits index (−0.54 %) and the centralization index (−0.45 %). On the other hand, the impact of minimum wage is smaller and positive, consistent with the puzzling positive coefficient found in column (1) of Table 6. The quantitative effect of LMI shocks referring to the smaller sample using OECD indicators is broadly consistent (see Table 8). Again, changes in minimum wage policy are found to have the lowest impact on the probability to locate. At the other end of the spectrum, we find shocks to the Employment Protection index to matter

[18] Given the insignificant role of the quality of governance in Table 3, we do not include this variable in the robustness. The aggregate FDI inflows variable is not included either because of the large correlation between this variable and *all* determinants of location choices that are not specific to French investors. See the discussion in Sect. 3.1

Table 7 Simulations—LMI variables (EF sources)

	Percentage change in the location probability due to a 1 standard deviation increase in:			
	Hir. & fir. index	Central. index	Unempl. ben. index	Min. wage index
Australia	−0.249	−0.133	−0.162	0.078
Austria	−0.314	−0.168	−0.205	0.098
Belgium	−1.898	−1.004	−1.228	0.578
Canada	−0.389	−0.207	−0.253	0.121
Denmark	−0.278	−0.148	−0.181	0.0869
Finland	−0.131	−0.0698	−0.085	0.0409
Germany	−1.787	−0.946	−1.157	0.545
Ireland	−0.280	−0.149	−0.182	0.087
Italy	−1.755	−0.929	−1.136	0.536
Japan	−0.716	−0.381	−0.465	0.222
Netherlands	−1.191	−0.633	−0.773	0.367
New Zealand	−0.329	−0.176	−0.214	0.107
Norway	−0.0978	−0.052	−0.064	0.031
Spain	−1.897	−1.004	−1.227	0.578
Sweden	−0.131	−0.070	−0.086	0.0411
Switzerland	−0.836	−0.445	−0.543	0.259
United Kingdom	−1.528	−0.810	−0.991	0.468
United States	−1.432	−0.760	−0.929	0.440
Mean	−0.847	−0.449	−0.549	0.260
Median	−0.552	−0.294	−0.359	0.172

Percentage change in the probability to be chosen as location attributable to a 1 standard deviation increase in each explanatory variable

the most for location choices. In between are the relative effects of increasing the degree of centralization of wage bargaining procedures and the level of unemployment benefits.[19]

Concerning the cross-country dimension, we find that French firms are more concerned about labor market regulation in the main partner countries such as core EU countries, the United States and Japan. This result holds for both sets of LMI variables (Tables 7, 8). For instance, French firms are about four times more sensitive to employment protection regulations in Great Britain than in Canada (according to the OECD data). This result therefore confirms the one obtained with the synthetic LMI index (Table 5).

[19] In Table 8, the mean impact of the shock on the centralization index is found slightly bigger than the one obtained for shocks to the unemployment benefit system (Columns (2) vs. (3)). The comparison of those numbers is misleading, however, since the shocks are not of equal size. The discrete nature of the OECD centralization variable prevents us from evaluating the marginal impact of a 1 standard deviation increase in this variable, as we made for the others. We thus present in Table 8 the mean impact of switching from one class to the one directly above.

Table 8 Simulations—LMI variables (OECD sources)

	Percentage change in the probability to be chosen due to a positive shock in:			
	EPL (1)	Centr. index (2)	Unempl. benefits (3)	Min. wage ratio (4)
Australia	−0.581	−0.208	−0.185	−0.141
Austria	.	.	.	.
Belgium	−3.544	−1.367	−1.103	−0.837
Canada	−1.059	−0.340	−0.336	−0.256
Denmark	.	.	.	.
Finland	−0.203	−0.103	−0.065	−0.049
Germany	−3.322	−1.286	−1.036	−0.786
Ireland	−0.600	−0.269	−0.191	−0.146
Italy	−3.326	−1.179	−1.038	−0.787
Japan	−0.954	−0.306	−0.303	−0.231
Netherlands	−1.610	−0.638	−0.509	−0.387
New Zealand	.	.	.	.
Norway	.	.	.	.
Spain	−3.386	−1.309	−1.056	−0.801
Sweden	.	.	.	.
Switzerland	−1.425	−0.509	−0.451	−0.343
United Kingdom	−3.872	−1.255	−1.202	−0.912
United States	−2.894	−0.935	−0.906	−0.688
Mean	−2.060	−0.747	−0.644	−0.490
Median	−1.610	−0.638	−0.509	−0.387

Columns (1), (3) and (4) report the percentage change in the probability to be chosen as location attributable to a 1 standard deviation increase in each explanatory variable. The centralization index being a discrete variable, simulations are run by assessing the marginal impact of switching from each class of centralization to its superior level. Column (2) reports the mean marginal effect

In a nutshell, our overall results of Tables 6, 7 and 8 bring us to the conclusion that, if LMI do indeed matter in FDI choices, regulations on employment protection and the unemployment benefit system play a leading role. Precisely, more stringent hiring and firing practices and a generous unemployment benefit system are found to have a significant and quantitatively non-negligible deterring effect on the propensity to locate for foreign investors.

4 Conclusion

This paper evaluates the empirical effects of LMI on FDI decisions, using a dataset describing French firms' expansion strategies in a set of 18 OECD countries over 1992–2002. We estimate the determinants of FDI decisions using a discrete choice model on all possible foreign locations. After controlling for standard FDI

determinants (such as market potential and supplier access), we evaluate the role of various labor market regulations in affecting the probability to settle in. Two main results emerge.

First, we show that LMI do matter in FDI decisions. Precisely, labor market rigidities exert a negative impact on the country's attractiveness for (French) foreign investors. Yet, while the effect is significant, its magnitude is small in comparison with FDI determinants related to the country's market potential or supplier access. This delivers an interesting message with regards to the design of labor market policy. The globalization process at work over the last decades has weakened welfare-state institutions in industrialized countries. The raising competition from low-wage emerging countries strengthens criticisms towards highly regulated labor markets, in particular in European countries. Our results tend to moderate this view. They suggest that reforming labor markets to reduce rigidities would indeed increase the country's attractiveness for foreign investments. However, the marginal effect is likely to be small given the predominant role of the country's market potential in firms' location decisions.

Second, we complement the related literature by enlarging the scope of labor market regulations under study beyond the single dimension of employment protection. We thus evaluate the role of employment protection, the centralization degree of wage bargaining, the unemployment benefit system and minimum wage policy in FDI location choices. If each labor market variable is found to affect FDI choices when individually included in the regression, not all of them remain significant when all LMI dimensions are simultaneously treated as regressors. Specifically, we find that employment protection plays a major role in affecting FDI decisions. In this respect, this result confirms *ex-post* the relevance of related papers that exclusively focus on this dimension. More originally, we also show that this is not the sole dimension that matters. In particular, our results indicate a robust role of the unemployment benefit system, even once the role of employment protection is controlled for. These results therefore call for more theoretical investigation. This is left for further research.

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Appendix 1: Data Appendix: Definitions and sources

We study FDI choices of French firms over the period 1992–2002 in the set of 18 OECD countries. The list of countries is notably reported in Table 9.

Standard explanatory variables

Sources for the standard explanatory variables of FDI choices included in our sample are described hereafter.

Table 9 OECD Labor market institutions: country and year coverage

Country	OECD LMI dataset				
	EPL degree	Central. ratio	UB ratio	Min. wage ratio	All LMI together
Australia	Yes	Yes	Yes	Missing	Missing
Austria	Yes	Yes	Yes	Yes	Yes
Belgium	Yes	Yes	Yes	Yes	Yes
Canada	Yes	Yes	Yes	Yes	Yes
Switzerland	Yes	Yes	Yes	Yes	Yes
Germany	Yes	Yes	Yes	Yes	Yes
Denmark	Yes	Yes	Yes	Missing	Missing
Spain	Yes	Yes	Yes	Yes	Yes
Finland	Yes	Yes	Yes	Yes	Yes
United-Kingdom	Yes	Yes	Yes	Missing 92–98	Yes
Ireland	Yes	Yes	Yes	Missing 92–99	Yes
Italy	Yes	Yes	Yes	Yes	Yes
Japan	Yes	Yes	Yes	Yes	Yes
Netherlands	Yes	Yes	Yes	Yes	Yes
Norway	Yes	Missing	Yes	Missing	Missing
New Zealand	Yes	Missing	Yes	Yes	Missing
Sweden	Yes	Yes	Yes	Missing	Missing
United-States	Yes	Yes	Yes	Yes	Yes
Nb of countries covered	18	16	18	14	13

The real market potential variable is constructed as in Redding and Venables (2004), relying on importation data taken from the "*Dots*" database of the IMF and gravity variables taken from the CEPII "*Distance*" database. Our measure is based on the following definition of country *i*'s real market potential:

$$RMP_i = \sum_j I_j P_j^{\sigma-1} \phi_{ij} \tag{3}$$

where I_j is the nominal income in country j, P_j the price level and ϕ_{ij} a measure of the various barriers limiting trade between countries i and j. Redding and Venables (2004) show how to build the variable using as proxy for the country-specific determinants of real market potential (the $I_j\ P_j^{\sigma-1}$ terms in the definition above) estimates of importer-specific fixed effects obtained from a gravity equation. The extent of trade barriers is then measured using various proxies.

The gravity equation that is first estimated has the following form:

$$\ln X_{ij} = \theta + \mu_i cty_i + \mu_j cty_j + \delta \Phi_{ij} + \varepsilon_{ij} \tag{4}$$

where X_{ij} is the value of the trade flow between country i and country j, cty_i and cty_j are exporter- and importer-specific fixed effects, and Φ_{ij} is a vector containing various measures of bilateral trade barriers (the distance between both countries and a set of binary variables, that indicate the existence of a common border, of past

colonial links, the use of a common language and the countries' involvement into trade agreements and monetary unions).

From the estimation of the gravity equation, one can restore a measure of real market potentials (expressed in current US dollars) as in:

$$\hat{RMP}_i = \sum_j \left[\exp(cty_j)\right]^{\hat{\lambda}_j} \left[\exp(\Phi_{ij})\right]^{\hat{\delta}} \quad (5)$$

The variable is built annually between 1992 and 2002.

The GDP per capita is obtained by dividing current GDP series (converted at nominal exchange rate in US Dollars) by the population level of the country, based on the "*World Developments Indicators*", World Bank. The variable is taken in logarithm.

As an alternative to GDP per capita, we use the unit labor cost, defined as the ratio of total labor costs to real output, or equivalently, as the ratio of average labor costs per hour to labor productivity. The series is expressed in percentage. Data are taken from the OECD's *Main Economic Indicators*. Series are available on a yearly basis for all countries of our sample except for Switzerland.

Distance from France ("ln distance") comes from the CEPII's "*Distance*" database.

The supply access variable is built as in Mayer et al. (2010) using data from the French *Input/Output (I/O) Tables* and the *Enquête Annuelle d'Entreprises* for employment data. The rationale behind the construction is the following. The incentive for a firm in sector s to locate in country i increases in (i) country i's supply of intermediate goods, relative to the rest of the world, and (ii) sector s's use of intermediate inputs. To capture the first element, we use information on input producers in country i which are affiliates of French firms. Namely, the share ω_i^m of inputs m produced in country i is measured by the share of the overall employment by French affiliates in industry m that is located in country i. The use of intermediate inputs in the sector firm k belongs to is approximated using information from the French I/O tables. This implicitly assumes that foreign affiliates of French firms have the same technological function as French firms in the same sector. The total share of intermediate goods in the production of the affiliate is thus approximated by the share recorded in the French I/O tables for sector s (called β_s hereafter). The same holds true for the technical coefficients a_s^m measuring the quantity of industry m's inputs needed to produce one unit of output in industry s.

Based on these data, it is possible to measure the availability of inputs within country i that are used by an affiliate operating in industry s as:

$$SA_i^s = \frac{\beta^s}{d_{ii}} \left[\sum_{m=1}^{S} a_s^m \omega_i^m\right] \quad (6)$$

The supply access variable thus measures the average share of world intermediate goods produced in country i. In the average, each industry is weighted by the technical coefficient measuring the reliance of sector s to this particular input (a_s^m): Affiliates benefit more of the proximity to local suppliers producing intermediate goods they use intensively. The supply access variable is also higher if intermediate

inputs are a large component of costs in industry s (as measured by β^s). Finally, the measure is divided by the internal distance of country i, d_{ii}, in order to account for the ease of access to suppliers inside i. Using I/O tables for each year of the sample, we obtain time-series of sector-specific supply access. In the estimates, the explanatory variable is supply access in the year preceding the investment, in order to limit endogeneity and avoid double-counting the firm's own investment.

The governance indicator is built using the governance indicators defined and measured by Kaufman et al. (2005). Data are available on the World Bank web site.[20] The indicators measure six dimensions of governance: (1) Voice and Accountability measures political, civil and human rights; (2) Political Instability and Violence measures the likelihood of violent threats to, or changes in, government, including terrorism; (3) Government Effectiveness measures the competence of the bureaucracy and the quality of public service delivery; (4) Regulatory Burden measures the incidence of market-unfriendly policies; (5) Rule of Law measures the quality of contract enforcement, the police and the courts, as well as the likelihood of crime and violence; (6) Control of Corruption measures the exercise of public power for private gain, including both petty and grand corruption as well as state capture.

Data are available for the years 1996, 1998, 2000 and 2002. All countries in the sample are covered. For the years 1992–1995, we use the same value than in 1996. For the year 1997, 1999 and 2001, we take the average of the two yearly adjacent values. All variables are transformed so that they take values between 0 and 100, increasing with the quality of governance. The average indicator is built as a simple arithmetic mean of the 6 dimensions of governance. The larger the variable, the better the quality of governance.

The corporate tax rate series are taken from the OECD Tax database. Precisely, we use the "combined corporate income tax rate". Series are built as a percentage share, taking values within a [0;100] interval. The corporate tax rate variable is thus introduced in level in the regression. It is denoted "Corporate tax rate (%)". Series are available on a yearly basis over the period 1992–2002 for all countries in the choiceset.

Aggregate FDI inflows series are taken from the OECD's International direct investment database. They correspond to the gross FDI inflows for the total economy. Series are available on a yearly basis over the period 1992–2002 for all countries in the choiceset, except for Switzerland (in 1993), Germany (in 1992) and New Zealand (in 2001).

Labor market institutions

Economic Freedom database: The database is provided by the Fraser Institute, available online, http://www.freetheworld.com. We use the 2005 edition of the Economic Freedom of the World annual report. LMI indicators are defined as follows:

[20] http://www.govindicators.org.

The Synthetic LMI Index sums up various sub-indices that are related to different dimensions of the labor market functioning: (1) the "minimum wage impact", (2) the "unemployment benefits" variable, (3) the "Hiring and firing practices" index, (4) the "Centralization" index, and (5) an indicator of the use of conscripts to obtain military personnel.

The Minimum Wage Impact variable is based on two survey responses obtained from the *Global Competitiveness Report*, asking about (1) the overall "impact of the minimum wage", and (2) the strength of enforcement of the minimum wage law. Countries receive lower ratings if the survey respondents indicate the minimum wage has a large impact and/or is strongly enforced.

The Unemployment Benefits variable indicates whether the unemployment benefits system preserves the incentive to work, with low values associated to pernicious effects.

The Hiring and Firing Practices variable indicates whether hiring and firing practices of companies are determined by private contract, with low values meaning that firing and hiring laws are more constraining.

The Centralization Index measures the share of labor force whose wages are set by centralized collective bargaining.

Original data take values over the range [0,10] but have been rescaled over [0,100] before introducing this variable in level in the conditional logit. This allows interpreting coefficients as the probability change attributable to a one percentage point increase in the indicator. Besides, original EF variables are increasing with the degree of labor market flexibility. To homogenize the interpretation of coefficients with OECD LMI variables, we rebuilt the variables from *Economic Freedom* for them to be increasing with the degree of labor market rigidity. Precisely, we take 100 minus the original value. This preserves the cross-country distribution of the variables, while making them take values over the range [0;100] as OECD LMI variables.

We use raw data that are given for the years 1990, 1995, 2000, 2001 and 2002, and we rely on interpolation for missing years. The only missing values in this dataset are for the Unemployment Benefit Index, that is missing for Australia in year 1992–1993 and 1994.

OECD sources: We collect data on various LMI for OECD countries over the period 1992–2002, using data provided by the OECD. We focus on the following set of LMI:

Employment Protection Laws: We consider the EPL indicator provided by the OECD, for all workers.[21] The original index takes values in the range [0;5], increasing with strictness of employment protection. We rescaled it over [0;100] and introduce it in level in the regressions. Data are available for 1990, 1998 and 2003. They are interpolated over the period 1992-2002.

Centralization Degree of Bargaining is a discrete variable of bargaining centralization taken from OECD (2004). It ranges between 1 and 5 and is increasing in the degree of centralization: 1 = Company and plant level predominant, 2 = Combination of industry and company/plant level, with an important share of

[21] Data are available on http://stats.oecd.org/.

employees covered by company bargains, 3 = Industry level predominant, 4 = Predominantly industrial bargaining, but also recurrent central-level agreements, 5 = Central-level agreements of overriding importance. Information on this variable covers a 5-year period, on 1980–84, 1985–89, 1990–1994, 1995–2000. We conserve the most recent value for 2001 and 2002.

Benefit Replacement Ratio: We consider the gross replacement rates provided by the OECD's *Social and Welfare Statistics* database.[22] It is defined as the average of the gross unemployment benefit replacement rates for two earnings levels, three family situations and three durations of unemployment. Raw data have one observation every 2 years, starting in 1985. We rely on interpolation for missing years.

Minimum Wage Legislation: The ratio of minimum wage to median wage is taken from the OECD's *Labor Force Statistics* database. It corresponds to the minimum relative to median wages for full-time workers. It is available on a yearly basis for 14 OECD countries. Notice that Ireland and the United Kingdom had no legal minimum wage policy before 2000 and 1999 respectively. We complete these pieces of information using data from ILO Bureau of Statistics (*LABORSTA* database). This database contains legal and negotiated minimum wages in national currency and international US$ in 2003. This information is used to reconstitute series of minimum wages for countries in which minimum wages are negotiated at the sector level, that are not included in OECD data (precisely, Switzerland, Germany, Finland and Italy). For these countries, we build the series of minimum-to-median wage ratio as follows. First, as the ILO data have no time dimension, it has been assumed that negotiated minimum wages only adjust to inflation. Under this assumption, time series can be rebuilt using inflation series, calculated on consumption-price indices obtained from national sources. Second, we calculate the ratio of minimum to median wages using OECD *Earnings* data on gross median wages.

Table 9 displays the country coverage for the various LMI dimensions coming from OECD sources.

Appendix 2: More on the role of labor market institutions

To detect potential collinearity problems when simultaneously including various LMI in the regression, we calculate the correlation coefficients between our LMIs. They are reported in Table 10. Precisely, we report here the "between-country" correlation coefficient, i.e., considering the mean value of the LMI over the sample period for each country.

First, it is worth noticing that all correlations are positive, notably with the synthetic LMI indicator, and whatever the source of LMI dataset (EF or OECD). In line with expectations, a higher value of each labor market variable can be associated with a more rigid labor market functioning. Second, if positive and non-negligible, the correlations between the specific LMI variables of the same dataset

[22] http://www.oecd.org/els/social/workincentives.

Table 10 Correlation between LMI dimensions

	Synth. LMI index	EPL		Unempl. benefits		Min. wage		Central. degree	
		EF	OECD	EF	OECD	EF	OECD	EF	OECD
EPL									
EF	0.6642	1.0							
OECD	0.8025	0.7272	1.0						
Unempl. benefits									
EF	0.7900	0.4723	0.5787	1.0					
OECD	0.4918	0.0910	0.3639	0.4746	1.0				
Minimum wage policy									
EF	0.5840	0.4336	0.4205	0.4701	0.2402	1.0			
OECD	0.6301	0.5010	0.3159	0.6194	0.4693	0.5096	1.0		
Centralization degree									
EF	0.8618	0.6190	0.6564	0.7356	0.5235	0.4049	0.6827	1.0	
OECD	0.6671	0.4601	0.4801	0.7063	0.5071	0.2470	0.4203	0.7547	1.0

The correlation coefficients are between-country, i.e., they are calculated based on the mean value of the country-specific LMI variable, over the whole period

Table 11 Collinearity diagnostics—Economic Freedom

(1) Number	(2) Eigenvalue	(3) Condition index	(4) Proportion of variation	(5)	(6)	(7)
			Central.	Unempl. benefits	Min. wage	Hiring and firing
1	2.735	1.000	0.027	0.034	0.042	0.041
2	0.719	1.951	0.029	0.061	0.830	0.000
3	0.390	2.647	0.001	0.288	0.116	0.654
4	0.156	4.183	0.943	0.617	0.012	0.305

Collinearity tests (with intercept adjusted) are derived from Belsley et al. (1980). A condition index above 10 indicates that weak dependency may be starting to affect the regression estimates

Table 12 Collinearity diagnostics—OECD

(1) Number	(2) Eigenvalue	(3) Condition index	(4) Proportion of variation	(5)	(6)	(7)
			EPL	Central. degree	Unempl. benefits	Min. wage
1	2.501	1.000	0.060	0.053	0.054	0.058
2	0.647	1.966	0.294	0.034	0.000	0.764
3	0.564	2.105	0.591	0.111	0.212	0.154
4	0.288	2.948	0.055	0.801	0.734	0.024

Collinearity tests derived from Belsley et al. (1980). A condition index above 10 indicates that weak dependency may be starting to affect the regression estimates

(i.e, either EF LMI variables or OECD LMI variables) reported in Table 10 are not that strong to make us suspect serious multicollinearity problems when all included in the regression (Table 6). However, to ensure this point, we also run collinearity tests on the set of LMI variables on the set of LMI variables as reported by Economic Freedom (Table 11) and the OECD (Table 12).

These collinearity diagnostics are obtained from the SAS software collinearity test routine and derived from Belsley et al. (1980). In each table, the numbers in Column (1) correspond to different linear combinations of the LMI variables. The eigenvalues in Column (2) correspond to the variance of that combination. The condition index, obtained from those eigenvalues and reported in Column (3), is used to detect potential multicollinearity issues. Namely, it indicates whether the inversion of the matrix is numerically unstable with finite-precision numbers. A high condition index associated with the linear combination that explains most of the variance of a given variable (reported in columns (4) to (7)) can be interpreted as indicative of potential multicollinearity issues. Belsey et al. (1980) suggest that, when this number is around 10, weak dependencies may be starting to affect the regression estimates. When this number is larger than 100, the estimates may have a fair amount of numerical error. In our case, for both LMI datasets, the highest condition index is lower than 10, we thus conclude on the absence of collinearity issue between the regressors.

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