Housing market regulation and social network*

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May 2013

Abstract

We study an aspect of the housing market regulation which is the procedural formalism. Why some OECD countries have high level of procedural formalism in the housing market? We provide an explanation based upon the complementarities between the strength of social network and the stringency of procedural formalism. The interest with the social network is that conflict resolution is cheaper than with law. In an area where the local people belong to a social network whereas the foreigners do not, the regulation may facilitate housing search for the locals at the expense of the foreigners. To illustrate this mechanism we build a search-theoretic model of the housing market. The model emphasizes that the support for regulation should increase with the size of social networks, the proportion of foreigners and the rental market tightness.

Keywords: Housing market regulation, social network

J.E.L classification : R38

1 Introduction

We study an aspect of the housing market regulation which is the procedural formalism. The aim of this paper is to explain why some countries, within the OECD, support high levels of procedural formalism on the housing market while it generates cost for landlords and tenants. The procedural formalism constrains the landlord to follow several independent procedural actions to solve a conflict with a tenant. It is time consuming and costly. Moreover, as conflicts are costly, landlords ask a higher rent to cover the potential losses. Then, in a frictional environment, where a match between a tenant and a landlord generates a surplus, the procedural formalism destroys the renting surplus of landlords and tenants.

Then why do we observe, in some countries, political support for legislation that reduces economic surplus ?

We propose an explanation based on the complementarities between the strength of social network and the stringency of procedural formalism. The social network reflects a pool of family and friendship ties between local people. Then, a landlord and a tenant belonging to the same social network can be matched together. They are network matched. To be network matched give some comparative advantages to a potential tenant. It is to build the comparative advantage that households demand procedural formalism.

*This work has benefited from comments by Bruno Decreuse and Tanguy van Ypersele.

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In an area where the local people belong to a social network whereas the foreigners do not, the regulation may facilitate housing search for the local applicants at the expense of foreigners. Indeed, a landlord will undertake legal action to solve dispute if the tenant who fails to pay the rent does not belong to his social network. Thus, the cost of dispute depends on procedural formalism. However, if the landlord knows the tenant, he cannot take legal action against him without deteriorating their friend/family relationship (Anderson and Francois (2008)). Therefore, a tenant and a landlord network matched can solve the conflict within the network by different ways: a kin of tenant who makes default, can be used as collateral or the tenant can return to live with its parents and to leave the housing quickly or the landlord can give more time to pay. At the consequences the cost of conflict does not depend on law if the landlord and the tenant are network matched. Thus, if conflict resolution is more expensive by law than within the social network, the landlord would prefer to rent its housing to people network matched. Therefore, local applicants would benefit from a high level of procedural formalism on the housing market. Firstly, it would enable them to be preferred over people without any social network when they are network matched. Secondly, if the social network is strongly developed, local applicants will be affected, only slightly, by the regulation because they will have a high probability to be network matched.

Our study is motivated by some stylized facts. At macro level, there is a positive correlation between procedural formalism and social network. At micro level, there is evidence that foreigners are discriminated on the rental market in Southern Europe (where regulation is strong):

At macro level, the countries where the social network is the most developed, are also the countries where procedural formalism is the highest. We evaluate the social network by the importance of family ties, friendship ties and neighborhood ties[1] because David et al (2010) show that strong family and friendship ties reflect local social network. We measure the housing market regulation by the procedural formalism index of Djankov et al (2003). In Figure 1, we observe a North-South divide: in the South of Europe (Spain, Portugal and Italy) there is a higher frequency of contacts with friends and neighbours as well as higher levels of regulation on the housing market. The opposite stands in the North of Europe. In Figure 2, we find the same North-South divide with family ties and procedural formalism.

[1] We use European value Survey (EVS), World Value Survey (WVS) and European Community Household Panel (ECHP) to quantify the importance of social network. We measure family ties from the EVS and WVS and friendship ties and neighborhood ties from ECHP as in David et al (2010). See in Appendix A the building of these different measures.

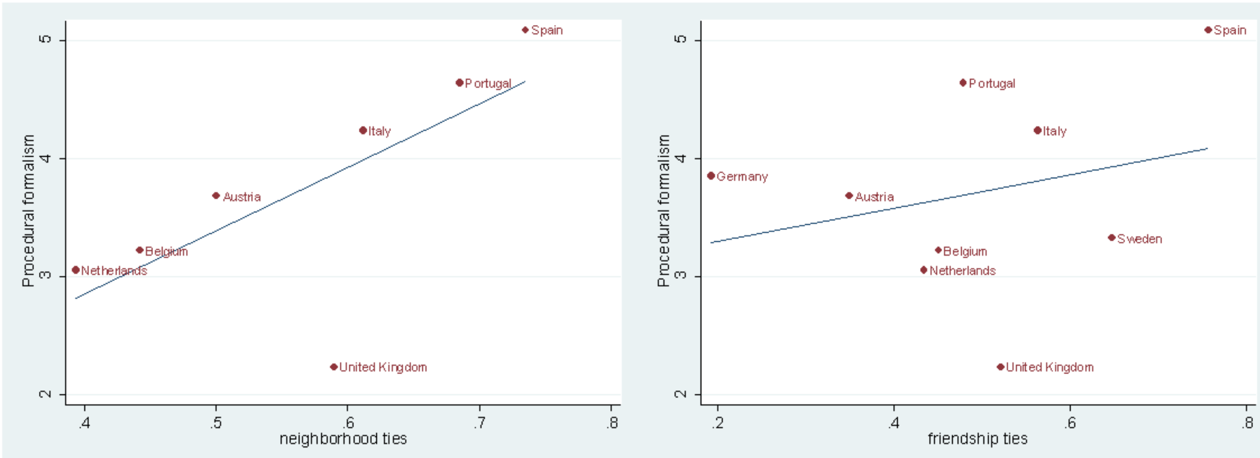

Figure 1: Social network and Procedural formalism: the figure displays the correlation between average value of the social capital measures by country for the active population and Procedural formalism. Data base: ECHP for friendship ties and neighborhodd tie and we use the procedural formalism index of Djankov et al (2003) to measure the degree of regulation. Sample period is 1994-2001 except Finland (1996-2001), Sweden (1997-2001), Austria (1995-2001) and Luxembourg (1994). See Appendix A for more details.

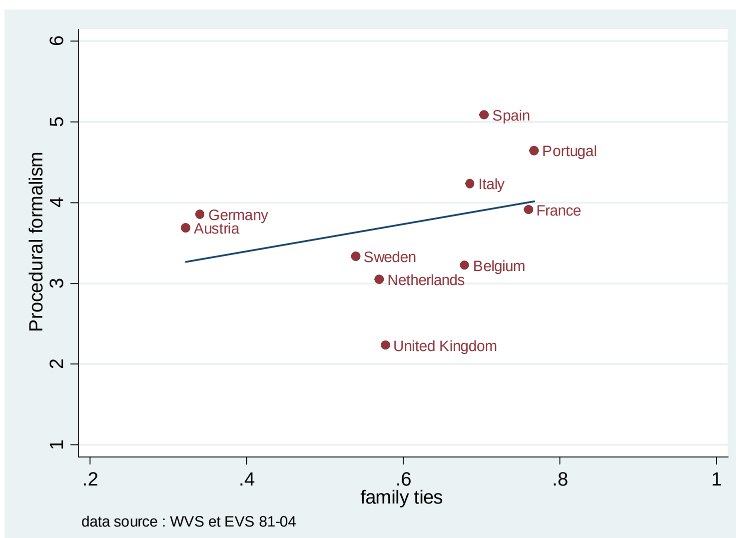

Figure 2: Social network and Procedural formalism: the figure displays the correlation between average value of the social capital measures by country for the active population and procedural formalism. Data base: EVS and WVS and we use the procedural formalism index of Djankov et al (2003) to measure the degree of regulation. Sample period is 1981-2004 . See Appendix A for more details.

At micro level, there is evidence that foreigners are discriminated on the rental market in Southern Europe. With a field experiment carried out on the Internet, Bosch et al. (2010) show that applicants with a Moroccan sounding name are 15 percentage points less likely to be contacted by the property owner than those with a Spanish name. Similarly, Baldini and Federici (2011) show ethnic discrimination in the Italian rental market. With an econometric study on the population in the French social housing, Bouvard et al. (2009) show that people of African descent are discriminated against on the French private rental market. Indeed, they show that people of African descent are over-represented in the French social housing because they have more difficulty to rent a housing in the French private rental market. We interpret such results as an evidence that landlords prefer to rent their dwelling to local applicants when the regulation on the rental market is strong.

We proceed in three steps. In Section 2, we develop a model to explain why procedural formalism should drive the landlords to favor local applicants network matched. The framework is a static matching model[2]. We build an urn-ball model. Each potential tenant sends one application to one vacant dwelling. Hence, a particular landlord can receive several applications and has to choose the best application. Therefore, each applicant is ranked according to the surplus generated. The surplus depends on the default rate and the cost of dispute resolution (network or law). Potential tenants with high default rate have low probability to get the lease. Moreover, when the regulation increases, applicants network matched become relatively more attractive compared to other applicants. Therefore, procedural formalism increases the probability to get a lease for tenants network matched and decreases the probability to get a lease for tenants match with landlords not belonging to their social network. A landlord and a tenant not belonging to the same social network and matched together are anonymously matched.

In Section 3, we study the preferences of applicants for the procedural formalism. Firstly, we show that foreign applicants have no interest to increase the procedural formalism in the rental market. Indeed, it decreases their match surplus. Their probability to get a lease decreases. Secondly, local applicants are confronted with a trade off. The procedural formalism, on the one hand, increases, on average, their probability to get a lease and on the other hand, involves paying a higher rent when they are anonymously matched. Local applicants choose to increase the procedural formalism if their social network is sufficiently large. Indeed, asking for a high level of regulation, enables local applicants to increase their probability to get a lease without (or little) affecting their match surplus as the probability of an anonymous match is low or null. Furthermore, we show that local people support even higher levels of regulation when the proportion of foreigners in the rental market is large as it increases the probability to be compared to non members of the network.

In section 4, we determine the preferred level of procedural formalism for local agent by simulation. We simulate and calibrate the average local applicant's utility from data in the housing survey realised

[2]Since Wheaton (1990) in the property market and Desgranges and Wasmer (2000) in the rental market, some papers (Mc Breen et al. (2011), Ménard (2009) and Wasmer (2005)) point out similarities between rental market and labor market and the pertinence to analyze the rental market with search theoretic model. Wasmer (2005) : "Housing and labor markets exhibit many similarities. First, information is imperfect. Tenant quality, like worker quality, is unobserved. Second, separation is costly and time consuming. The laws and regulation typically complicate or slow down the termination process of the contractual relationship and make it more costly for firms and landlords to fire an employee/evict a tenant. And finally, there are rigidities in nominal wages and rents."

in 2006 by the INSEE and from data computed and collected by Djankov et al (2003). We simulate the average local applicant's utility because we assume that there is a majority of local agent and they vote under the veil of ignorance, i.e without knowing their default rate for the vote. We show that the support for regulation increases with the size of social networks. The vote under the veil of ignorance makes a redistribution between local agents of different default probabilities. The level of regulation determined by the veil of ignorance is profitable to the weakest local applicants at the expense of the best local tenants. Finally, we show that the optimal level of regulation is even higher when the rental market tightness is strong or the proportion of foreigners in the rental market is large.

This paper adds to the growing literature on the positive analysis of Housing market regulation (HMR). This literature aims at understanding the degree of HMR specific to each country. As explained by Botero et al (2004), the regulation has three explanations: rent-seeking, legal origins of the judicial system and market failure.

According to the legal origin argument, the regulation of the rental market depends on the fundamental characteristics of the judicial system (Djankov et al (2003)). Common-law judicial systems lower the need for regulation as they are characterized by the importance of decision-making by juries, independent judges, and the emphasis on judicial discretion as opposed to code in civil law countries. However, these differences explain only about 40% of regulation variation between these countries. Our paper takes a complementary approach based upon the complementarities between the strength of social network and the stringency of housing market regulation.

The market failure argument analyses HMR as a way to improve welfare in the context of market imperfection. Transposing labor market arguments, Alesina et al (2010) argue that HMR is a way to reduce the monopsony power of the landlords in a context of depressed rental offer. People with strong family ties like to live near their family and moving away from home is costly. Thus, individuals with strong family ties rationally choose regulated labor markets to avoid moving and limiting the monopsony power of firms. We keep the main idea of Alesina's paper. People with strong family ties/social network rationally ask for a high level of regulation. However, we present a different approach where the procedural formalism enables local people to get a head of foreigners.

The rent seeking argument analyses HMR as a way to maximize the welfare of insiders who benefit from more secure lease. When the regulation is strong, landlords have more difficulties to expel tenants who fail to pay the rent. This protects insiders at the expense of outsiders. Indeed, landlords, to avoid problems and legal cost when the tenants fail to pay the rent, will be more vigilant about the individual incomes. Desgranges and Wasmer (2000) and Wasmer (2005) show that the legislation on the rental market can generate discrimination and some problems between outsiders and insiders. Our paper goes further. It shows why some applicants (outsiders in Wasmer) would want to increase the procedural formalism. The procedural formalism enables local applicants to get a head of foreigners.

This paper contributes to present another aspect of the social network in search theoretic models. In our paper, the social network is a way for a tenant/worker with social network to get a head of a tenant/worker without social network in the queue. In the existing search model literature (Mayer (2011), Igarashi (2011), Calvo-Armengol and Jackson (2007) and Calvo-Armengol and Zenou (2005), the social network is a way to open a new ticket window or queue. Indeed, in these papers, workers have two channels to find a work, a "traditional channel" (newspapers, work center) and their social network with for example the word of mouth communication. But at no point in these papers, the social network is a way for the worker/tenant to be preferred by an employer/landlord. The firm chooses the first worker/tenant who presents to it, in one of two queues but does not choose the best worker/tenant between the two queues. Instead, in our paper, there is only one queue but the landlord/firm must choose the best tenant/worker. Furthermore, a tenant/worker belonging to a social network is better ranked and has more chances to be chosen.

2 The model

This section introduces a search theoretic model in order to define the probability to get a lease for foreign and local applicants according the level of procedural formalism and the size of social network. We choose an urn-ball model because it is an easy way to ensure that the landlords must choose their tenant within a pool of applicants. We consider a static economy peopled by V landlords[3], L local applicants and F foreign applicants. We note $F = Tx$ and $L = T(1-x)$ where T represents the total of potential tenants $(L+F)$ in the housing market and $x \in \left[0, \frac{1}{2}\right]$. Applicants differ in default probability δ which is distributed according to a probability density function H on the support $[0, \overline{\delta}]$. With probability δ, an agent is not able to pay the rent.

Local tenants and landlords are embedded in social networks. Each local tenant knows N landlords. Therefore, the size of the social network is $n = \frac{N}{V}$. The foreigners are not embedded in any local network. The only interest of the social network is that conflict resolution does not depend on law. For example, the kin of a tenant who not pay the rent can be used as collateral, to guarantee the landlord to recover the missing rent. Thus, a landlord having to evict a tenant would pay D^n if they are network matched and D^m if not. This implies that D^n depends on the credibility of collateral whilst D^m depends on procedural formalism.

The timing is as follows:

1. All potential applicants send one application to one vacant dwelling, randomly.
2. Landlords, when facing several applicants, choose the most lucrative one.
3. The rent is the result of a bargaining process between the landlord and the tenant.

The model is solved by backward induction.

i) Bargaining step:

A tenant type $i = n$ is network matched whilst a tenant type $i = m$ is anonymously matched.

A landlord who does not rent his housing has a rental opportunity cost C. A landlord facing a tenant type i gets an expected payoff

$$R\,(1-\delta) - \delta D^i + \delta C. \tag{1}$$

He perceives a rent R when the tenant pays the rent and an opportunity cost C when tenant fails to pay. However, he has to pay the cost D^i to evict a tenant type i who does not pay the rent.

[3] Decreuse and van Ypersele (2013) show that the regulation doesn't have a significant negative effect on the rental market share in the industrialised countries. Therefore, it's not a disadvantage to consider a static economy.

A tenant gets an expected payoff

$$(\alpha - R)(1-\delta). \tag{2}$$

With a probability $(1-\delta)$ he pays the rent R and enjoys its dwelling with a utility α. Then, he perceives the difference $(\alpha - R)$. With a probability δ, he does not pay the rent and is evicted. He is without dwelling and has a utility equal to zero. Therefore, a matching between tenant type i and a landlord generates a surplus

$$S^i = (1-\delta)(\alpha - C) - \delta D^i. \tag{3}$$

Only the surplus generated by an anonymous match depends on housing market regulation. The surplus S^n and S^m depend negatively on the default probability δ and on the default cost:

$$\frac{dS^n}{d\delta} = -(\alpha - C + D^n) \text{ and } \frac{dS^m}{d\delta} = -(\alpha - C + D^m), \tag{4}$$

$$\frac{dS^n}{dD^n} = -\delta \text{ and } \frac{dS^m}{dD^m} = -\delta. \tag{5}$$

These effects are stronger when the default probability δ and the default cost D^m and D^n are high. The applicants have to pay a higher rent, to compensate the potential losses of landlords. The rent is the result of a Nash bargaining process between landlord and tenant

$$\max_R \left[((\alpha - R)(1-\delta))^\beta \left(R(1-\delta) - \delta D^i + \delta C - C\right)^{1-\beta} \right], \tag{6}$$

where β represents the bargaining power of tenants. Hence, landlord and tenant type i negotiate the following rents

$$R^i = \frac{\beta \delta D^i + \beta C(1-\delta) + (1-\beta)(1-\delta)\alpha}{(1-\delta)}. \tag{7}$$

Given the bargained rents and the expected payoffs, we can compute the expected incomes of landlords

$$\begin{aligned} Y^i &= C + (1-\beta)\left[(1-\delta)(\alpha - C) - \delta D^i\right] \\ &= C + (1-\beta) S^i. \end{aligned} \tag{8}$$

The expected incomes Y^m and Y^n depend respectively on the match surplus S^m and S^n. Hence, they are negatively affected by the default rate δ and by the default costs D^m and D^n. For a default probability δ given, if D^n is lower than D^m,a landlord prefers a tenant network matched because S^m is lower than S^n. Moreover, if the expected incomes are lower than the rental opportunity cost C, landlords prefer not to rent. Therefore, we deduce two threshold values above which landlords prefer not to rent.

$$\delta^n = \frac{\alpha - C}{\alpha - C + D^n} \text{ and} \tag{9}$$

$$\delta^m = \frac{\alpha - C}{\alpha - C + D^m}. \tag{10}$$

Then, the regulation can exclude some tenants of the market and reduce the rental market size. However, we want to study only the assumption that the procedural formalism enables local applicants to get a head of foreigners. Therefore, we assume that all tenants have a default rate δ below the breakeven (δ^n and δ^m). The assumption is verified for all default costs D^m and D^n (i.e. $\overline{\delta} < \delta^n$ and $\overline{\delta} < \delta^m$ for all D^m and D^n).

ii) Selection step:

Each potential tenant sends randomly an application to one landlord. Hence, a landlord may receive several applications. He can receive an application from a tenant belonging to its social network as well as from a tenant not belonging to its social network. Therefore, a landlord does not choose only the applicant with the lower default rate but he chooses the best available option i.e. renting to the most profitable tenant. Typically, if a landlord compares a tenant network matched and a tenant anonymously matched, the landlord chooses the tenant network matched if $Y_i^n \geq Y_j^m$ $\left(i.e \text{ if } \delta_j \geq \frac{\delta_i(\alpha - C + D^n)}{\alpha - C + D^m}\right)$. Reciprocally, the landlord chooses the tenant anonymously matched if $Y_i^m \geq Y_j^n$ $\left(i.e \text{ if } \delta_j \geq \frac{\delta_i(\alpha - C + D^m)}{\alpha - C + D^n}\right)$. Furthermore, he chooses the tenant with the lower default rate if the landlord compares two tenants network matched or two tenants anonymously matched.

iii) The probability for an applicant to get a lease.

We start to build the distribution function of landlord's expected income.

$$G(Y) = \Pr[j \in network] \Pr[Y^n \leq Y] + \Pr[j \notin network] \Pr[Y^m \leq Y], \tag{11}$$

where

$$\Pr[j \in network] = n(1-x) \text{ and } \Pr[j \notin network] = 1 - n(1-x). \tag{12}$$

The function $G(Y)$ represents the probability that an applicant, randomly selected, pays less than an expected income Y. Indeed, to be the best expected income, Y has to be greater than Y^n with a probability $n(1-x)\Pr[Y^n \leq Y]$ or has to be greater than Y^m with a probability $(1 - n(1-x))\Pr[Y^m \leq Y]$.

Typically, if a landlord is network matched, he has an expected income Y^n. Thus, the probability that another applicant, randomly selected, pay less than Y^n is

$$G(Y^n) = n(1-x)\left(1 - H(\delta)\right) + \left(1 - n(1-x)\right)\left(1 - H\left(\frac{\delta\left(\alpha - C + D^n\right)}{\alpha - C + D^m}\right)\right). \tag{13}$$

Indeed, for a tenant network matched, the probability to be the best application, when he is compared to another applicant randomly selected is :

- The probability to have the lower default rate $(1 - H(\delta))$ if the applicant also is network matched or

- The probability that Y^n is greater than Y^m, i.e. $\Pr[Y^m \leq Y^n] = \left(1 - H\left(\frac{\delta(\alpha - C + D^n)}{\alpha - C + D^m}\right)\right)$, if the applicant is anonymously matched.

Similarly, if a landlord is anonymously matched, he has an expected income Y^m. Thus, the probability that another individual, randomly selected, pay less than Y^m is

$$G(Y^m) = n(1-x)\left(1 - H\left(\frac{\delta\left(\alpha - C + D^m\right)}{\alpha - C + D^n}\right)\right) + \left(1 - n(1-x)\right)\left(1 - H(\delta)\right). \tag{14}$$

Indeed, for a tenant anonymously matched, the probability to be the best application when he is compared to another applicant randomly selected is :

- The probability to have the lower default rate $(1 - H(\delta))$ if the applicant also is anonymously matched or

- The probability that Y^m are greater than Y^n, i.e. $\Pr[Y^n \leq Y^m] = \left(1 - H\left(\frac{\delta(\alpha - C + D^m)}{\alpha - C + D^n}\right)\right)$, If the applicant is network matched.

However, the landlord can be matched with $0, 1, 2, ..., t$ potential tenants among the $T-1$ other applicants. Indeed, a landlord may receive several applications. Then, an applicant shall get the lease if he is the best application Y^i (according if he is network matched or anonymously matched) , amongst the t other potential tenants matched with the landlord. Hence, the probability to get the lease is

$$P_i = \sum_{t=0}^{T-1} \frac{(T-1)!}{t!(T-1-t)!} \left(\frac{1}{V}\right)^t \left(1 - \frac{1}{V}\right)^{T-1-t} G(Y^i)^t, \tag{15}$$

where $\frac{1}{V}$ is the probability to send an application at one particular landlord. Furthermore, if we consider a large economy, so that V and T (i.e. F and L) go to infinity, we can simplify the probability to get a lease as follows

$$P_i = e^{-\frac{T}{V}\left(1 - G\left(Y^i\right)\right)}. \tag{16}$$

The probability to get a lease for a tenant network matched is

$$\begin{aligned} P_n &= e^{-\frac{T}{V}(1 - G(Y^n))} \\ &= e^{-\frac{T}{V}\left(1 - \left(n(1-x)(1-H(\delta)) + (1 - n(1-x))\left(1 - H\left(\frac{\delta(\alpha - C + D^n)}{\alpha - C + D^m}\right)\right)\right)\right)}, \end{aligned} \tag{17}$$

and the probability to get a lease for a tenant anonymously matched is

$$\begin{aligned} P_m &= e^{-\frac{T}{V}(1 - G(Y^m))} \\ &= e^{-\frac{T}{V}\left(1 - \left(n(1-x)\left(1 - H\left(\frac{\delta(\alpha - C + D^m)}{\alpha - C + D^n}\right)\right) + (1 - n(1-x))(1 - H(\delta))\right)\right)}. \end{aligned} \tag{18}$$

The probabilities to get a lease are negatively affected by the default rate. Indeed, probabilities P_n and P_m are decreasing in δ:

$$\frac{dP_n}{d\delta} = -\left(n\frac{T(1-x)}{V}h(\delta) + \frac{\alpha - C + D^n}{\alpha - C + D^m}h\left(\frac{\delta(\alpha - C + D^n)}{\alpha - C + D^m}\right)(1 - n(1-x))\frac{T}{V}\right)P_n \leq 0, \tag{19}$$

$$\frac{dP_m}{d\delta} = -\left(+n\frac{T(1-x)}{V}\frac{\alpha - C + D^m}{\alpha - C + D^n}h\left(\frac{\delta(\alpha - C + D^m)}{\alpha - C + D^n}\right) + \frac{T}{V}(1 - n(1-x))h(\delta)\right)P_m \leq 0. \tag{20}$$

Therefore, the potential tenants with the higher default rates have less chances to find a housing. However, procedural formalism changes the ranking of applicants. Indeed, the regulation has different effects on the probabilities P_n and P_m:

On the one hand, we have

$$\frac{dP_m}{dD^m} = -n\frac{T(1-x)}{V}\frac{\delta}{\alpha - c + D^n}h\left(\frac{\delta(\alpha - C + D^m)}{\alpha - C + D^n}\right)P_m \leq 0. \tag{21}$$

The impact of the procedural formalism on the probability P_m is still negative for almost all δ and level of network n. The impact is null only for agent with $\delta = 0$ and $\delta = \overline{\delta}$ or when there is no network $n = 0$.

When δ equals zero, whatever the level of procedural formalism, people with a default rate equal to zero are always preferred to other candidates. They have a probability to get a lease equal to one.

When δ equals $\overline{\delta}$, an applicant with a default rate maximum is never preferred to any other candidates. The only way to get the lease is to be matched alone with a landlord. Then, the probability to get a lease is

$$P_m = e^{-\frac{T}{V}}, \tag{22}$$

and does not depend on the regulation.

When n equals zero, nobody have a network, then nobody can get a head of the others with the regulation. Then, the probability to get a lease is

$$P = e^{-\frac{T}{V}H(\delta)}. \tag{23}$$

Therefore, the probability P_m is strictly decreasing with the regulation when n is different from zero and δ is different from zero or $\overline{\delta}$. Thus, a higher procedural formalism decreases the chances to find a housing when people are anonymously matched.

On the other hand, when people are network matched we have that

$$\frac{dP_n}{dD^m} = \frac{T}{V}\left(1 - n(1-x)\right)\frac{\delta\left(\alpha - C + D^n\right)}{\left(\alpha - C + D^m\right)^2}h\left(\frac{\delta\left(\alpha - C + D^n\right)}{\alpha - C + D^m}\right)P_n \geq 0. \tag{24}$$

The impact of the regulation on the probability P_n is positive or null for all δ and for all level of network n different from zero[4]. Moreover, this effect is strictly positive if δ is different from zero. Thus, a higher procedural formalism increases the chances of getting the lease of an applicant network match.

To summarize, the regulation is a way for an applicant network matched to be better ranked than the others. A higher procedural formalism increases the probability to get a lease if the potential tenant is network matched and decreases the probability if not. Therefore, the regulation differently should affect the foreign tenant's utility and the local tenant's utility. Hence, we propose to analyze, in the following section, how the regulation affects the expected utility of local and foreign tenants and how these differences enable one group of tenants to get a head of the others.

3 Impact of the procedural formalism on expected utilities

This section defines the expected payoffs of applicants as functions of the level of procedural formalism and the size of social network.

A foreign applicant has no social network. He only is anonymously matched. Hence, we can write the foreign applicant's expected utility, as the product of the probability P_m and the match surplus S^m weighted by the bargaining power β:

$$U_f = \beta\left[(1-\delta)(\alpha - C) - \delta D^m\right]P_m = \beta S^m P_m. \tag{25}$$

The foreigner's expected utility decreases with the default rate δ. Indeed, as we have seen above, both, probability P_m and match surplus S^m are decreasing in δ.

[4]If the network is empty nobody has the probability P_n.

We have seen in the previous section that S^m and P_m are negatively affected by the regulation when δ belongs to $\left(0,\overline{\delta}\right)$ and $n \neq 0$. Otherwise, the impact of the regulation on the expected utility is null. Therefore, the impact of the procedural formalism, on the foreigner's expected utility is negative or null

$$\frac{dU_f}{dD^m} = \frac{dS^m}{dD^m}P_m + \frac{dP_m}{dD^m}\beta S^m \leq 0. \tag{26}$$

Procedural formalism has two negative impacts. Firstly, it is more difficult for foreigners to be selected because they become more costly than potential tenant network matched. Secondly, the regulation decreases the match surplus. The bargained rent is higher to balance the losses of landlords when a tenant fails to pay the rent. The magnitude of such effects increases with the default probability. Foreign applicants with a default rate equal to zero are not affected by the regulation.

The local applicant's expected utility is a little more complex because local applicants are embedded in a given social network. They can be network matched as well as anonymously matched. With probability $(1-n)$, local applicant is anonymously matched and he has the same expected utility as a foreign applicant. However, with a probability n, he is network matched and his expected utility is given by the product of P_n and S^n weighted by the bargaining power β:

$$\begin{aligned} U_l &= (1-n)\,P_m\beta\left[(1-\delta)(\alpha-C)-\delta D^m\right] + nP_n\beta\left[(1-\delta)(\alpha-C)-\delta D^n\right] \\ &= (1-n)\,\beta S^m P_m + n\beta P_n S^n. \end{aligned} \tag{27}$$

The local applicant's expected utility decreases with the default rate δ. Indeed, the probabilities P_n and P_m and the match surplus, S^n and S^m are decreasing in δ. Tenants with low default rate have a higher expected utility because they have a higher probability to get a lease and they bargain lower rents.

We have seen that the procedural formalism has different impacts on the probabilities P_n and P_m and on the match surplus S^n and S^m. Therefore, the regulation has different impacts on the local applicant's utility depending whether the local applicant is network matched or not. Then, the total impact of the regulation on the potential local tenant's utility is given by

$$\frac{dU_l}{dD^m} = (1-n)\,\beta\left(\frac{dS^m}{dD^m}P_m + \frac{dP_m}{dD^m}S^m\right) + n\beta S^n\frac{dP_n}{dD^m}. \tag{28}$$

When he is anonymously matched, the regulation has a negative impact on his expected utility. Indeed, the regulation decreases both the match surplus S^m and the probability to get a lease P_m. But when the local tenant is network matched, the procedural formalism increases his expected utility. Indeed, the regulation does not decrease the match surplus S^n and increases the probability to get a lease P_n. As mentioned above, the regulation is a way for an applicant network matched to be better ranked than the others.

A local people is in favor of higher level of regulation, if the total effect of the regulation is positive, i.e. if

$$\left|n\beta S^n\frac{dP_n}{dD^m}\right| > \left|(1-n)\,\beta\left(\frac{dS^m}{dD^m}P_m + \frac{dP_m}{dD^m}S^m\right)\right|. \tag{29}$$

Furthermore, we can deduce the following proposition.

Proposition 1 *A higher procedural formalism increases,on average, the probability to get a lease for a local applicant.*

Proof. We know that potential tenants have a default rate between zero and $\bar{\delta}$. Therefore, we can define the average probability to get a lease for the foreign tenants and local tenants as follows

$$\overline{P_f} = \int_0^{\bar{\delta}} P_m h(\delta)\, d\delta, \tag{30}$$

and

$$\overline{P_l} = n \int_0^{\bar{\delta}} P_n h(\delta)\, d\delta + (1-n) \int_0^{\bar{\delta}} P_m h(\delta)\, d\delta. \tag{31}$$

Moreover, we know that

$$(1-x)\overline{P}_l + x\overline{P}_f = cst, \tag{32}$$

because the number of matches is fixed. Furthermore, we know that $\frac{dP_m}{dD^m} \leq 0$, then we can deduce from equation (30) that $\frac{d\overline{P_f}}{dD^m} \leq 0$. Finally, from this latter statement and the equation (32) we can deduce that $\frac{d\overline{P_l}}{dD^m} \geq 0$. Then, on average, the regulation increases the probability to get a lease for local potential tenants. ■

Then, the potential local tenant is confronted to an arbitrage between the probability to get a lease and the rent if he is anonymously matched . As we have seen above, the regulation decreases the match surplus when the tenant is anonymously matched ($\frac{dS^m}{dD^m} < 0$). From Proposition 1, we know that on average, the procedural formalism increases the probability to get a lease for potential local tenant. Therefore, would it be interesting for local people on average to increase the level of procedural formalism ?

The average local applicant's expected utility $\overline{U}_l$ is defined by

$$\overline{U}_l = \int_0^{\bar{\delta}} U_l h(\delta) d\delta. \tag{33}$$

Then, we can deduce the following proposition :

Proposition 2 *There exist n_1 and n_2, $n_1 \leq n_2$, such that*
i) if $n \leq n_1$ then $\frac{d\overline{U_l}}{dD^m} < 0$ for all level of $D^m \geq 0$;
ii) if $n \geq n_2$ then $\frac{d\overline{U_l}}{dD^m} > 0$ for all level of $D^m \geq 0$.

Proof. i) As $\frac{d\overline{U_l}}{dD^m}$ is continuous in n and $\lim_{n \longrightarrow 0} \frac{d\overline{U_l}}{dD^m} < 0$ for all $D^m \in \mathbb{R}^+$, it exists a level of network n_1 such as for $n < n_1$ we have

$$\left| (1-n)\, \beta \int_0^{\bar{\delta}} \left(-\delta P_m + \frac{dP_m}{dD^m} S^m \right) h(\delta) d\delta \right| > \left| n\beta \int_0^{\bar{\delta}} S^n \frac{dP_n}{dD^m} h(\delta) d\delta \right|. \tag{34}$$

ii) As $\frac{d\overline{U_l}}{dD^m}$ is continuous in n and $\lim_{n \longrightarrow 1} \frac{d\overline{U_l}}{dD^m} > 0$ for all $D^m \in \mathbb{R}^+$, it exists a level of network n_2 such as for $n > n_2$ we have

$$\left| (1-n)\, \beta \int_0^{\bar{\delta}} \left(-\delta P_m + \frac{dP_m}{dD^m} S^m \right) h(\delta) d\delta \right| < \left| n\beta \int_0^{\bar{\delta}} S^n \frac{dP_n}{dD^m} h(\delta) d\delta \right|. \tag{35}$$

■

Hence, when a social network is lower than n_1, no local applicant has any utility to increase the regulation. Indeed, the regulation has no (or little) impact on the probability to get a lease but strongly decreases the match surplus. A contrario, if the social network is greater than n_2, all potential local tenants want a high level of regulation. Asking a high level of regulation enables the local applicants to considerably increase their probability to get a lease without (or little) affecting their match surplus. Indeed, they know a very large number of landlords. However, we cannot determine analytically the value of n_1 and n_2. Indeed, the social network has two different effects on $\frac{d\overline{U_l}}{dD^m}$ of which the total effect is ambiguous and depends on $G(y)$,

$$\begin{aligned}\frac{d\overline{U_l}}{dD^m dn} &= -\beta\int_0^{\bar{\delta}}\left(-\delta P_m + \frac{dP_m}{dD^m}S^m\right)h(\delta)d\delta + \beta\int_0^{\bar{\delta}} S^n\frac{dP_n}{dD^m}h(\delta)d\delta \\ &\quad + (1-n)\,\beta\int_0^{\bar{\delta}}\left(-\delta\frac{dP_m}{dn} + \frac{dP_m}{dD^m dn}S^m\right)h(\delta)d\delta + n\beta\int_0^{\bar{\delta}} S^n\frac{dP_n}{dD^m dn}h(\delta)d\delta\ .\end{aligned} \tag{36}$$

When n increases ,a local tenant is more likely to be network matched than anonymously matched. This first effect is positive

$$-\beta\int_0^{\bar{\delta}}\left(-\delta P_m + \frac{dP_m}{dD^m}S^m\right)h(\delta)d\delta + \beta\int_0^{\bar{\delta}} S^n\frac{dP_n}{dD^m}h(\delta)d\delta > 0. \tag{37}$$

However, if the social network of one applicant increases, the social network of other local people increases too. This second effect is ambiguous on the $\frac{d\overline{U_l}}{dD^m}$:

$$(1-n)\,\beta\int_0^{\bar{\delta}}\left(-\delta\frac{dP_m}{dn} + \frac{dP_m}{dD^m dn}S^m\right)h(\delta)d\delta + n\beta\int_0^{\bar{\delta}} S^n\frac{dP_n}{dD^m dn}h(\delta)d\delta. \tag{38}$$

Indeed, it decreases the positive effect of the regulation on the local probability to get a lease P_n,

$$\frac{dP_n}{dD^m dn} = \frac{T}{V}\left(-(1-x)\right)\frac{\delta\left(\alpha - C + D^n\right)}{\left(\alpha - C + D^m\right)^2}h\left(\frac{\delta\left(\alpha - C + D^n\right)}{\alpha - C + D^m}\right)P_n + \frac{L}{V}\left(H\left(\frac{\delta\left(\alpha - C + D^n\right)}{\alpha - C + D^m}\right) - H\left(\delta\right)\right)P_n \le 0, \tag{39}$$

and has an ambiguous impact on $\frac{dP_m}{dD^m}$,

$$\frac{dP_m}{dD^m dn} = -\frac{T(1-x)}{V}\frac{\delta}{\alpha - c + D^n}h\left(\frac{\delta\left(\alpha - C + D^m\right)}{\alpha - C + D^n}\right)P_m + \frac{L}{V}\left(H\left(\delta\right) - H\left(\frac{\delta\left(\alpha - C + D^m\right)}{\alpha - C + D^n}\right)\right)P_m. \tag{40}$$

Therefore, the total result of two effects explicated in equations (37) and (38) are analytically ambiguous and prevents us to conclude analytically that $\frac{d\overline{U_l}}{dD^m}$ is monotonically increasing in n.

Nevertheless, if the level of social network is such that $n > n_2$, local people support an even higher level of procedural formalism when the proportion of foreigners in the rental market is high.

$$\begin{aligned}\frac{dU_l}{dx} &= \beta n\frac{dP_n}{dx} + \beta\left(1-n\right)\frac{dP_m}{dx} \\ &= \beta\left(n\right)^2\frac{T}{V}\left(H\left(\delta\right) - H\left(\frac{\delta\left(\alpha - C + D^n\right)}{\alpha - C + D^m}\right)\right)P_n + \beta\left(1-n\right)\frac{T}{V}n\left(H\left(\frac{\delta\left(\alpha - C + D^m\right)}{\alpha - C + D^n}\right) - H\left(\delta\right)\right) \ge 0\ .\end{aligned} \tag{41}$$

Indeed, the local tenant's expected utility is increasing in x for all δ and D^m.

To highlight the different mechanisms seen above, we propose to calibrate and to simulate our model from the French housing data in the following section. The objective is firstly to show that from a given level of social network, local people should have an interest to vote for a high level of regulation and secondly, to understand which level of regulation maximizes their utility.

4 Which level of regulation ?

We are interested in the positive analysis of procedural formalism. We know that regulation always has a negative impact on the foreigner's utility. Therefore, a foreigner never has interest in choosing a strong level of regulation on the rental market. However, they are less numerous than local people and cannot influence the choice for the optimal level of procedural formalism. Therefore, we concentrate our work on the local people's expected utility. The objective is to determine how the social network size n and the distribution function $G(y)$ shape the optimal level of procedural formalism. We assume that local people vote under the veil of ignorance, i.e without knowing their default rate for the vote. The default rate is revealed when the landlord and the potential tenant meet on the rental market. Then, to understand the choice for the regulation realized by local people with this process of vote, we simulate the average local people's utility from the French 2006 housing survey realized by the INSEE and from data collected by Djankov et al (2003).

To simulate the average local people's utility, we calibrate equation (33) where δ is distributed according to a uniform distribution. From the Housing Survey we find there is in France $9,140,000$ local tenants L and $1,435,000$ foreign tenants F. We name local tenants, tenants of French nationality. Except if tenants are French by naturalization, marriage, declaration or option to its majority. We have considered as foreigners, tenants who have foreign nationality, tenants who are French by naturalization, marriage, declaration or option to its majority and tenants who are stateless. We only assume that those tenants do not have social network in France. We also find that there is approximately $2,000,000$ vacant housing. From these data we can deduce the number of landlord V in our model with the following equation

$$Ve^{-\frac{10575}{V}} = 2000. \tag{42}$$

Indeed, if there is only one applicant and V landlords in the rental market, the probability for a landlord to receive an application is $\frac{1}{V}$ and the probability to receive no application is $\left(1 - \frac{1}{V}\right)$. However, as there are T potential tenants, the probability for landlord to receive no application is $\left(1 - \frac{1}{V}\right)^T$.Finally, if we consider a large economy, so that T and V go to infinity, this last probability can be summarized by $e^{-\frac{T}{V}}$. Then, given that there are $2,000,000$ vacant dwellings and $10,575,000$ tenants in the french rental market, we can deduce by the equation (42) that the number of landlords V in our model is equal to $7,783,000$.

We would like to look if the market tightness has an influence on the optimal level of procedural formalism. Therefore we choose to simulate our model with two others values of landlords. We set V equal to 10575 to study a case where supply and demand are equal and we set V equal to 12575 to cover a case where the supply is greater than the demand.

From Djankov et al. (2003), we have information to estimate the cost of conflict resolution. Indeed, we can note a positive correlation between the index of housing market regulation computed by Djankov et al. (2003) and the number of days required to evict a tenant who does not pay his rent [5]. Therefore, we can estimate the cost of conflict resolution as the product of the opportunity cost of housing C by the number of months necessary to evict a tenant who does not pay its rent[6], n_{months}. Thus $D^m = C \times n_{months}$, where $n_{months} \in [0; 32]$ because the maximum number of months necessary to evict a tenant who does not pay its rent observed in Europe is equal to 32.

By principle, D^n does not depend on the law. For example, a kin of tenant who fails to pay the rent can be used as collateral, to secure the landlord to recover the missing rent when the tenant and the landlord belong to the same network. It assumes that D^n depends on the credibility of collateral. Implicitly, we suggest a low cost D^n in the countries where the social network is large because people have strong family/friendship ties. Hence, D^n is the product of the opportunity cost of the housing C by $n_{\min}$, the minimum number of months necessary to evict a tenant who fails to pay the rent observed in the data[7]. Thus $D^n = C \times n_{\min}$.

For the other variables of the model α, C, β and n, we don't have information from the database. However, we can normalize α to 1 without loss of generality. To set the value of C, we suppose that if the market was without friction, the value of C would be close to α (i.e close to 1). Therefore, C is free between 0 and 1. Typically, we test our model with three values of C, 0.25, 0.5 and 0.75. The choice of β does not matter (see equation 29). Thus, we set $\beta = 0.5$. Finally we leave n free between 0 and 1, in order to see the impact of the social network on the choice of the optimal level of regulation.

It is worth noting that given the different values of C and the number of months necessary to evict a tenant who fails to pay the rent, D^m varies between 0 and 24 and D^n between 0.5 and 1.5. Finally given the possible values of parameters α, C and D^m and to keep the maximum similarities between all the estimates presented in the paper, δ belongs to $[0, 0.01]$. Indeed according to the threshold value δ^m (see equation (9)), δ should not be greater than $\frac{1-0.75}{1-0.75+0.75*32} \simeq 0.01$.

Parameters	Simulation 1	Simulation 2	Simulation 3	Simulation 4 to 7
$L = T(1-x)$	9140	9140	9140	$10575(1-x)$ and $x \in \left[0, \frac{1}{2}\right]$
$F = Tx$	1435	1435	1435	$10575(x)$ and $x \in \left[0, \frac{1}{2}\right]$
V	7783	10575	12575	7783
α	1	1	1	1
C	0.5	0.5	0.5	0.5
β	0.5	0.5	0.5	0.5
n	$[0, 1]$	$[0, 1]$	$[0, 1]$	$[0, 1]$
D^m	$[0, 16.5]$	$[0, 16.5]$	$[0, 16.5]$	$[0, 16.5]$
D^n	1	1	1	1
δ	$[0, 0.01]$	$[0, 0.01]$	$[0, 0.01]$	$[0, 0.01]$

Table 1: Parameters calibration for simulations

[5] See Annex B.
[6] See Annex B, Table 2.
[7] See Annex B, Table 2.

We present in the main text the results with C equal to 0.5 whereas the results with C equal to 0.25 and 0.75 lie in Appendix C. Simulation 1 is the reference, which enables to define which level of procedural formalism local people would choose on average. Simulations 2 and 3 enable to study the impact of the market tightness on the optimal level of procedural formalism. Simulations[8] 4, 5, 6 and 7 enable to study the impact of rate of foreigners in the economy on the optimal level of regulation. The proportion of foreigner is null in the simulation 4 and increases in the following simulations (simulation 5,6 and 7).

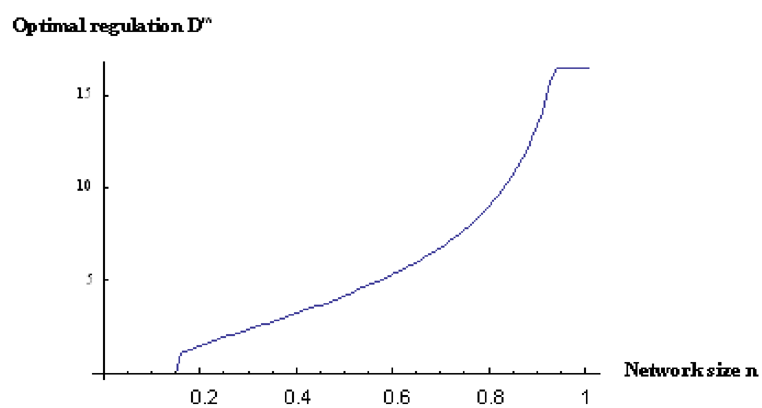

Figure 3: Optimal regulation and social network.

The blue curve depicts the $\arg\max$ of equation (33) calibrated with the values of simulation 1.

Figure 3, depicts the result of simulation 1.The optimal level of procedural formalism increases with the size of the social network. Local people use the regulation to increase their utilies to get a lease. When the social network is low (less than 0.16) local people set the regulation to 0. However, from n equal to 0.16 on, local people set a level of regulation greater than $D^n = 1$ and the preference for procedural formalism grows with n. Finally, we can note that when the social network is large enough,local people choose to put the maximum level of procedural formalism. If we take into account the fact that some people can be ejected out of the market, local people choose to increase the regulation until the point where the regulation start to eject some local people of the rental market (see figure 8 in the Appendix D).

[8] See in detail the parameters value of the estimate 4, 5, 6 and 7 in the Appendix E.

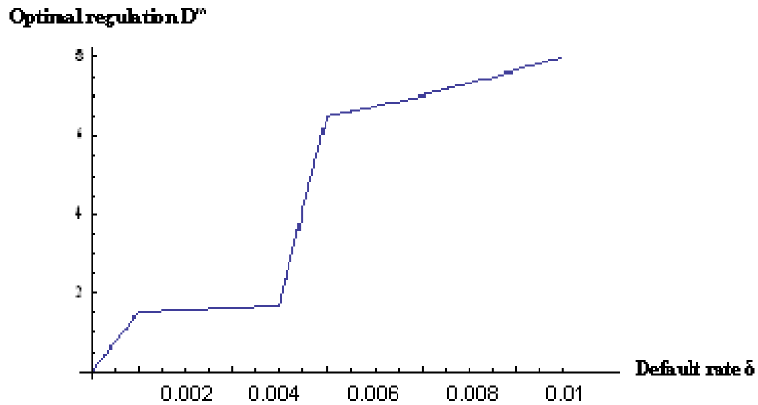

Figure 4: Optimal regulation as a function of individual default rate. The blue curve depicts the $\arg\max$ of equation (27) calibrated with the values of simulation 1 where $n = 0.16$ and δ is free.

The vote under the veil of ignorance makes a redistribution between local agents of different default probabilities. To see such redistribution we compute the individual utility U_l for different values of δ. Figure 4 depicts the results. Indeed, when we simulate the individual utility U_l (see equation(27)) with the parameters value of simulation 1, where $n = 0.16$ and δ is free; we can see, in Figure 4, that local people with low default rate, don't choose to increase the regulation above $D^n = 1$, while on average (Figure 3), local people choose to put a level of regulation greater than $D^n = 1$. This means that when potential tenants vote under the veil of ignorance for a level of regulation, they establish a redistributive public policy. Indeed, the best local tenants (i.e. the local applicants with the lower default rates) accept to loose in utility for the benefit of the weakest (i.e. the local applicants with the higher default rates).

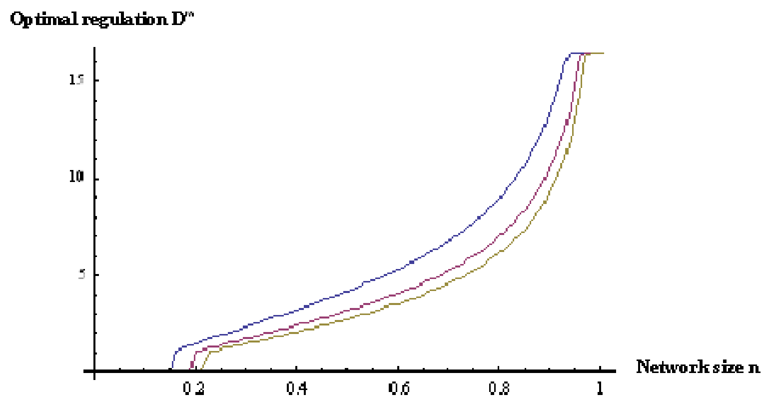

Figure 5: Optimal regulation and market tightness

The brown curve depicts the $\arg\max$ of equation (33) calibrated with the values of simulation 3, the red curve depicts the $\arg\max$ of equation (33) calibrated with the values of simulation 2 and the blue curve depicts the $\arg\max$ of equation (33) calibrated with the values of simulation 1.

Figure 5 depicts the impact of the market tightness on the preference for regulation : the blue curve lies at the left of the red curve and the red curve lies at the left of the brown curve, corresponding respectively to simulation 1, 2 and 3. It shows that the optimal regulation decreases with the supply of dwellings. Local people ask a higher level of regulation when the market tightness is strong. Indeed, when the market tightness is strong (i.e. when the supply is lower than the demand on the housing market) the competition to get a lease between potential tenants is harder than when the market tightness is low (i.e. when the supply is higher than the demand on the housing market). Local people are more aggressive in their choice of regulation in order to keep a high probability to get a lease, when the market tightness is strong.

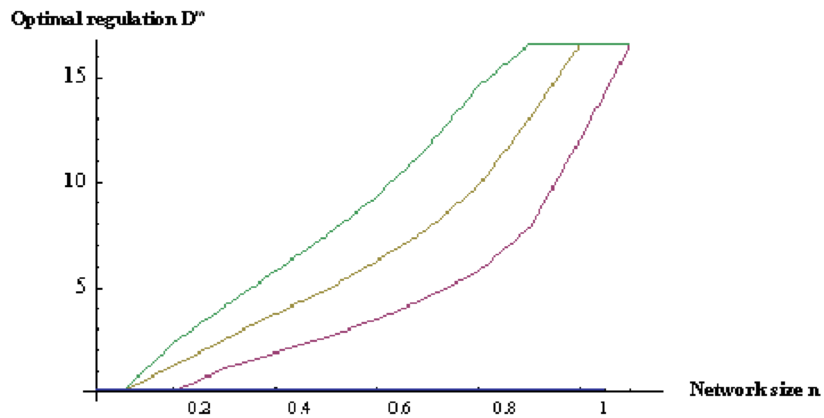

Figure 6: Proportion of foreigner and optimal regulation.

The blue curve depicts the arg max of equation (33) calibrated with the values of simulation 4, the red curve depicts the arg max of equation (33) calibrated with the values of simulation 5, the brown curve depicts the arg max of equation (33) calibrated with the values of simulation 6 and the green curve depicts the arg max of equation (33) calibrated with the values of simulation 7.

Figure 6 depicts the impact of the proportion of foreigners in the rental market on the preference for regulation: the red curve lies at the right of the brown curve and the brown curve lies at the right of the green curve, corresponding respectively to simulation[9] 5, 6 and 7. It shows that optimal regulation increases with the proportion of foreigners in the rental market. Moreover, we note that when there is no foreigner in the country, local people set the level of regulation at 0 for all network sizes (blue curve).Indeed, when the proportion of foreigners is strong the competition to get a lease between local people and foreigners is harder than when the proportion of foreigners is low. Therefore, local people must be more aggressive in their choice of regulation, in order to keep a high probability to get a lease when the proportion of foreigners in the rental market is strong.

To summarize, the model emphasizes that the support for regulation should increase with the size of social networks, the market tightness and the proportion of foreigners on the rental market.

5 Conclusion

This paper answers a central question in public policy : why do we observe, in some countries, political support for legislation that reduces economic surplus? The explanation is based upon the complementarities between the strength of social network and the stringency of housing market regulation. The interest of the social network is that conflict resolution does not depend on law. In an area where the

[9] See the parameters values of estimates 4, 5, 6 and 7 in the Appendix E.

local people belong to a social network whereas the foreigners do not, the regulation facilitates housing search for the local applicants at the expense of foreigners.

Our study is motivated by some stylized facts. There is a positive correlation between procedural formalism and local social capital. Moreover, there is evidence that foreigners are discriminated on the rental market in Southern Europe (where regulation is strong). We build a serch-model theoretic where the regulation enables the applicant network matched to be better ranked than the other applicants. We show that local applicants have interest in increasing the regulation on the rental market if their social network is well developed. Hence, local people can use the regulation to increase their welfare.

In a second step, we show that the optimal level of regulation increases with the social network size, with the market tightness and with the proportion of foreigners on the rental market.

Our paper could be extended in various directions. First of all, in our paper, the housing supply is fixed. Therefore it would be interesting to endogenize it. Secondly, we could extend our reasoning to the labor market. Indeed, Decreuse and van Ypersele (2012) have showed that HMR and employment protection legislation are positively correlated and Kramarz and Nordström Skans (2011) show that strong social ties are an important determinant of where young workers find their first job. Finally, we would like to extend this model to two regions.

Appendix

A Building friendship, neighborhood and family ties variables

The friendship ties and neighborhood ties variables are obtained from ECHP as in David et al (2010). In the ECHP, individuals are asked about i) the frequency of relationships with neighbors, ii) the frequency of contacts with friends and relatives outside the household. Authors transform the answers to the questions into a daily frequency to simplify the exposition. Indeed, the answer to the two questions defines a frequency for a discrete support value, set as follows: 1. On most days; 2. Once or twice a week; 3. Once or twice a month; 4. Less often than once a month; 5. Never. Therefore David et al (2010) built the following index measure that we have used to present the graphic in the introduction :

$$Z_{i,t} = I\left[X_{i,t}=1\right] + I\left[X_{i,t}=2\right]\frac{2}{7} + I\left[X_{i,t}=3\right]\frac{2}{30} + I\left[X_{i,t}=4\right]\frac{1}{60} + I\left[X_{i,t}=5\right]0$$

where $Z_{i,t}$ is the index value for individual i at time t and $X_{i,t}$ the answer to the question. $I[.]$ is an indicator function that takes value 1 if the expression in brackets is true and 0 if it is not.

The family ties variable is obtained from EVS and WVS survey. The question is : "would you consider important to teach your children to leave your home?". The answer to the question is yes/no and is attributed the value 1 or 0. We attribute 0 for the answer yes and we attribute 1 for the answer no. Therefore we obtain an index value of family ties between 0 and 1. Hence, it's a good proxy to estimate the family ties. Indeed several studies (Van de Velde (2008) and Reher (1998)) explain that when family ties are strong in a country, young people, by their education and their culture, become independent later than young people in countries where family ties are weaker.

B Housing market regulation

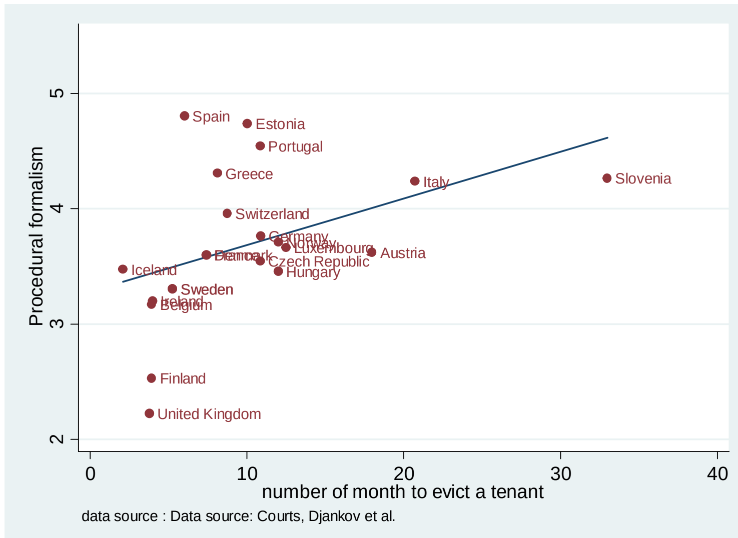

Figure 7: Correlation between Procedural formalism and number of months to evict a tenant.

Country	Number of days to evict a tenant	Number of months to evict a tenant
Iceland	64	2.1053
United Kingdom	115	3.7829
Belgium	120	3.9474
Finland	120	3.9474
Ireland	121	3.9803
Sweden	160	5.2632
Spain	183	6.0197
Danemark	225	7.4013
France	226	7.4342
Greece	247	8.1250
Switzerland	266	8.7500
Estonia	305	10.0329
Czech Republic	330	10.8553
Portugal	330	10.8553
Germany	331	10.8882
Hungary	365	12.0066
Norway	365	12.0066
Luxembourg	380	12.5000
Austria	547	17.9924
Italy	630	20.7232
Slovenia	1003	32.9934

Table 2 : Number of months to evict a tenant in Europe.

C Impact of C on the optimal regulation

In a market without friction the value of C is close to α (so close to one). Then, C is low when the frictions on the market are important. Thus, increasing the regulation has more impact when C is low.

Parameters	Simulation 8	Simulation 9
$L = T(1-x)$	9140	9140
$F = Tx$	1435	1435
V	7783	10575
α	1	1
C	0.25	0.75
β	0.5	0.5
n	$[0,1]$	$[0,1]$
D^m	$[0,8]$	$[0,24]$
D^n	0.5	1.5
δ	$[0, 0.01]$	$[0, 0.01]$

Table 3 :Parameters calibration for simulation 8 and 9.

We know that $D^m = C * n_{months}$, where the number of months belong to $[0;32]$. We also know that $D^n = n_{\min}$, where $n_{\min} = 2$. Then, given that the maximum value of the regulation that local people can choose when C is equal to 0.25 is 8 , whilst it is of 24 when C is equal to 0.75.

Europe is equal to 32, we can see that the maximum value of the regulation that local people can choose

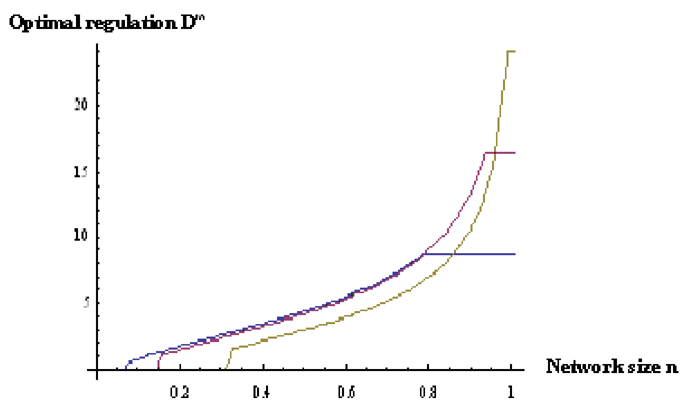

Figure 8: Impact of C on the optimal regulation. The blue curve depicts the $\arg\max$ of equation (33) calibrated with the values of simulation 8, the red curve depicts the $\arg\max$ of equation (33) calibrated with the values of simulation 1 and the brown curve depicts the $\arg\max$ of equation (33) calibrated with the values of simulation 9.

In Figure 8, the blue curve lies at the left of the red curve and the red curve lies at the left of the brown curve, corresponding respectively to simulations 8, 1 and 9. This means that when C is low, local potential tenants set a more stringent regulation than when the C is strong. To summarize, increasing the regulation has more impact when C is low.

D Model taking into account the probability that some tenants can be evicted out of the rental market when the regulation increases

In the paper, we neglect the fact that the regulation can evicted out some tenants of the market and reduce the housing market size. However, if we take into account this phenomenon, we must modify our model as follows: the probabilities P_m and P_n become

$$P_n^{'} = e^{-\frac{L.H\left(\frac{\alpha-C}{\alpha-C+D^n}\right)+F.H\left(\frac{\alpha-C}{\alpha-C+D^m}\right)}{V}\left(1-\left(\begin{array}{c} n\frac{L.H\left(\frac{\alpha-C}{\alpha-C+D^n}\right)}{L.H\left(\frac{\alpha-C}{\alpha-C+D^n}\right)+F.H\left(\frac{\alpha-C}{\alpha-C+D^m}\right)}\left(1-H\left[\delta\right]\right)+ \\ \left(1-n\frac{L.H\left(\frac{\alpha-C}{\alpha-C+D^n}\right)}{L.H\left(\frac{\alpha-C}{\alpha-C+D^n}\right)+F.H\left(\frac{\alpha-C}{\alpha-C+D^m}\right)}\right)\left(1-H\left(\frac{\delta(\alpha-C+D^n)}{\alpha-C+D^m}\right)\right) \end{array}\right)\right)}$$

and

$$P_m^{'} = e^{-\frac{L.H\left[\frac{\alpha-C}{\alpha-C+D^n}\right]+F.H\left[\frac{\alpha-C}{\alpha-C+D^m}\right]}{V}\left(1-\left(\begin{array}{c} n\frac{L.H\left(\frac{\alpha-C}{\alpha-C+D^n}\right)}{L.H\left(\frac{\alpha-C}{\alpha-C+D^n}\right)+F.H\left(\frac{\alpha-C}{\alpha-C+D^m}\right)}\left(1-H\left(\frac{\delta(\alpha-C+D^m)}{\alpha-C+D^n}\right)\right) \\ +\left(1-n\frac{L.H\left[\frac{\alpha-C}{\alpha-C+D^n}\right]}{L.H\left(\frac{\alpha-C}{\alpha-C+D^n}\right)+F.H\left(\frac{\alpha-C}{\alpha-C+D^m}\right)}\right)\left(1-H\left(\delta\right)\right) \end{array}\right)\right)}$$

Therefore, there are in the distribution $G(y)$, only the potential tenants profitable for the landlord, i.e. local applicants with a default probability δ lower than the threshold value δ^n and foreign applicants with a default probability lower than the threshold value δ^m. Moreover we know that $\delta^n > \delta^m$ if $D^m > D^n$. Then, the simulated model becomes

$$\overline{U_l^{'}} = \int_0^{\delta^m} \left(\left(1-n\right)\beta S^m P_m^{'} + n\beta P_n^{'} S^n\right) h(\delta) d\delta$$

We calibrate this model with the parameters values of simulation 1 presented above, where we let D^m free (i.e. D^m belongs to $\mathbb{R}^+$) and set n to 0.99. Then, we obtain the Figure 9:

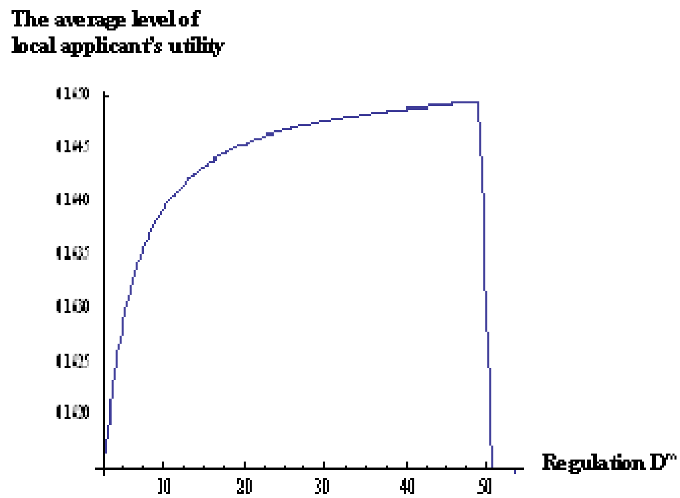

Figure 9: Average local utility and regulation.

The blue curve is calibrated with the parameter values of simulation 1. It depicts the average level of local applicants' utility in function of the level of regulation.

In Figure 9, the average local people's utility decreases directly from the point on where the regulation evicts some local applicants of the market. This means that local people choose the highest level of regulation before the regulation evicts some local applicant of the market. Indeed, given the threshold value δ^m equal to $\frac{1-0.5}{1-0.5+D^m}$(see equation 9) and that δ belongs to $[0, 0.01]$, some local potential tenants can be evicted out of the rental market when $D^m \geq 52$. In fact $\frac{1-0.5}{1-0.5+52} < 0.01$.

E Proportion of foreigner : Simulations values

Parameters	Simulation 4	Simulation 5	Simulation 6	Simulation 7
$L = T(1-x)$	10575	$10575(1-0.1)$	$10575(1-0.25)$	$10575(1-0.5)$
$F = Tx$	0	$10575(0.1)$	$10575(0.25)$	$10575(0.5)$
V	7783	7783	7783	7783
α	1	1	1	1
C	0.5	0.5	0.5	0.5
β	0.5	0.5	0.5	0.5
n	$[0, 1]$	$[0, 1]$	$[0, 1]$	$[0, 1]$
D^m	$[0, 16.5]$	$[0, 16.5]$	$[0, 16.5]$	$[0, 16.5]$
D^n	1	1	1	1
δ	$[0, 0.01]$	$[0, 0.01]$	$[0, 0.01]$	$[0, 0.01]$

Table 4 : Parameters calibration for simulations 4 to 7.

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