# Essays on sectoral-level wage bargaining

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# Essais sur la négociation sectorielle

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# General introduction

Collective bargaining is one of the main features of European labor markets. The level at which it occurs varies a lot across Europe (see Du Caju et al. (2009)). Although the effects on the labor markets are well known (for a summary see Cahuc et al. (2014)), their impact on the overall economy is an open question. This thesis builds on a rich economic literature on sector-level agreement. I first present it, and then focus on the content of this thesis.

Early contributions to this literature are theoretical. Three main effects were highlighted. First, according to Calmfors and Driffill (1988), when the wage is negotiated at the industry-level, unions can exert market power and thus extract a higher rent than it would possible if wages were negotiated at the firm-level. Second, Haucap et al. (2001) established that incumbent firms have an interest to raise the industry wage floor in order to impede the entry of new firms. Finally, Jimeno and Thomas (2013) conclude that when the wage is negotiated at the sector-level, there are wage compression effects which push less productive firms out of the market.

More recently, empirical studies have contributed to this literature. A first set of papers described the relation between those agreements and other fundamental variables of the labor market. For instance, using French data, Avouyi-Dovi et al. (2013) described the relation between firm-level agreements and industry-level agreements. Cardoso and Protugal (2005) find that wages negotiated at the firm-level *"stretches the returns to worker and firm attributes, whereas it shrinks the returns to union power. Therefore, firm-specific arrangements partly offset collective bar- gaining, granting firms certain freedom when setting wages."*. A second set of papers focused on the determinants of sector-level agreements. For example, Fougère et al. (2018a) demonstrate that an increase of the national minimum wage is associated with a significant increase in wages negotiated at the industry level. Martins and Hijzen (2016) and Hijzen et al. (2017) focus on the importance of federations' lack of representativeness. More precisely, Martins and Hijzen (2016) explain that *"the lack of representativeness of employer associations is a potentially important factor behind the adverse effect of extensions"*.

A third strand of the literature looks at the effect of industry-level agreements. A positive effect of wage floor on the wage bill is found (see Guimarães et al. (2017)). An increase in wages negotiated at the industry-level is associated with a significantly higher probability of firms destruction, and the effect is even stronger on small firms (see Martins (2014b)). Moreover, it has been found that sector-level agreements prevent wage falls in case of a recession. This downward rigidity is associated with lower employment (see Díez-Catalán and Villanueva (2015)).

Among all effects highlighted, I chose to focus on the anti-competitive effects of sector-level agreements. This choice was made for several reasons. First, this effect has been mainly studied from a theoretical point of view. Using French Data, I was able to go one step further and study this effect from an empirical perspective. Moreover, the rise in monopsony and product markups, and their harmful effects, received a large attention from economists (see Van Reenen (2018) for a literature review) and by economic institutions (see CEA (2016)). Indeed, the rise of the product market concentration undermines productive efficiency (see Van Reenen (2011)), raises prices (see De Loecker and Eeckhout (2017)) , reduces real wages (see Benmelech et al. (2018)) and rise in inequality (see Hershbein and Macaluso (2018)). Focusing on the anti-competitive effects of sectoral-agreements enables one to understand a potential source of this phenomenon.

In the first chapter, after a presentation of institutional settings, I focus on the use of sector-level agreements by large firms in order to reduce competition. Indeed, wage floors are binding for all firms of the industry, whether they sit at the negotiating table or not. This chapter provides a theoretical framework showing that such agreements can be used by dominant firms to reduce competition. In this framework, the higher the over-representation of large firms in employers' federations, the larger the bargained wage floors. This leads to the eviction of small firms. This prediction is tested on French administrative data. I document the domination of large firms within federations and devise an instrumental strategy to show that when the bargaining firms are relatively large compared to the industry standard - ie the lower the federation's representativeness, the higher are wage floors.

In the second chapter, I look at the effect of sector-level agreements on innovation. It is based on a model with monopolistic competition between products of an industry on the one hand, and between industries on the other hand. First, I find that when the bargaining process occurs at the industry level, negotiating parties take into account that a wage increase will deter investments of competitors. Indeed, when the wage negotiated at the industry-level increases, the labor cost increases. This implies that the reward for innovations decreases. As this reduces the probability to be outperformed, there is a wage surplus when the bargaining takes place at the industry-level, reducing both production and employment. Furthermore, it decreases the research effort of the industry reducing the productivity growth.

In the final chapter, I find that international competition mitigates the previous effects. Indeed, collective wage bargaining allows firms of a given industry to coordinate. However, international competition makes this collusive equilibrium unsustainable. Indeed, domestic firms face competition from foreign competitors which are not bound by those agreements. To support this argument, a Melitz-type model is developed and its implications tested on French data using the China Shock as a source of exogenous variation. The rent extracted during sector-level agreements no longer exist when domestic firms face Chinese competition.

# Introduction

La négociation collective est l'un des aspects majeurs des différents marchés du travail Européens. Le niveau auquel a lieu la négociation varie fortement d'un pays à l'autre (voir Du Caju et al. (2009)). Bien que les effets de ce niveau de négociation sur le marché du travail ont été largement étudiés (pour un résumé voir Cahuc et al. (2014)), l'impact sur l'économie dans son ensemble a été négligé. Après avoir présenté les différentes études portant sur le sujet, je décris les trois chapitres de cette thèse.

La première contribution sur ce sujet a été théorique. Trois effets principaux ont été mis en avant. Premièrement, d'après Calmfors and Driffill (1988), lorsque le salaire est négocié au niveau de l'industrie, les syndicats possèdent un pouvoir de négociation plus important, augmentant alors les salaires négociés. Ensuite, Haucap et al. (2001) ont montré que les entreprises utilisaient ces salaires négociés au niveau de l'industrie pour augmenter le coût du travail, et ainsi mettre en place une barrière à l'entrée. Enfin, Jimeno and Thomas (2013) concluent que la négociation d'un salaire minimum au niveau de l'industrie empêche les entreprises avec un niveau de productivité plus faible de baisser leurs salaires, les forçant à quitter le marché.

Plus récemment, des contributions empiriques ont été apportées. Un premier ensemble de papiers s'est porté sur la relation entre les négociations sectorielles et d'autres variables du marché du travail. Ainsi, Avouyi-Dovi et al. (2013) ont décrit la relation entre négociations sectorielles et négociations au sein des entreprises. Fougère et al. (2018a) ont eux démontré qu'une augmentation du salaire minimum en France avait un impact fortement haussier sur les salaires négociés au niveau des industries. Enfin, Martins and Hijzen (2016) et Hijzen et al. (2017) ont prouvé que le manque de représentativité dans les syndicats patronaux explique en partie l'impact négatif des négociations sectorielles sur les petites entreprises.

Une troisième partie de la littérature se penche sur les effets macro-économiques des négociations de branche. Un effet positif sur les salaires négociés par les travailleurs a été trouvé (voir Guimarães et al. (2017)). De plus, une augmentation des salaires négociés au niveau de l'industrie est synonyme d'une plus grande probabilité de destruction d'entreprises, cet effet étant particulièrement fort sur les petites entreprises (voir Martins (2014b)).

Parmi tous les effets présentés précédemment, j'ai choisi de me focaliser sur les effets des négociations sectorielles sur la compétition entre entreprises. Premièrement parce que les études portant sur le sujet ont été principalement théoriques. En utilisant des données françaises, j'ai pu apporter une réelle contribution à la littérature. De plus, l'augmentation de la concentration et des monopsones est un sujet important dans la littérature économique moderne (voir Van Reenen (2018))ainsi que pour les institutions économiques (voir CEA (2016)). En effet, l'augmentation du pouvoir de marché des grosses entreprises nuit à la compétition (voir Van Reenen (2011)), augmente les prix (voir De Loecker and Eeckhout (2017)) , réduit les salaires (voir Benmelech et al. (2018)) et augmente les inégalités (voir Hershbein and Macaluso (2018)). L'étude des négociations sectorielles permet alors de comprendre une des sources de ce phénomène.

Dans le premier chapitre, après une présentation des institutions responsables des négociations salariales en France, je me penche sur l'utilisation, par les grandes entreprises, des salaires planchers pour évincer la concurrence. En effet, les salaires négociés au niveau de l'industrie s'appliquent à l'ensemble des entreprises, qu'elles soient présentent lors des négociations ou non. Ce chapitre possède une partie théorique, où il est montré que les plus grosses entreprises ont un intérêt à augmenter les salaires planchers pour réduire le profit des plus petites entreprises, et ainsi récupérer leurs parts de marché. Par conséquent, plus les syndicats patronaux représentent les intérêts des grandes entreprises, plus le salaire négocié au niveau sectoriel est important. Cette prédiction est testée en utilisant des données françaises. L'utilisation d'une stratégie instrumentale permet de montrer que plus les entreprises négociant les salaires planchers sont grosses par rapport à la moyenne de l'industrie concernée, plus le salaire négocié est important.

Dans le second chapitre, je regarde l'effet des négociations sectorielles sur l'innovation. J'utilise un modèle avec compétition monopolistique. Je trouve que, dans le cas d'une négociation salariale au niveau de l'industrie, les parties à la négociation prennent en compte le fait que l'augmentation du coût du travail va diminuer les investissements de leurs concurrents. En effet, avec la négociation sectorielle, l'augmentation du salaire plancher implique que les revenus tirés d'une innovation diminuent. Cette baisse des investissements permet aux entreprises dominantes de sécuriser leur place, ce qui possède un effet négatif sur l'innovation et la croissance.

Dans le dernier chapitre, je trouve que la compétition internationale réduit l'importance des effets mis en avant précédemment. En effet, les négociations sectorielles permettent aux entreprises dominantes de former des accords collusifs. Cependant, les entreprises étrangères du même secteur ne sont pas sujettes à ces accords salariaux. Cela vient donc empêcher la mise en place de ces effets de cartel. Ce chapitre est basé sur un modèle de type Melitz. De plus, des donnés sur les salaires négociés en France sont utilisées. L'augmentation des échanges avec la Chine est utilisée comme un choc exogène. Il est prouvé que cela réduit la rente extraite lors des accords de branche.

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# Chapter 1

# Large firms' collusion in the labor market : Evidence from collective bargaining

This chapter is a joint work with Bérangère Pataault (CREST). In several countries, including France, industry-level agreements are binding for all firms of the industry, whether they sit at the negotiating table or not. This paper provides a theoretical framework showing that such agreements can be used by dominant firms to reduce competition. In this framework, the higher the over-representation of large firms in employers federations, the larger the bargained wage floors, which entails in turn the eviction of small firms. This prediction is tested using French administrative data. We document the domination of large firms within federations and devise an instrumental strategy to causally show that the larger the bargaining firms relatively to the other firms of the industry - ie the lower the federation's representativeness, the higher their incentives to raise wage floors.

## 1.1 Introduction

Wage setting can occur at different levels, from the most decentralised level - firm level - to the most centralised one - national level. In their seminal paper, Calmfors and Driffill (1988) show that the intermediate level of centralisation - industry level - leads to the worse macroeconomic performance. The simultaneity of the German decentralisation of wage bargaining and resurgence of the German economy in the 1990s seems to corroborate such findings (Dustmann et al., 2014). We argue in this paper that some common features of industry-level wage bargaining can produce the effect of an anti-competitive tool. Indeed, in several countries, among which France, Italy or Portugal, the bargained wages are extended to all firms of the industry, whether they sit at the negotiating table or not, and firms cannot opt out from these agreements. Because of this extension system, the characteristics of bargaining firms are a crucial component of the bargaining outcome. If bargaining firms have different characteristics, and thus different objectives, as the average firm in the industry - ie are *unrepresentative* of the industry, the bargained wage may favour affiliated firms. In particular, the domination of employers federations by large firms[1] - that we will denote *unrepresentativeness* in the following - , tilts the bargaining process in their favour, generating a cartel effect. Therefore, dominant firms can use collective bargaining as a tool to raise the labor cost of competitors, and in doing so, reduce the number of producing firms. The following quote, extracted from an Economic survey of the OECD on Portugal (see OECD (2012)), summarizes this mechanism.

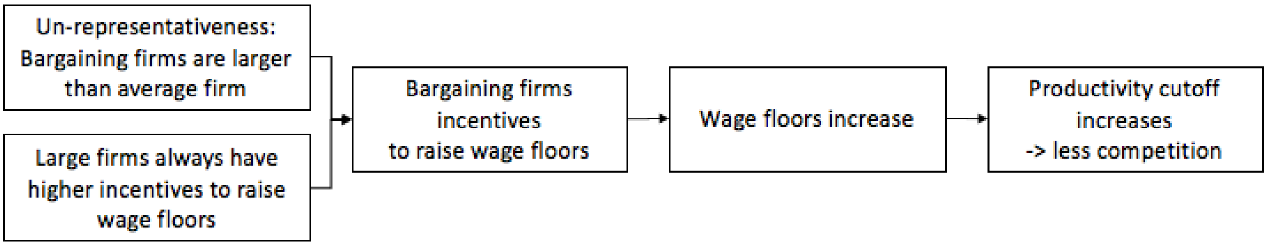
1. See Mortimer et al. (2004) for a case study and Barry and Wilkinson (2011) for a literature review, Traxler (2000))

*"[...] dominant firms impose wage and working conditions on others via the administrative extension of collective agreements, reducing competition and entry, thereby hurting competitiveness.".*

OECD, Economic surveys Portugal, 2012.

In the first two parts of the paper, we compare within a Melitz-type model (Melitz (2003)) two different levels of wage bargaining : firm-level and industry-level bargaining. First, we find that the higher the productivity-level of the firm, the higher the rent to be shared, so the higher the wage negotiated at the firm-level. As a consequence, when there is an industry-level wage floor, it is binding only for small firms, and it raises the wages they pay above their optimal level, thus driving them out of the market . The higher the domination of large firms on the employers federations, the higher the wage floors, which is detrimental to small firms. Equivalently, the more employers federations are dominated by large firms, the higher the negotiated wage floor and, as a result, the lower the product market concentration. We depict the main results of our model in Figure 1.1.

FIGURE 1.1 : Results from our theoretical model




Note : All the mechanisms depicted above are results of our model. One result of our model is that large firms have higher incentives to raise wage floors. The higher the unrepresentativeness of employers federations, the higher the incentives of bargaining firms to raise wage floors.

We then empirically confirm the collusion effect highlighted by the model. We first derive novel stylized facts on the relation between the representativeness of employers federations and the degree of competition of an industry. To measure representativeness we construct a novel proxy using unique data from the Minister of Labour. This dataset enables us to compare for the first time the average size, for each industry agreement, of the bargaining firms as compared to the average size of all firms of the industry - ie bargaining and non-bargaining firms. The index built therefore proxies the domination of employers federations by large firms, ie the federations' unrepresentativeness. We find a positive correlation between unrepresentativeness and product market concentration, as well as between unrepresentativeness and small firm's destruction rate.

In our model, the mechanism explaining the positive correlation between federations unrepresentativeness and product market concentration is that bargaining firms have higher incentives to raise wage floors the larger they are compared to the average firm of the industry - ie the more unrepresentative the employers federation. Our model indeed establishes that large firms always have higher incentives than small firms to raise the wage floors because it enables them to evict the small firms from the market. However, for that to translate into higher wage floors, bargaining firms must be the large firms. Therefore, the over-representation of large firms in employers federations - that we call unrepresentativeness of federations - is a crucial component to understand the outcomes of the bargaining system. In other words, bargaining firms have differential incentives to raise wage floors whether they are representative or not of the average firm in the industry.

However, this mechanism cannot be directly tested because bargaining firms incentives to raise the wage floor are unobservable by nature. We solve this problem by using a variable shifting the large firms incentives to raise wage floors : the share of workers employed by small firms. The higher the share of workers employed by small firms, the higher the incentives for large firms to increase bargained wage floors. Indeed, the higher this share, the higher the competition from small firms, and thus the higher the large firms incentives to evict small firms from the market (a similar argument is used in Magruder (2012)). If bargaining firms are the largest firms - ie in unrepresentative industries, then the share of workers employed in small firms should have a positive effect on the bargained wage floors. On the opposite, in representative industries, the share of workers employed by small firms should not have any effect on the bargained wage floors. We use our index of unrepresentativeness of the employers federations and estimate in the same regression the effect of the share of workers employed by small firms for both representative and unrepresentative industries on wage floors evolution.

Two variables are likely to be endogenous in our setting : the share of workers employed by small firms for representative industries and the share of workers employed by small firms for unrepresentative industries[2]. To achieve causality, we thus use two instrumental variables : for each industry, we construct the share of workers employed by small firms in both Denmark and Germany. Our instrumental strategy is based on the assumption that there is no unobserved variable affecting both those foreign shares and French domestic labor costs. Naturally Danish and German sectoral shares are correlated with the industry unobserved comparative advantages through international trade. To mitigate this issue, we exploit the existence of several wage floors per industry agreement and add industry $\times$ year fixed effects, thereby controlling for such comparative advantages. Moreover, we ensure that there is no common shock affecting both wages negotiated in France and the share in Denmark and Germany by using lagged values of our instruments. Another potential threat to identification could be the existence of a technological shock hitting small firms that would be common to France and the country of interest (either Denmark or Germany). Such technological shock would induce a change in the French labor demand by small firms, thus probably changing the wage floors, and would be correlated to both the Danish (for instance) share of workers employed in small firms. We alleviate this concern by controlling for the evolution of the share of workers employed in small firms, which enables to capture labor demand shocks that would affect proportionally more small firms.

Consistently with our model predictions, we find that the share of employees working in small firms has a positive and significant effect on wage floor variations only for unrepresentative industries. This confirms that bargaining firms have differential incentives to raise wage floors whether they are representative or not of the average firm in the industry. The representativeness of employers federations therefore plays a key role in determining collective bargaining outcomes.

This paper speaks to several strands of the literature. First, it relates to the theoretical literature studying the effect of industry-level agreements on competition (see the seminal work of Calmfors and Driffill (1988)). The main effects highlighted by the literature are twofold. The closest paper to ours is Haucap et al. (2001), which established that incumbent firms have an interest to raise the industry wage floor in order to impede the entry of firms. Our contribution is to add firms heterogeneity, which enables to distinguish large from small firms interests in the bargaining process, and thus to assess the effect of the domination of employers federations by large firms. Jimeno and Thomas (2013) show that the industry wage floors are a source of wage rigidity as it impedes less productive firms to settle a lower wage. We generalize the approach used by these papers by integrating industry-level wage bargaining in a standard firm dynamics model (Melitz (2003)) that allows to account for competition both between heterogeneous monopolistic firms and between industries. Our framework allows for firms entry, which is crucial to analyze the barriers to entry induced by sector-level agreements. Therefore, our model is able to disentangle the different effects highlighted in the previous literature, and show that they do not offset each other. The cartel effect that we uncover thanks to our model

2. The share of workers employed by small firms for representative industries is constructed as the interaction of the share of workers employed by small firms and a dummy equal to one if the industry is representative

has been confirmed before by the empirical literature. Indeed, Martins (2014a) and Magruder (2012) demonstrate that the implementation of industry-level wage floors has a strong negative effect on small firm survival.

The main novelty of the paper is to emphasize the role of representativeness on collective wage bargaining. To the best of our knowledge, we present the first model focusing on the impact of the formation of the employers federations' objective, in presence of firms heterogeneity.

On the empirical side, Martins and Hijzen (2016) and Hijzen et al. (2017) are the only papers underlining the importance of federations lack of representativeness. More precisely, Martins and Hijzen (2016) explain that 'the lack of representativeness of employer associations is a potentially important factor behind the adverse effect of extensions'. However, their degree of representativeness, computed as the share of the workforce in affiliated firms to the total employment of the sector, does not increase significantly the effect of extensions. We argue instead that the primary factor is the difference between the interests of decision-makers among employers federations and those of covered firms. More precisely we look at small firms representation, rather than overall representativeness.

This paper relates naturally to the large literature on the effects of industry-level wage bargaining on unemployment, employment losses and wage rigidities (Díez-Catalán and Villanueva (2015), Dustmann et al. (2014), Guriev et al. (2016), Hartog et al. (2002), Martins (2014a), Murtin et al. (2014), Villanueva (2015)).

This paper also contributes to a broader debate on the wage inequality effect of unions. Numerous papers analyze the presence of a wage surplus associated with union membership (DiNardo and Lee (2004), Hirsch (2004) or Lewis (1986)). While this may increase the dispersion of wages throughout the economy, collective agreements mechanically raise the wage compression in covered firms. Although these countervailing forces result in an ambiguous theoretical effect, empirical studies have tended to set forth a negative effect of unions on wage inequality (see Frandsen (2012) or Farber et al. (2018)).

Finally, this paper relates to the recent literature exploring the rise of both the labor and product market monopsony. These trends, and the major concerns about its harmful effects, received a large attention from economists (see Van Reenen (2018) for a literature review) and by economic institutions (see CEA (2016)). Indeed, the rise of the product market concentration undermines productive efficiency (see Van Reenen (2011)), raises prices (see De Loecker and Eeckhout (2017)) , reduces real wages (see Benmelech et al. (2018)) and increases inequalities (see Hershbein and Macaluso (2018)). Several causes has been presented in order to explain this movement of concentration (see Grullon et al. (2017) who argue that it is generated by a decrease of the anti-trust legislation). Autor et al. (2000) argue that it is generated by superstar firms where more markets become 'winners take all'. In this article we argue that regulation increases the monopsony as it introduce barriers to entry, and allows larger firms to strengthen their dominant position.

The structure of the paper is as follows. Section 1.2 provides some information about the French institutional setting. Section 1.3 lays out the model and compares industry-level wage bargaining with firm-level bargaining. Section 1.4 characterizes the theoretical impact of representativeness of employer federations. Section 1.5 explores the empirical validity of the model's predictions. Section 1.6 concludes.

## 1.2 Institutional setting

### 1.2.1 Collective wage bargaining in France

In almost every OECD country, three distinct levels of minimum wage may coexist : national minimum wage, industry-level minimum wage and firm-level minimum wage. Yet, the predominant level of bargaining starkly differs across countries[3], as exhaustively explained in the OECD Employment Outlook 2017. In France, the predominant level of wage bargaining is sectoral bargaining : each year around $70\%$ of French total workforce is covered by an industry-level agreement[4] (see Dares (2015b)).

Employers associations and unions negotiate over several topics, among which wages, working time, training, health, severance pay and bonuses. In order to negotiate over wages, the parties must first agree on qualifications levels, and then on a wage floor for each of them. A single industry-level agreement thus often includes several wage floors levels. Figure 1.1 provides an example of job qualifications and corresponding wage floors for Hairdressing in 2013. In this paper, we ignore the other components of collective bargaining and restrict our attention to wage floor levels as, except for wage floors and qualifications, the negotiation at the firm-level enables to opt out from industry-level agreements[5].

TABLE 1.1 : Grid of qualification and the negotiated wage floors for Hairdressing

| **CLASSIFICATION** | **MINIMUM WAGE** |
|---|---|
| LEVEL 1 - GRADE 1<br>Beginner hairdresser | 1484 |
| LEVEL 1 - GRADE 2<br>Hairdresser | 1489 |
| LEVEL 1 - GRADE 3<br>Experienced hairdresser | 1494 |
| LEVEL 2 - GRADE 1<br>Qualified hairdresser<br>OR Technician | 1514<br>1544 |
| LEVEL 2 - GRADE 2<br>Highly qualified hairdresser<br>OR Qualified technician | 1635 |
| LEVEL 2 - GRADE 3<br>Very highly qualified hairdresser<br>OR Highly qualified technician | 1756 |
| LEVEL 3 - GRADE 1<br>Manager | 1911 |
| LEVEL 3 - GRADE 2<br>Experienced manager<br>OR Network leader | 2289<br>2701 |
| LEVEL 3 - GRADE 3<br>Highly qualified manager<br>OR Experienced network leader | 2863<br>2914 |

The perimeter of an industry is decided by unions and employers associations and is validated by administrative

3. Figure 1.A.1 in the Appendix, taken from the OECD Employment Outlook (2017), provides a summary of the key features of wage bargaining in each OECD country in 2015.

4. There are around 700 industry-level agreements in France , which cover around 15 millions workers (see Dares (2015b)). Those agreements display a wide heterogeneity in terms of the covered population size. For example, in 2013, 13% of industry agreements covered three quarters of French employees under permanent contracts and 24% covered less than 0.2% of them.

5. It should also be noted that if firms could not opt out from industry-level agreements regarding those other components, restricting the analysis to wage floor levels in the model would underestimate the effect of collective bargaining.

controls[6]. Extensions of collective agreements are quasi-automatic in France : once the agreement is signed, except very rare cases that are not economically significant, the Minister of Labor extends them to the entire industry, usually within two or three months[7]. The Minister may, in principle, exclude from the extension certain clauses of the agreement for legal reasons or reasons of general interest (Labor Code L.2261-25). However, refusals to extend the entire agreement are rare and above all founded on the legal validity of the text - never on economic or social arguments. The possibility for the Minister of Labor to refuse an extension on a ground of general interest, in particular the objectives of economic and social policy or the protection of the situation of third parties, exists but it is practically never used. Such quasi-automatic extensions prevail in a large number of European countries, including Italy, Portugal or Spain. The main rationales for such extensions are fairness considerations for workers - ie to ensure that all workers in a given industry are treated the same way - and transaction costs reduction - ie to avoid some firms from engaging in lengthy negotiations. However, it has been argued before that extensions could be a tool for 'insider firms' to drive competitors out of the market (Haucap et al. (2001), Magruder (2012), Martins (2014a)).

### 1.2.2 The issue of representativeness

Whether extensions are desirable or detrimental is closely intertwined with the representativeness of bargaining institutions - namely the representativeness of both employee unions and employer federations. In France, for an industry agreement to be signed, employees unions have to be representative enough according to a legal threshold which corresponds to 8% of the votes in the last work council elections. In several countries an employer federations representativeness criterion is also applied : for instance, Portugal requires that workers in signing firms represent at least 50% of workers of the industry. In France, no such criterion applied until the 2014 and 2016 laws. Those laws established that an employer federation should represent either 8% of all firms pertaining to employers federations or 8% of all workers of these corresponding firms.

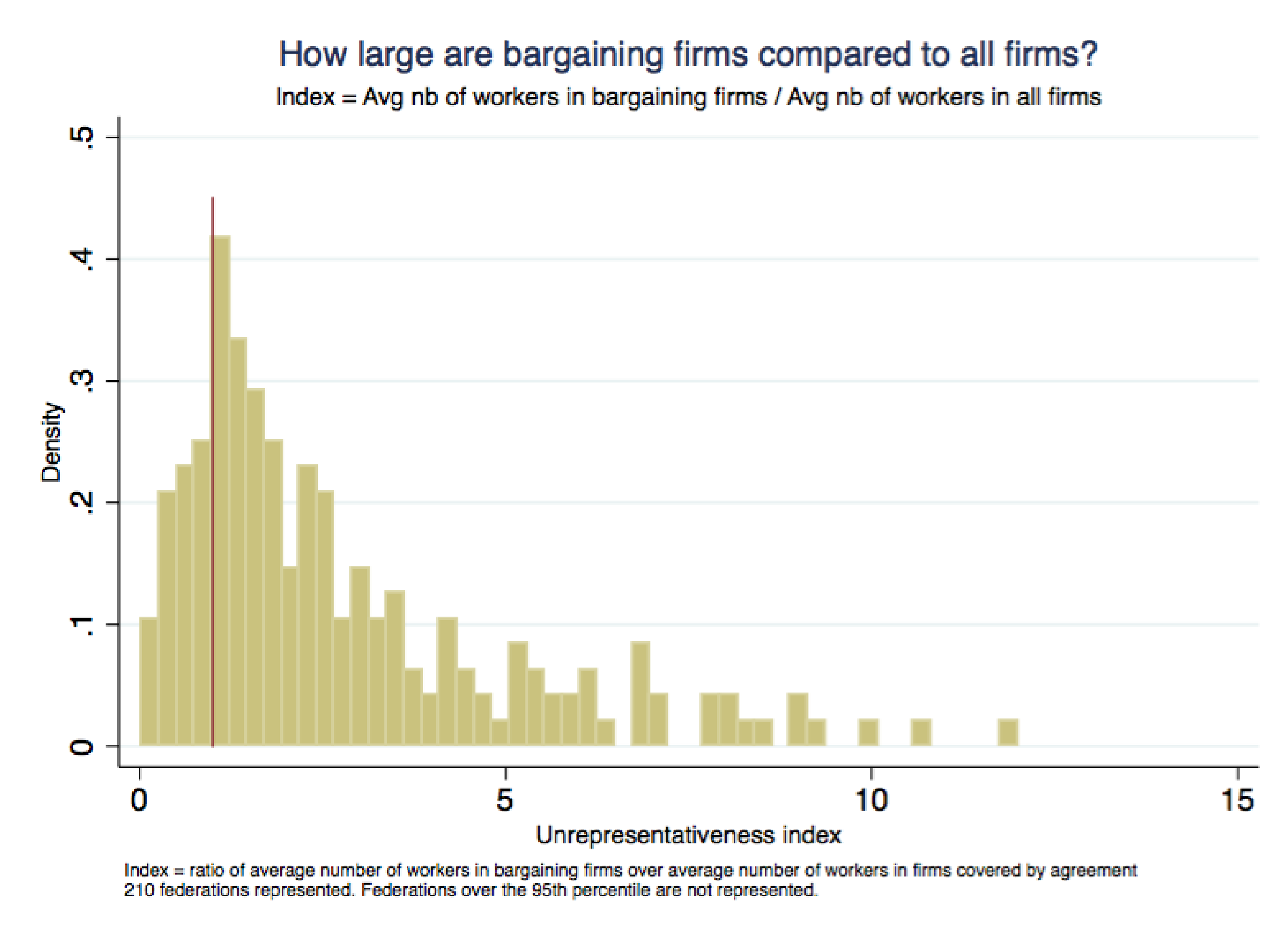
Employer federations representativeness is often defined as '*the share of the workforce in affiliated firms in the total employment of the relevant sector*' (Martins and Hijzen (2016)). However, a criterion based on this definition does not ensure that signing firms are representative of all the firms covered by the industry agreement. In other words, the representativeness criterion can be met even if employers federations over-represent large firms, and therefore large firms' interests. Such concern has been expressed in the OECD Employment Outlook 2017 : '*Extensions may also have a negative impact when the terms set in the agreement do not account for the economic situation of a majority of firms in the sector. For instance, when the employer association is representative only of large and relatively more productive firms (and hence willing to pay higher wages), it may agree on wage floors and other components that are not sustainable for smaller and less productive firms.*'.

A cruel lack of statistics on employer organisations' membership (OECD Employment Outlook 2017) often prevents from providing an adequate picture of employers' federations. Figures on the population covered by collective agreement are usually available : in OECD countries, 26% of small firms workers are covered by a collective agreement while 34% of large firms workers are covered[8]. Yet, information about which firm pertains to which employers federations is largely ignored. Still, it has been documented that large firms are more willing to affiliate than small ones (Traxler (1995), Traxler (2000), Traxler (1995), Barry and Wilkinson (2011), Mortimer et al. (2004)). We present in Figure 1.2 an index of large firms domination in employers federations, constructed from

6. In a vast majority of cases a firm is covered by a unique industry agreement.
7. Sources : French Labor Code, OECD Employment Outlook, Fougère et al. (2018b)
8. Source : OECD Employment Outlook 2017

French data[9]. An index higher than one means that the average size of bargaining firms is higher than the average size of all firms in the sector. In other words, for an industry to have a high index means that in this industry, large firms dominate the bargaining process. The histogram exhibits a positively skewed distribution, and most industries display an index superior to one : in most industries, the bargaining firms are the largest firms.

FIGURE 1.2 : Histogram of the index of large firms domination in employers federations




Reasons for this lack of small firms participation can be manifold : lack of time, lack of information, membership contributions. Sociological studies (Giraud (2012), Offerlé (2013)) put forward the limited time of small-firms CEOs to fully participate to federations, and therefore negotiations. It is even sometimes argued that some federations refuse small firms as they would not be cost-efficient for the federation : they would contribute low amounts while consuming a lot of the federation's services (Offerlé (2013)).

9. Public data enables us to know how many firms bargain for each industry-level agreement and how many workers these firms represent. Administrative data (DADS) enables us to know for each industry-level agreement how many firms and workers there are. Merging these two datasets thus enables to compute the average number of workers in bargaining firms and the average number of workers in all firms. The ratio of the two is higher the higher the domination of large firms in industry-level federations.

## 1.3 Model : the impact of industry-level wage bargaining

We use in this section a model very close to Melitz (2003), in which we introduce firm-level bargaining and industry-level bargaining. Going from firm-level to industry-level bargaining raises the productivity threshold, which drives the least productive firms out of the market and which thus benefits the dominant - or most productive - firms. The general equilibrium effects of such sectoral bargaining are an increase in the unemployment rate and a decrease in the utility of consumers. We first lay-out the basic set-up of the model and then study the impact of the bargaining level on the economy[10].

### 1.3.1 Setup of the model

Suppose the national market consists of $J$ industries. An industry is composed by a continuum of heterogeneous firms which produce each a single product and operate in situation of monopolistic competition. A representative consumer allocates her consumption between industries on the basis of an aggregate industry price, and then between firms of an industry on the basis of the price they charge. We first focus on the demand side, and then we turn to the supply side.

#### Utility and consumption

The real consumption index of products from industry j is the following Dixit-Stiglitz aggregator :

$$Q_j = \left[ \int_{\omega \in \Omega_j} q(\omega)^{\frac{\sigma-1}{\sigma}} d\omega \right]^{\frac{\sigma}{\sigma-1}}$$

where $\sigma$ is the elasticity of substitution between products of a same industry : $\sigma > 1$ and is constant across industries. $q(\omega)$ is the consumption of product $\omega$, and $\Omega_j$ is the set of products of industry $j$. The representative agent, with total spending $E$, faces the following maximization program :

$$\max U = \left[ \sum_{j=0}^{j=J} \frac{1}{J} \left(Q_j\right)^{\frac{\xi-1}{\xi}} \right]^{\frac{\xi}{\xi-1}} \text{ such that } E \geq U.P$$

where $\xi > 1$ is the elasticity of substitution between industries and $P$ is the national aggregate price. Following empirical evidence[11], we impose $\sigma > \xi$, *ie* we assume that products of the same industry are more substitutable than products of different industries.

We denote $p(\omega)$ the price of product $\omega$ and $P_j$ the price index of industry $j$. Aggregate prices $P$ and $P_j$ write :

$$P = \left[ \sum_{j=0}^{j=J} \frac{1}{J} \left(P_j\right)^{1-\xi} \right]^{\frac{1}{1-\xi}} \tag{1.1}$$

$$P_j = \left[ \int_{\omega \in \Omega_j} p(\omega)^{1-\sigma} d\omega \right]^{\frac{1}{1-\sigma}} \tag{1.2}$$

10. We restrict our analysis to a closed economy.
11. See Lewis and Poilly (2012), Oberfield and Raval (2012), Broda and Weinstein (2006) and Bernard et al. (2003)

Following Grossman and Helpman (1991) and Lentz and Mortensen (2008), we choose the numeraire so that the national total spending is equal to $E$. Then, following Dixit and Stiglitz (1977), for each industry $j$, aggregate consumption and aggregate revenue equal :

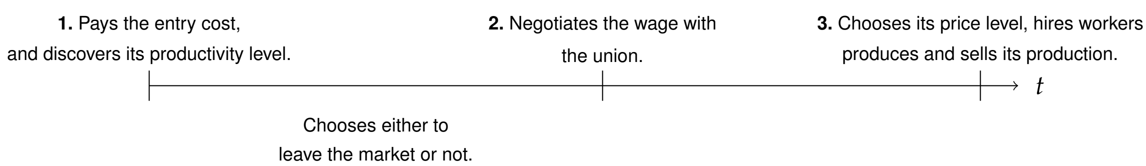
$$Q_j = \frac{1}{J}\left(\frac{P_j}{P}\right)^{-\xi}\frac{E}{P} \tag{1.3}$$

$$R_j = Q_j P_j = \left(\frac{P_j}{P}\right)^{1-\xi}\frac{E}{J} \tag{1.4}$$

The equilibrium price $P_j$ captures the fact the consumer's utility decreases in the price and increases with the number of products.

### Industry composition

FIGURE 1.3 : Timeline of an entrepreneur.




**Production Process** Figure 1.3 describes the timeline of an entrepreneur. A potential entrant must pay a fixed entry cost $f_e$ to discover its productivity level $\phi$, drawn from the distribution $g(\phi)$[12]. Depending on the productivity level drawn, the entrepreneur chooses either to leave the market or not. If the entrepreneur does not exit, she will then in a second step bargain over the wage with a monopolistic union. Then the entrepreneur will hire workers, choose a price and sell her production. We solve the model using backward induction.

**Firms maximization** The only factor of production is labor. Within an industry j, an operating firm produces one variety of good $\omega$, faces a fixed cost $f$, has a productivity level $\phi$, charges the price $p$ and pays each worker $w$. A worker of a firm with productivity $\phi$ produces $\phi$ units. Therefore a firm with $h$ workers produces a quantity $q(\omega) = \phi h$ and earns a revenue equal to $r(\omega) = p(\omega)q(\omega)$. The structure of the demand implies :

$$q(\omega) = Q_j\left[\frac{p(\omega)}{P_j}\right]^{-\sigma} \tag{1.5}$$

$$r(\omega) = R_j\left[\frac{p(\omega)}{P_j}\right]^{1-\sigma} \tag{1.6}$$

The firm takes the wage as given when fixing its price.

12. $G(\phi)$ is the cumulative distribution. This distribution is identical across industries.

**Lemma 1.** *The price and profits of a firm of productivity $\phi$ paying a wage $w$ and operating in industry $j$ are given by :*

$$p(\phi, w) = \frac{w}{\rho\phi} \tag{1.7}$$

$$\pi_j(\phi, w) = \frac{R_j}{\sigma}\left(\frac{p(\phi, w)}{P_j}\right)^{1-\sigma} - f \tag{1.8}$$

*where $\rho = \frac{\sigma-1}{\sigma}$ is the profit-maximizing markup set by the firm.*

**Firms entry and equilibrium structure of an industry** The equilibrium structure of an industry is characterized by a mass of firms $M_j$ that enter the market[13] and a distribution of productivity levels, which are both pinned down by the zero cutoff profit condition and the free entry condition.

The zero cutoff profit condition - or equivalently firms destruction condition - states that a firm produces if and only if its profits are positive. This condition implies the following relationship between the average profit $\overline{\pi_j}$ in the industry and the productivity cutoff $\phi_j^*$ , which is the minimum productivity level generating a non-negative profit :

$$\pi(\phi_j^*) = 0 \Leftrightarrow \overline{\pi}_j = \frac{1}{1 - G(\phi_j^*)}\int_{\phi_j^*}^{\infty} \pi_j(\phi) g(\phi) d\phi = f\left[\Gamma(\phi_j^*) - 1\right] \tag{1.9}$$

where

$$\Gamma(\phi^*) = \frac{1}{1 - G(\phi^*)}\int_{\phi^*}^{\infty} \left[\frac{w(\phi)\phi^*}{w(\phi^*)\phi}\right]^{1-\sigma} g(\phi) d\phi$$

The free entry condition - or equivalently firms creation condition - indicates that a prospective firm pays the entry cost only if the expected profit from entry - equal to the average profit conditional on surviving, multiplied by the probability of surviving - is higher than the entry cost. Therefore, the free entry condition defines a positive relationship between the average revenue $\overline{\pi_j}$ and the productivity threshold $\phi_j^*$ :

$$\overline{\pi}_j = \frac{f_e}{1 - G(\phi_j^*)} \tag{1.10}$$

The zero cutoff profit and free entry conditions will enable to pin down the production cutoff $\phi_j^*$ and the average profit $\overline{\pi_j}$[14]. The value of the mass of firms is given by the aggregate industry demand.

**Aggregate variables** Based on previous results, we derive the formulas for the aggregate price index, $P_j$, the aggregate profit, $\Pi_j$, the aggregate revenue, $R_j$, and the aggregate employment, $L_j$, given in Appendix 1.B.

13. Entering firms are firms choosing to pay the entry cost.
14. This will be proved in Proposition 1. Proposition 1 will demonstrate that both the profits and the wage are increasing in the productivity level $\phi$. Consequently, equation 1.9 defines a negative relationship between the production cutoff $\phi_j^*$ and the average profit $\overline{\pi_j}$. Therefore, the zero cutoff profit and free entry conditions define equilibrium values of $\phi^*$ and $\pi_{j_{(\phi^*)}}$. The determination of the equilibrium is depicted in Figure 1.4.

### 1.3.2 Impact of the introduction of industry-level bargaining

In this section, we study the impact of the implementation of industry-level bargaining - ie bargaining system where an industry-wide union and an industry-wide employers federation bargain over a binding industry's minimum wage - relative to the baseline situation of firm-level bargaining. We use in the following the subscript $f$ and $i$ for respectively the firm-level bargaining and the industry-level bargaining.

When wages are negotiated at the industry level, firms internalize that a rise in the wage floor will increase the competitors' costs. Thus, the introduction of industry-level bargaining raises wages. Moreover, we find that sector-level agreements impede the least productive firms from producing and increasing the profits of the largest firms. The general equilibrium effects of the industry-level bargaining are a decrease of both employment and consumers utility. In both bargaining systems we use a right-to-manage model[15] (Nickell and Andrews (1983)).

#### Firm-level bargaining

After paying the entry cost and having discovered its productivity level, an entrepreneur bargains over the wage with a unique union. In the firm-level bargaining situation, the union represents all workers of the economy and maximizes the sum of their expected utilities minus their reservation utilities[16]. Following the literature (see Cahuc et al. (2014) for a summary), we assume that there is a reservation wage denoted by $\widetilde{w}$, which is an exogenous parameter representing an unemployed person's utility. We also assume, for simplicity and at no cost for the results, that the utility of a worker is directly given by its wage. Finally, we denote $l_f(\phi, w)$ the employment level of firm $f$.

**Lemma 2.** *When the negotiation takes place at the firm level, the wage paid by a firm of productivity $\phi$ is given by*

$$\max_{w} \left\{ \left[ l_f(\phi, w) \right]^{\beta} [w - \widetilde{w}]^{\beta} \left[ p_f(\phi, w) q_f(\phi, w) - w \frac{q_f(\phi, w)}{\phi} - f \right]^{1-\beta} \right\} \tag{1.11}$$

Where $\beta$ is the bargaining power of unions, considered as being identical across firms. This directly implies the following proposition

**Proposition 1.** *When the negotiation takes place at the firm level, wages and profits fulfill the following propositions (Proof are given in Appendix 1.C)*

*[label=,noitemsep] The wage is an increasing function of productivity and fulfills the following condition*

$$\widetilde{w} \leq w_f(\phi) \leq w_f^{max} = \left[ 1 + \frac{\beta}{\sigma - 1} \right] \widetilde{w} \tag{1.12}$$

*Profits are increasing in the productivity level $\phi$.*

15. In such a model the firm and the union negotiate only over the wages, ie the firm still chooses its employment level. This assumption is made in order to maximize comparability between scenarios. Indeed, it would be highly counter-factual to assume that, at the industry-level, unions and employers federations bargain over the level of employment.

16. The utility of the union when bargaining occurs with firm $f$ is : $v_f = l_f u(w) + (L - l_f)\widetilde{u}$, where $\widetilde{u}$ is the reservation utility of individuals and $L$ the population size. In our setting, $u(w) = w$ and $\widetilde{u} = \widetilde{w}$. The utility of the union in case of bargaining failure is $\widetilde{v} = L\widetilde{u}$. Therefore the union maximizes $v_f - \widetilde{v} = l_f(u(w) - \widetilde{u}) = l_f(w - \widetilde{w})$.

A first important implication of Proposition 1 is the existence and unicity of the productivity threshold $\phi_j^*$. Because the wage is perfectly pinned down by the productivity level and because there is a positive relation between profits and productivity, equation 1.9, derived from the zero cutoff profit condition, defines a negative relationship between the average revenue $\overline{\pi_j}$ and the productivity threshold $\phi_j^*$. Together with the free entry condition defined in equation 1.10, this proves that the productivity threshold exists and is unique. The determination of the equilibrium is depicted in Figure 1.4a in the $(\phi, \overline{\pi})$ space.

A key result of the model is that more productive firms pay higher wages. Indeed, because more productive firms have higher profits and the wage elasticity of revenue is invariant with productivity, the absolute value of the wage elasticity of profit is lower in the most productive firms.

Firms with a productivity level equal to the productivity cutoff pay a wage equal to the reservation wage - ie $w_f(\phi^*) = \widetilde{w}$. Those marginal firms are indifferent between producing or not. Similarly workers of those firms are indifferent between being employed or not. When productivity tends to infinity the wage converges toward its upper bound. This maximum wage increases with the outside option and with the bargaining power of the union. Furthermore, it decreases with the substitutability of competitors products : the higher the value of $\sigma$, the more sensitive profits are to a wage increase.

### Industry-level bargaining

In this section we derive the equilibrium structure of the industry when employers and workers negotiate a binding minimal wage which applies to the entire industry. A single union represents all the workers in the economy[17]. The employers federation represents firms which choose to produce - *ie* firms that exist at step 2 of Figure 1.3.

In the following, we first describe the impact of the introduction of a binding minimum wage on the structure of the industry. Then we turn to the analysis of the bargaining game and its impact on the equilibrium structure of the industry.

**Features of the industry's minimum wage** In the industry-level bargaining scenario, an industry-wide employers federation and an industry-wide union negotiate a wage floor. To account for institutional features of countries using industry agreements, we assume that the final wage floor is the maximum of the industry-level and the firm-level bargained wage floors[18]. In other words, the industry wage floor is only binding for firms that would have negotiated, at the firm level, a lower wage[19].

**Impact of the industry's minimum wage on the equilibrium structure of the industry** We denote the industry's minimum wage $\overline{w}$. Introducing industry-level wage bargaining shifts the zero cutoff profit condition, which will then impact the equilibrium structure of the industry. Results are summarized in the following Proposition.

17. The utility of the union when bargaining occurs for industry $i$ is : $v_i = l_i u(w) + (L - l_i)\widetilde{u}$, where $\widetilde{u}$ is the reservation utility of individuals and $L$ the population size. In our setting, $u(w) = w$ and $\widetilde{u} = \widetilde{w}$. The utility of the union in case of bargaining failure is $\widetilde{v} = L\widetilde{u}$. Therefore the union maximizes $v_i - \widetilde{v} = l_i(u(w) - \widetilde{u}) = l_i(w - \widetilde{w})$.

18. In every country with sector-level bargaining, workers can be, and generally are, paid more than the wage floor (see Fougère et al. (2018a) for France).

19. In industries using wage floors, we still observe firm-level agreements (see Avouyi-Dovi et al. (2013) for France).

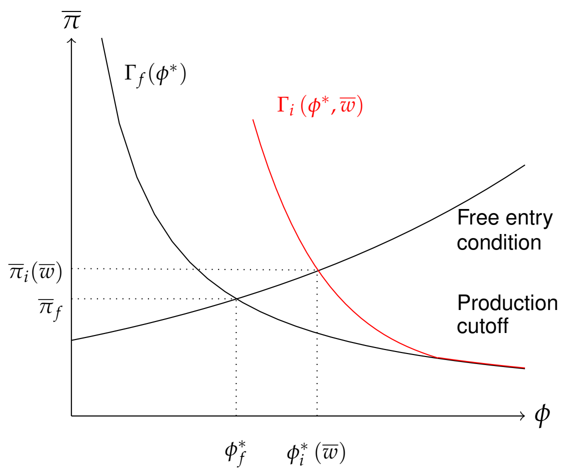
**Proposition 2.** *When an industry's minimum wage is implemented the equilibrium structure of the industry fulfills the following propositions (Proof are given in Appendix 1.D.1)*

*[label=,noitemsep] As long as the industry wage floor is between the reservation wage $\widetilde{w}$ and $w_f^{max}$, both the average revenue and the productivity cutoff increase with the wage floor. As long as the industry's minimum wage is not binding for all firms[20], the higher it is the higher firms' profits. Equivalently : $w_i(\phi, \overline{w}) > \overline{w} \Rightarrow \frac{\partial r_i(\phi, \overline{w})}{\partial \overline{w}} > 0$.*

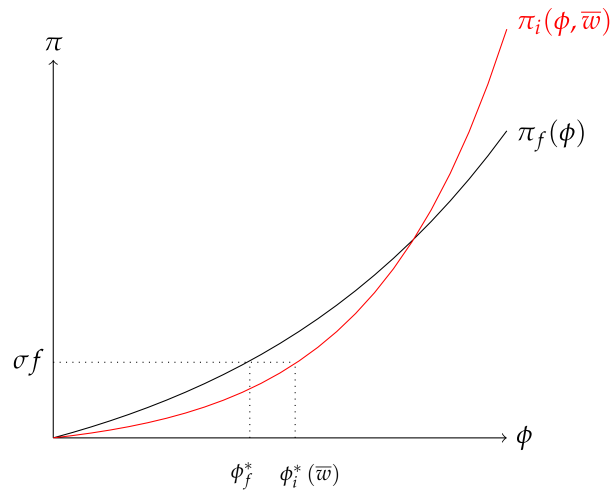
The higher the industry's wage floor, the higher the productivity cutoff, thus the lower the number of firms in the market. Furthermore, among producing firms, the wage floor will increase the labor cost of firms for which it is binding. Those two mechanisms will decrease competitiveness of the industry and, consequently, will increase the profits of the largest firms.

Figure 1.4 depicts the equilibrium structure of the economy under firm-level versus industry-level bargaining. Figure 1.4a represents the equilibrium profits under each wage bargaining system. The implementation of an industry-level wage floor shifts the zero cutoff production curve to the right, while it has no impact on the free entry condition. Consequently, under industry-level bargaining, both the equilibrium productivity cutoff and the equilibrium value of profit increase. Figure 1.4b represents the equilibrium distribution of profits. The wage floor increases the prices set by the least productive firms, which decreases their profits and, as a consequence, it increases the profit of the largest firms.

FIGURE 1.4 : Impact of industry level bargaining on industry structure




(a) Equilibrum structure of the market

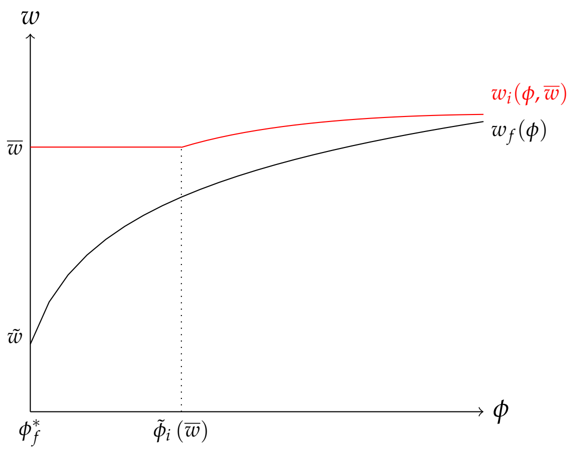



(b) Equilibrium structure of profit

Note : Black curves represent the situation under firm-level bargaining, red curves under industry-level bargaining. $\overline{\pi_f}$ and $\overline{\pi_i}$ respectively denote the average profit in the industry under firm-level bargaining and under industry-level bargaining, $\phi_f^*$ and $\phi_i^*$ the productivity cutoff under firm-level bargaining and under industry-lvel bargaining, $\overline{w}$ the industry wage floor, $\phi$ the productivity level.

2.

FIGURE 1.5 : Impact of wage floor on wages




Note : The black and red curves respectively represent the relationship between the wage $w$ and the firm's productivity $\phi$ under firm-level bargaining and under industry-level bargaining. $\phi_f^*$ denotes the productivity cutoff under firm-level bargaining. $\widetilde{\phi}_j(\overline{w}$ represents the higher level of productivity such that under industry-level bargaining a firm pay a wage equal to the wage floor

Figure 1.5 depicts the wages both under firm-level bargaining and under industry-level bargaining[21]. First, firms of low productivity negotiate firm-level wages lower than the industry wage floor, consequently compliance with the industry's minimum wage implies that they pay a wage equal to the wage floor. In the figure, we define a productivity level $\tilde{\phi}_i(\overline{w})$ which represents the higher level of productivity such that firms pay a wage equal to the wage floor. However, industry-level wage floors raise wages even for firms for which they are not binding - *ie* firms for which $\phi > \tilde{\phi}_i(\overline{w})$. There is indeed an indirect source of wages increase : industry-level bargaining raises large firms' profits and, because the wage negotiated at the firm-level increases with the level of profits, wages paid by those firms are higher than without industry-level wage bargaining.

**The wage bargaining process** At the industry level an employers federation, representing the interests of producing firms, negotiates with the employees union. We suppose that, for the employers association, each firm has the same weight in the aggregate industry's objective. Therefore, the aggregate profit is the sum, over all firms, of the employer profits. The employees union's objective is now evaluated at the industry level. Consequently, the objectives are given by :

*Union's objective :*

$$U_i(\overline{w}) = \left[\frac{1}{1-G(\phi_i^*)}\int_{\phi_i^*}^{\infty}(w_i(\phi,\overline{w})-\tilde{w})\,l_i(\phi,\overline{w})g(\phi)Md\phi\right] \tag{1.13}$$

*Employers federation's objective :*

$$V_i(\overline{w}) = \Pi_i(\overline{w}) = \frac{1}{1-G(\phi_i^*))}\int_{\phi_i^*}^{\infty}\pi_i(\phi,\overline{w})Mg(\phi)d\phi \tag{1.14}$$

20. Ie when $\overline{w} < w_f^{max}$
21. We represent the industry-level barganining situtation for which there is a wage floor fulfilling the condition $\overline{w} < w_f^{max}$

**Lemma 3.** *When an industry wage floor is negotiated, it solves the following problem :*

$$\max_{\overline{w}} \left\{ \left[ \frac{1}{1-G(\phi_i^*)} \int_{\phi_i^*}^{\infty} \left( w_i(\phi, \overline{w}) - \widetilde{w} \right) l_i(\phi, \overline{w}) g(\phi) M d\phi \right]^{\beta} \left[ \Pi_i(\overline{w}) \right]^{1-\beta} \right\} \tag{1.15}$$

**Proposition 3.** *The industry wage floor satisfies the following propositions (Proof are given in Appendix 1.D.2)*

*[label=] The wage floor is finite, is strictly higher than the reservation wage and has an upper bound denoted $\overline{w}^{max}$ [22].*

$$\widetilde{w} < \overline{w} \leq \overline{w}^{max} = \widetilde{w} \left[ 1 + \frac{\beta}{\xi - 1} \right]$$

*The introduction of industry-level wage bargaining increases the productivity cutoff, the average profit and the wage paid by every firm.*

The intuition behind Proposition 3.1 is the following. The most productive firms benefit from an increase in the wage floor as it raises their profits. For firms for which the wage floor is binding though, profits decrease with the wage floor. However such a negative impact on profits is partly offset by the increase in competitors labor cost. Therefore, overall firms have an incentive to raise the negotiated wage above the reservation wage.

Yet, as products of different industries are substitutable, the most productive firms do not capture the entire loss of revenue of the least productive firms in their industry. Indeed, a raise in an industry's wage floor will compel the representative consumer to allocate a lower share of the national aggregate revenue in goods of this industry. Therefore, the industry's aggregate revenue will decrease after an increase of the wage floor, ensuring that there is a finite solution. Indeed, the industry's minimum wage is bounded from above because when it becomes binding for all firms it does not generate any relative labor cost increase. The negotiating parties then only account for the competition with other industries.

Because the upper bound of the industry-level wage floor is superior to the upper bound of firm-level negotiated wages - ie $\overline{w}^{max} > w_f^{max}$ -, a situation in which the industry-level wage floor is binding for every firm of the industry can arise. In other words, it is possible that $\overline{w} \in [w_f^{max}, \overline{w}^{max}]$ [23], but this seems like a very unrealistic scenario.

It must be noticed that previous results crucially rely on two assumptions. First, an entrepreneur cannot opt-out from an industry-level agreement. Second, we consider that every firm is covered by the agreement, and not just those that are members of the employers federation. This assumption is made to account for institutional features of countries using industry-level agreements. For example, in France, the ministry of Labor extends the agreements quasi-automatically beyond the limits of signing parties. If we relax this assumption, this would generate an equilibrium equivalent to the one with only firm-level agreements. Indeed, if the wage floor was binding for an entrepreneur she would choose to freely exit the employer organization and to implement the wage negotiated at the firm level.

22. The upper bound is the wage that would be paid by a firm with revenue equal to $\overline{r}^{max}$, facing competition with enterprises manufacturing products having an elasticity of substitution equal to $\xi$.

23. The closer the elasticities of substitution across and within industries $\xi$ and $\sigma$, the lower the probability of such a case to arise.

#### General equilibrium

In this section we derive the structure of a symmetric equilibrium, in which the wage is negotiated at the same level in every industry. We find that industry-level bargaining raises unemployment and decreases the utility of the representative consumer.

We focus on the national aggregate spending and assume that there are no savings so firms profits and wages are entirely consumed. The fixed cost for operating is paid to other firms in the economy, thus it increases the aggregate demand. The entering cost $f_e$ investment cost is financed by a loan, that has to be paid off later, and we do not consider equilibrium situations where there is either national savings or national deficit. Then, at the equilibrium, the impact of investment on profits of operating firms and on demand sum to zero.

**Lemma 4.** *The aggregate resource in the economy is given by*

$$E = \left\{ \sum_{j=1}^{j=J} \frac{1}{1-G(\phi_k^*)} \int_{\phi_k^*}^{\infty} \left[ \pi_k(\phi) + w_k(\phi)\frac{q_k(\phi)}{\phi} + f \right] g(\phi) M_k d\phi \right\}_{k \in \{f,i\}} \tag{1.16}$$

**The general equilibrium**

**Definition 1.** *A steady-state equilibrium is a set of productivity cutoffs and average revenues $\{\phi_k^*, \bar{r}_k\}_{k \in \{f,i\}}$, wages $\{w_k(\phi)\}_{k \in \{f,i\}}$, prices $\{p_k(\phi)\}_{k \in \{f,i\}}$ and masses of firms $\{M_k\}_{k \in \{f,i\}}$ such that*

1. *The productivity cutoff and the average revenue solve both the free entry condition and the zero cutoff profit condition.*
2. *The wage solves bargaining equation 1.15 under industry-level bargaining and equation 1.11 under firm-level bargaining.*
3. *Price settled by firms always solve equation 1.7.*
4. *The aggregate revenue solves equation 1.4.*
5. *Price level fulfills the condition on the numeraire.*
6. *The aggregate resource constraint, equation 1.16, is satisfied.*

**Impact of level at which the bargaining takes place** The first three conditions ensure that the productivity cutoff is higher when a wage floor is implemented, as developed above. Using the following propositions it can be derived that

**Proposition 4.** *Introducing industry-level bargaining raises unemployment and decreases consumers' utility (Proof given in Appendix 1.E).*

As wages are higher when there is an industry wage floor, hired workers captures a higher share of firms revenues. Therefore, this will reduce the labour demand, and so employment. Moreover an industry's minimum wage will decrease the variety of the economy, which decrease the utility of consumers. Finally, as wage floors increase the labor cost, it will increase prices of goods, which also have a negative impact on the utility.

## 1.4 Model : the role of the representativeness of bargaining institutions

In section 1.3 we demonstrate that the implementation of industry-level bargaining leads to higher wages, thus conducing to the eviction of small firms. In this section we study the impact of the over-representation of large firms' interests in employers federations. Large firms' profits increase when the wage floor increases, consequently the more the objective of the employers federation takes into account the interests of large firms, the higher the negotiated wage floor. As a result, the productivity cutoff increases and the variety of the industry, the employment and the utility of the consumers decrease.

Similarly to the previous section, we do not endogenize the choice between the firm-level bargaining scenario and the sector-level bargaining scenario. However, this would strengthen our results. Indeed large firms always have an interest to implement a wage floor. Consequently, when their domination increases, they will choose to implement it.

### 1.4.1 Representativeness of employers federations

This subsection focuses on the equilibrium structure of the economy when employers federation over-represent the interests of the largest firms during the industry-level bargaining process. We denote $h$ the type of such a bargaining institution. We provide in Appendix 1.F.1 a micro-foundation explaining the existence of such bargaining institution - ie an institution that attributes higher weights to larger firms

As firms are heterogeneous in terms of productivity, their objectives may differ. Yet, when negotiating at the industry level, the employers organization must aggregate them into a single objective. Previously, we assumed that the employer association gives the same importance to each firm, but this appears to be far from reality. Indeed, large firms are over-represented in the composition of employers federations (see, for France, Dares (2015a)). Furthermore, the domination of large firms in employers organizations has been well established by the literature (see Traxler (2000) for example).

In order to take into account this phenomenon we assume that, at the industry level, the aggregate objective of the employers organization is built on a voting system where the larger the firm the larger its share of votes. In this section, the voting share of a firm depends only on its productivity, and is denoted $h(\phi)$. The definition of an employers federation that over-represents interests of large firms is given by

**Definition 2.** *An unrepresentative employers federation is defined by an objective $V_h(\overline{w})$ and a function $h(.)$ belonging to the set of functions $H$, where :*

$$V_h(\overline{w}) = \frac{\int_{\phi^*(\overline{w})}^{\infty} \pi(\overline{w},\phi)g(\phi)h(\phi)Md\phi}{\int_{\phi^*(\overline{w})}^{\infty} g(\phi)h(\phi)d\phi}$$

$$h \in H \Leftrightarrow \left\{\forall x \in [0,\infty]\ h'(x) \geqslant 0;\ \int_0^{\infty} h'(x)dx > 0 \ \text{ and } \ \int_0^{\infty} h(x)g(x)dx = 1\right\}$$

The first condition on $H$ implies that the voting share is weakly increasing in productivity. The second one ensures that it differs from the "equal votes" case, and the last condition implies that $h(.)$ represents weights. We define $g_h(.) = g(.)h(.)$, the last condition thus implies that $g_h(.)$ can be understood as being a distribution of firms, constructed from the real distribution of firms ($g(.)$), and from their vote share ($h(.)$). Finally, we define $G_h(.)$ as being the cumulative distribution of the previous function. The aggregate employers federation's objective becomes

$$V_h(\overline{w}) = \frac{1}{1 - G_h(\phi^*(\overline{w}))} \int_{\phi^*(\overline{w})}^{\infty} \pi_h(\phi, \overline{w}) M g_h(\phi) d\phi \tag{1.17}$$

During the bargaining process, on the employer side, everything happens as if it was an "equal votes" system but with a more positively skewed distribution of firms. Definition 3 characterizes a ranking among the set $H$ of functions on the basis of the magnitude of large firms over-representation.

**Definition 3.** $\widetilde{h}(.)$ *represents an economy in which large firms interests are more valued than the economy represented by* $h(.)$ *when :*

$$\left\{ \left\{ \widetilde{h}(.), h(.) \right\} \in H^2 ; \forall x \in [0, \infty] \ (\widetilde{h}'(x) - h'(x)) \geqslant 0; \int_0^{\infty} (\widetilde{h}(x) - h'(x)) dx > 0 \right\}$$

The bargaining problem is presented in Lemma 5 : the only difference with the section 1.3 is that the employers objective is now $V_h(\overline{w})$ instead of $V_i(\overline{w})$ (defined in equation 1.14).

**Lemma 5.** *When the negotiation takes place at the industry-level and when interests of the largest firms are over-represented, the bargaining problem is given by*

$$\max_{\overline{w}} \left\{ \left[ \frac{1}{1 - G(\phi^*(\overline{w}))} \int_{\phi^*}^{\infty} (w(\phi, \overline{w}) - \widetilde{w}) l_f(\phi, \overline{w}) M g(\phi) d\phi \right]^{\beta} [V_h(\overline{w})]^{1-\beta} \right\} \tag{1.18}$$

When large firms are over-represented in employers federation - *ie* when the federation is unrepresentative, the negative impact of a minimum wage increase for the federation becomes less important. Indeed, this negative effect is concentrated the among smallest firms, and their interests are less accounted for. Moreover, large firms have an interest to raise the wage floor, which is more reflected in the industry's aggregate objective. Those two effects will have a positive impact on the negotiated wage.

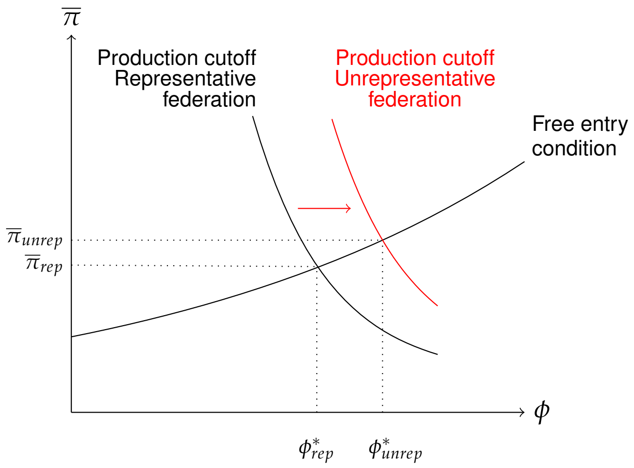
The over-representation of large firms will also increase the negative impact of the industry's wage floor on the variety of the industry as the wage floor increase will impede more firms to produce. Therefore, we can derive the following proposition.

**Proposition 5.** *When representativeness of labor market institutions changes, as long as the wage floor is not binding for every operating firm, the economy fulfills the following propositions (Proofs are given in Appendix 1.F.2)*

*[label=]The higher the over-representation of large firms interests, the higher the wage floor and the wage paid by every operating firm. The higher the over-representation of large firms, the higher the average revenue and the productivity cutoff.*

*2.*

FIGURE 1.6 : Equilibrum structure of the market under representative and un-representative industry-level bargaining




Note : The dark and red curves respectively represent the zero cutoff production (ZCP) condition under industry-level bargaining with representative and unrepresentative employers federations. $\phi^*_{rep}$ and $\phi^*_{unrep}$ respectively denote the productivity cutoff with a representative and unrepresentative employers federation, $\pi_{rep}$ and $\pi_{unrep}$ respectively denote the average profit in the industry with a representative and unrepresentative employers federation. The more unrepresentative the employers federations, the more the ZCP curve is shifted to the right, thus increasing the productivity cutoff $\phi^*$.

### 1.4.2 General equilibrium

The general equilibrium fulfills equations given in definition 1. Then, using the results of Proposition 5 we can derive the following Proposition.

**Proposition 6.** *As long as the minimum wage is not binding for every operating firm, the more interest of large firms are over-represented, the higher the unemployment rate and the lower the consumers utility.*

As the over-representation of large firms interests leads to a wage floor increase, the negative effects of the baseline "equal weights" system will be strengthened. Therefore, this will reduce the variety of products and increase prices, reducing consumers utility. This implies that the representativeness of negotiating institutions has a strong impact on the negotiation outcomes, and thus the equilibrium structure.

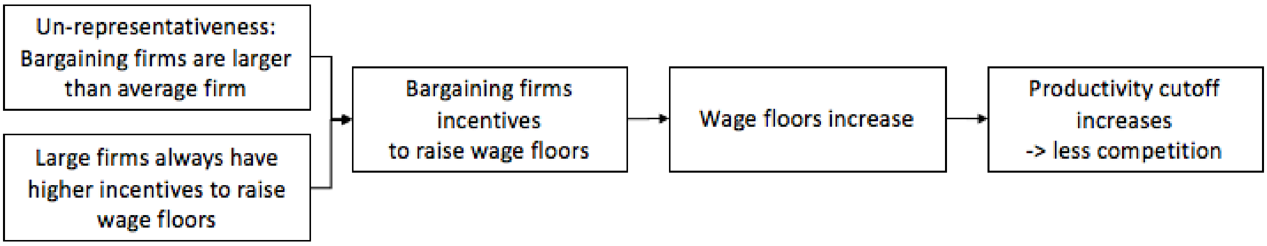
## 1.5 Empirical evidence on the impact of employers federations unrepresentativeness

In this section we explore the empirical validity of the model's predictions, namely the positive relationships between the over-representation of large firms' interests in employers federations and both bargained wage floors and product market concentration. In a first step we document novel stylized facts regarding the positive correlation between federations unrepresentativeness and product market concentration. The theoretical mechanism of our model which explains such a positive correlation is that bargaining firms have higher incentives to raise wage floors when they are larger than the average firm of the industry - ie in unrepresentative federations. In a second step, we provide causal evidence corroborating this mechanism thanks to novel data about employers federations representativeness in France.

### 1.5.1 Testing the model's predictions

The first part of our model establishes that large firms always have higher incentives than small firms to raise the wage floors because it enables them to evict the small firms from the market. However, for that to translate into higher wage floors, bargaining firms must be the large firms. Therefore, the over-representation of large firms in employers federations - that we call unrepresentativeness of federations - is a crucial component to understand the outcomes of the bargaining system. These mechanisms are depicted in Figure 1.7 below.

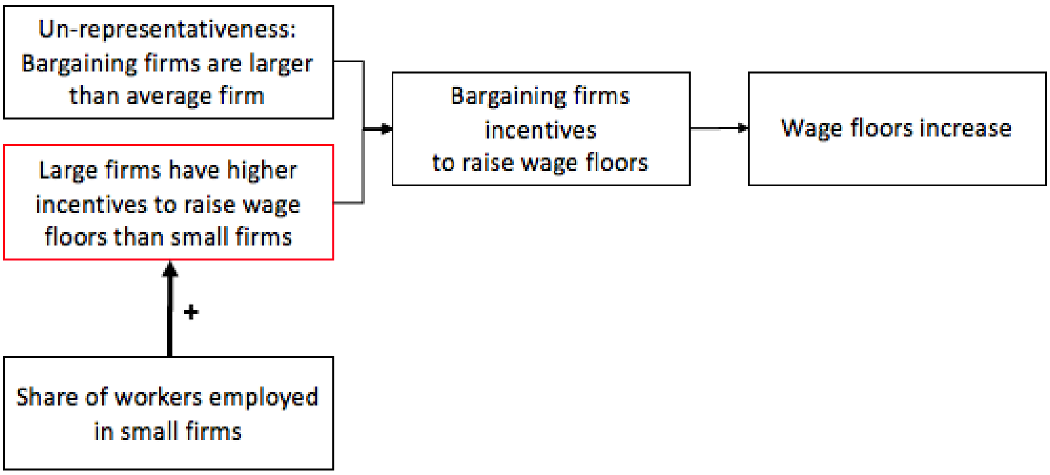
FIGURE 1.7 : Results from our theoretical model




Note : All the mechanisms depicted above are results of our model. One result of our model is that large firms have higher incentives to raise wage floors. The higher the unrepresentativeness of employers federations, the higher the incentives of bargaining firms to raise wage floors.

The main mechanism highlighted in our model is therefore that the higher the over-representation of large firms interests in employers federations, the higher the bargaining firms incentives to raise the wage floor, and thus the higher the wage floor. In other words, bargaining firms have differential incentives to raise wage floors whether they are representative or not of the average firm in the industry. However, this mechanism cannot be directly tested because bargaining firms incentives to raise the wage floor are unobservable by nature.

FIGURE 1.8 : Testing the model's predictions




Note : Because large firms incentives to raise the wage floors are by nature unobserved, we use the share of workers employed in small firms as a proxy. The higher the share of workers employed in small firms, the higher the competition faced by large firms, and therefore the higher their incentives to evict the small firms from the market.

We solve this problem by using a variable shifting the large firms incentives to raise wage floors : the share of workers employed by small firms. The higher the share of workers employed by small firms, the higher the incentives for large firms to increase bargained wage floors. Indeed, the higher this share, the higher the competition from small firms, and thus the higher the large firms incentives to evict small firms from the market. If bargaining firms are the largest firms - ie in unrepresentative industries, then the share of workers employed in small firms should have a positive effect on the bargained wage floors. On the opposite, in representative industries, the share of workers employed by small firms should not have any effect on the bargained wage floors. We build an index capturing the representativeness of the employers federations bargaining at the sector-level and estimate the effect of the share of workers employed by small firms on wage floors for representative and unrepresentative industries.

Because it is highly likely that industries diverge in their wage floors due to some unobserved industry-level factors, such as productivity or unions history, we conduct the analysis *within* industry. We indeed use the fact that within a single industry agreement, several skill-dependent wage floors coexist to compare wage floors within a given industry. This enables us to alleviate several of the most obvious endogeneity concerns by removing any unobserved industry-level heterogeneity.

### 1.5.2 Data

The empirical analysis draws on three French datasets. The novelty of our approach lies in particular in the merge of wage floor data with employers federations' representativeness indices.

**Matched employer-employee data** We first use French matched employer-employee data - DADS Postes - containing information on every French employee over the period 2008-2014 (*Déclarations annuelles de données sociales*). This dataset contains a vector of information on each employee (size of the firm he operates in, annual earnings, annual hours worked, industry he operates in etc.) and includes the administrative number of the industry-level agreement covering the employee.

**Wage floor data** The second data set contains around 48,000 wage floors established between 2008 and 2014, split between the 345 largest industry agreements in terms of number of covered employees. All the data can be freely collected on a French governmental website[24]. This data set contains the name of the industry agreement, its administrative number, the name of unions signing it, the date of the agreement, the date of the enforcement and the negotiated wage floors. Within a given agreement several skill-level wage floors are bargained over. We define a wage floor level as the increasing order of the wage floor within the industry agreement - a higher level meaning both a higher worker qualification and a higher wage floor. Table 1.1 provides an example of job qualifications and corresponding wage floors for Hairdressing in 2013.

Using the number of the industry-level agreement, we merge the two aforementioned datasets - namely DADS Postes and wage floor data. Because in the matched employer-employee dataset wages appear at the annual level, we annualize bargained wage floors[25]. A caveat of DADS Postes is that, though the industry agreement of each worker is known, the wage floor skill-level is not, thus preventing us from perfectly matching each worker to her adequate wage floor level $\times$ industry agreement. To merge the two data sets, we instead make the assumption that the modes of the distribution of the base wages correspond to those of the contractual wages set by collective bargaining (see Cardoso and Portugal (2005) for an empirical justification). Merging the datasets enables us, among other, to compute, for each wage floor, the features of the population of covered workers. We use the 2-digit French classification of socio-professional categories (*PCS-ESE*), which contains 42 occupations, to identify the most frequent occupation of each wage floor.

24. http ://www.legifrance.gouv.fr/initRechConvColl.do
25. In order to annualize wage floors, we simply compute the annual value of a wage floor by averaging its value over the year.

**Domination of employers federations by large firms** In 2017, the results of the employers federations elections were made public by the DARES (*Direction de l'Animation de la Recherche, des Etudes et des Statistiques*) following the March 2014 French law on federations representativeness. 2017 is therefore the first year the representativeness of employers federations is measured in France. The representativeness criterion set by the 2014 law is that each federation represent at least 8% of the total number of firms in the industry affiliated to a federation[26]. It must be noted that this representativeness criterion does not take into account the percentage of affiliated firms : a federation can be called 'representative' even if only a tiny portion of firms are affiliated. Rather than this criterion, we use in our subsequent analysis some statistics on affiliated firms, in particular the average size of bargaining firms as compared to the size distribution within the industry.

**Sample restriction** The final sample covers the 2008-2014 period. We restrict the analysis to full time workers covered by a wage agreement, aged between 18 and 60 years old and working in firms with more than 9 workers.

**German firm-level data set** We have access to a data set that contains all German firms, their size, the industry in which they are operating (5 digit of the NACE classification), over the period 2005-2014 (Establishment History Panel BHP produced by the IAB).

**Danish firm-level data set** We have access to a data set that contains all Danish firms, their size, the industry in which they are operating (5 digit of the NACE classification), over the period 2005-2014 (FIRM data base).

### 1.5.3 Indices construction and descriptive statistics

In this sub-section we construct two indices of interest for testing the model's predictions, namely the share of workers operating in small firms and an index of federations' representativeness.

**Share of workers operating in small firms** We calculate, for each wage floor $i$, time $t$ and industry-level agreement $j$, an index equal to the share of employees operating in small firms as follows :

$$S_{ijt} = \frac{\sum_{k \in J} \mathbb{1}\left(pos_k = i\right) \mathbb{1}\left(N_{kt} \leq 50\right)}{\sum_{k \in J} \mathbb{1}\left(pos_k = i\right)} \tag{1.19}$$

where $J$ denotes the set of workers operating in industry $j$, $k$ refers to a worker, $N_{kt}$ is the size of the firm he is operating in, $pos_k$ is the wage floor covering the individual $k$. Constructing an index at the wage-floor level will allow us to exploit within-industry and year heterogeneity in the subsequent estimations. In line with our model's predictions, the higher this index, the larger the interests of large firms to increase wage floors. We should therefore observe empirically a positive impact of this index on wage floors variations.

**Index of federations domination by large firms** In 2017, DARES published results of employers federations elections. Such results enable to reconstruct for each industry agreement $j$ the average size of the bargaining firms. Comparing this size to the average size of all firms of the industry - ie bargaining and non-bargaining firms - enables to compute an index of domination of federations by large firms. Formally : for each industry $j$ we treat bargaining firms as one representative firm of size $L_j$ and compute the percentile of firm size distribution of the industry corresponding to size $L_j$[27]. The higher the percentile, the larger the bargaining firms as compared to the other firms of the industry.

26. Or that those firms represent at least 8% of workers
27. The average size of bargaining firms in industry $j$ is computed as follows :

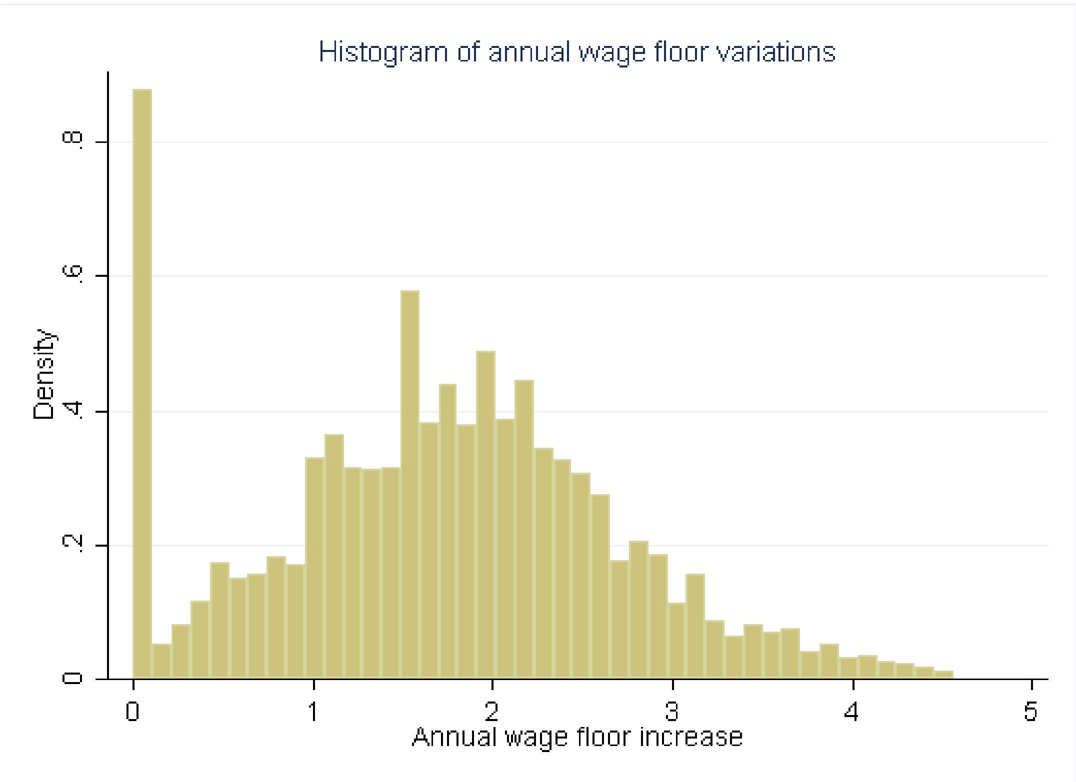
$$L_j = \frac{\sum_{k \in B_j} N_k}{N_{Bj}} \tag{1.20}$$

In the following, we will interchangeably denote this measure the 'unrepresentativeness measure' or the 'measure of large firms domination of federations'.

The index is computed in 2017 and is used to measure the representativeness of employers federations over several years. However, it has been documented that there is an important persistence among employers federations (see Mahoney and Thelen (2010)). On this basis we argue that, if employers federations are not representative in 2017, they were not on the entire period studied.

**Descriptive statistics** Table 1.7 summarizes statistics on the wage-floor-level dataset obtained. The final data include 28,907 observations at the wage floor $i$ $\times$ industry agreement $j$ $\times$ year $t$ level, and comprises 316 distinct industry-level agreements $j$. On average there are 12 wage floors $i$ per industry agreement $j$ and each agreement. The average wage floor annual variation[28] is 1.727%. These wage floors display substantial heterogeneity, as displayed in Figure 1.9. The index of representativeness has a mean value of 0.885 and a standard deviation of 0.119, which ensure that we have enougth variation. We display in Table A1 and Table A2 of the Appendix the ten industries most and least dominated by large firms.

FIGURE 1.9 : Histogram of wage floors variations




Note : This graph displays the histogram of the evolution of wage floors.

where $B_j$ is the set of bargaining firms in industry $j$, $N_k$ the size of firm $k$, $N_{Bj}$ the number of bargaining firms in industry $j$. Then to obtain our unrepresentativeness measure, we calculate the percentile $p_j$ such that $F_j(L_j) = p_j$, with $F_j$ the cumulative distribution function of firm size within industry $j$.

28. We compute the wage floor annual variation as follows :

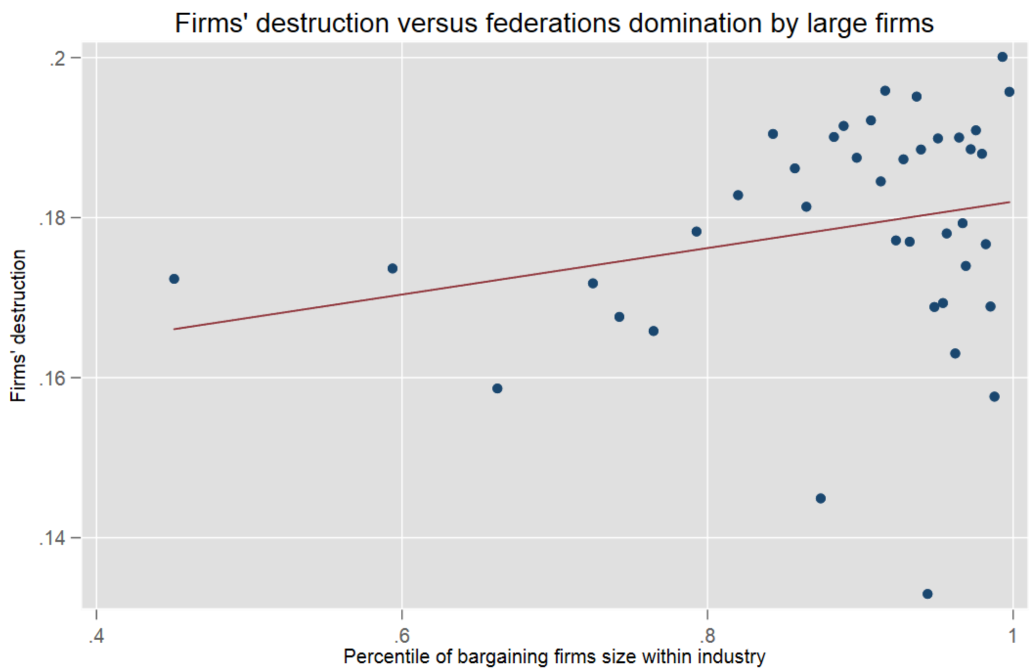
$$\Delta wf_{ijt} = log\left(\frac{wf_{ijt}}{wf_{ijt-1}}\right) * 100 \tag{1.21}$$

### 1.5.4 Stylized facts

We present in a first step simple correlations between the employers federations unrepresentativeness and industry's outcomes. Our model predicts that when only large firms' interests are accounted for by employers federations, sector-level agreements are used to impede small firms to exist. Indeed, large firms use this legislative framework to collude in order to secure their position, and to increase their market share. The following stylized facts bring evidence of the existence of such a restriction of competition.

**Representativeness and small firms destruction** Proposition 5.2 first states that the higher the over-representation of large firms interests, the higher the productivity cutoff. We exhibit in Figure 1.10 the positive correlation between unrepresentativeness and small firms destruction. As expected, the more interests of large firms are taken into account, the higher the probability that small firms are driven out of the market. This highlights the use of sector-level agreements by large firms as a barrier to entry.

FIGURE 1.10 : Large firms revenues and federations un-representativeness



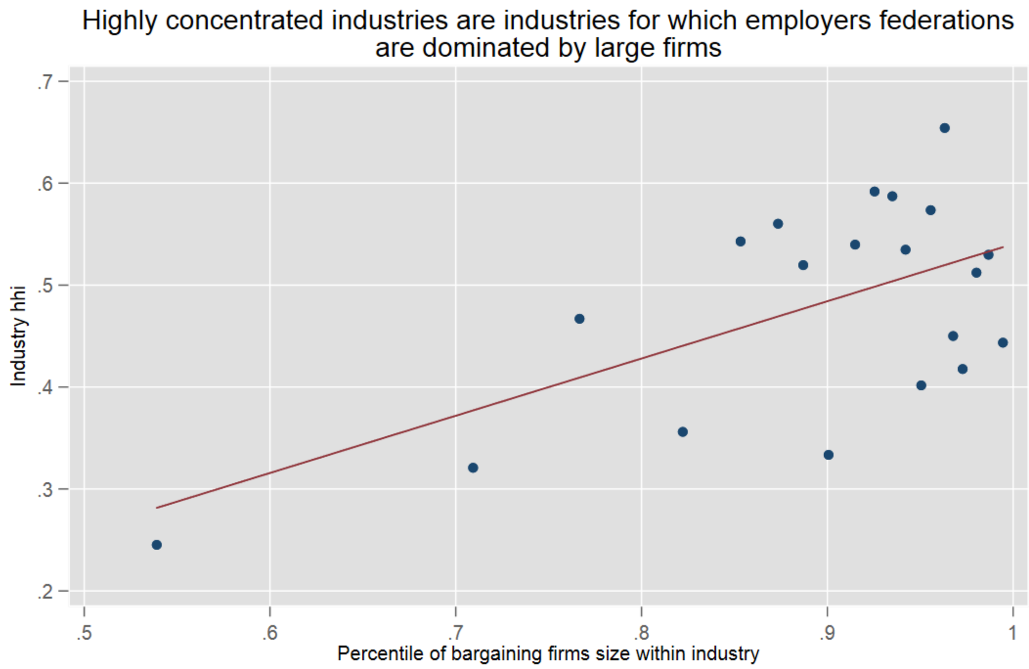

Note : This graph displays the correlation between the proportion of small firms destruction and the unrepresentativeness of the industry. The x-axis represents an index of domination of employers federations by large firms : we compute for each industry the average size of bargaining firms and we calculate the percentile within the industry size distribution that corresponds to this average size. The y-axis is the ratio, computed for each year and each industry, of firms with less than 50 employees that are destructed over the total number of firms with less than 50 employees.

**Representativeness and industry concentration** Secondly, our theoretical model, in Proposition 5.2, suggests that the higher the over-representation of large firms in employers federations, the lower the product market concentration. We proxy product market competition by the industry Herfindahl index[29], denoted *hhi* in the following. The higher the *hhi*, the higher the concentration of the industry. Figure 1.11 exhibits the positive correlation between the *hhi* and the over-representation of large firms interests in federations. Moreover, the same Proposition implies

29. The Herfindahl index for an industry $j$ is constructed as the sum of the squared market shares of firms $i$ of the industry. It is algebraically as follows : $\sum_i \left(\frac{sales_i}{\sum_i sales_i}\right)^2$

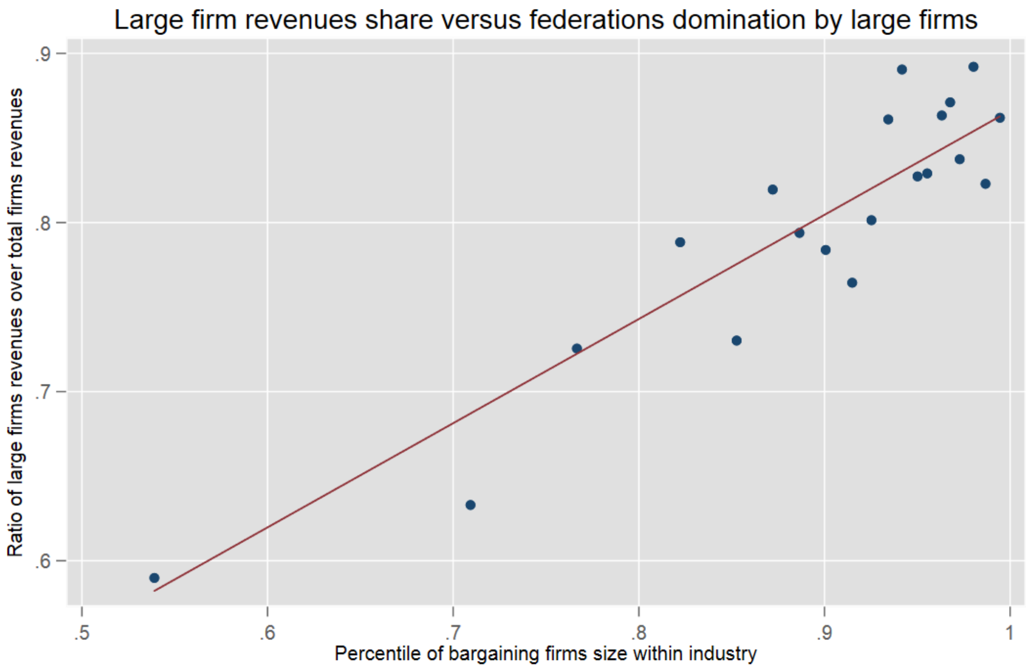
that large firms revenues increase with the unrepresentativeness of employers federations. We display in Figure 1.12 the correlation between unrepresentativeness and the share of the industry's revenues captured by large firms.

FIGURE 1.11 : Industry concentration and federations un-representativeness




Note : This graph displays the correlation between industry concentration, as measured by the Herfindahl index (hhi) of sales in each industry, and the unrepresentativeness of the industry. The x-axis represents an index of domination of employers federations by large firms : we compute for each industry the average size of bargaining firms and we calculate the percentile within the industry size distribution that corresponds to this average size.

FIGURE 1.12 : Large firms revenues and federations un-representativeness




Note : This graph displays the correlation between the share of large firms revenues in total industry revenues and the unrepresentativeness of the industry. The x-axis represents an index of domination of employers federations by large firms : we compute for each industry the average size of bargaining firms and we calculate the percentile within the industry size distribution that corresponds to this average size. The y-axis is the ratio of large firms revenues (large firms being firms over the 75th percentile in employment level) in total industry revenues.

### 1.5.5 Estimation strategy

The stylized facts displayed above are indicative about the correlation between federations' representativeness and industry concentration. The theoretical mechanism explaining this correlation is that bargaining firms have differential incentives to raise wage floors whether they are representative or not of the average firm in the industry. We test this theoretical prediction by studying the effect of the share of small firms on bargained wages, both for representative and unrepresentative industries.

**OLS estimation** In order to test the validity of theoretical conclusions, we test whether in unrepresentative industries the share of workers operating in small firms is positively correlated to wage floor variations. Formally, we estimate the following equation :

$$\Delta wf_{ijt} = \beta_0 + \gamma_1 S_{ijt} \times 1(U_j > \overline{U}_j) + \gamma_2 S_{ijt} \times 1(U_j < \overline{U}_j) + \theta_o + \zeta_{jt} + \epsilon_{ijt} \tag{1.22}$$

Where $\Delta wf_{ijt}$ is the evolution of the wage floor $i$, negotiated as part of the industry level agreement $j$, between year $t$ and $t-1$. $S_{ijt}$ denotes the share of workers in wage floor level $i$ and industry agreement $j$ operating in small firms[30]. $U_j$ is our industry-level indicator of federations unrepresentativeness and $\overline{U}_j$ the median value of unrepresentativeness in our sample. Industries with a high value of $U_j$ are therefore industries whose employers federations over-represent large firms the most - ie unrepresentative industries. $\gamma_1$ therefore captures the effect of the share of workers employed in small firms for unrepresentative industries, and $\gamma_2$ for representative industries. $\theta_o$ and $\zeta_{jt}$ respectively denote the occupation fixed effects and the industry-level $\times$ year fixed effects, and $\epsilon_{ijt}$ the error term.

One should note that looking at wage floor variations, rather than wage floor levels, is crucial for the analysis as it mitigates the potential reverse causality issue. The theoretical model indeed states that high wage floors lead to an eviction of small firms, thus inducing a negative correlation between wage floor levels and the number of small firms. However, this effect plausibly unfolds in the medium or long term. In the short term, as the share of small firms employees increases, large firms incentives to raise wage floors increase as well : this should induce a positive correlation between wage floor variations and the share of small firms.

To consistently estimate $\hat{\gamma}_1$ and $\hat{\gamma}_2$, one requires exogeneity, ie

$$E(\epsilon_{ijt} | S_{ijt} \times 1(U_j > \overline{U}_j), S_{ijt} \times 1(U_j \leq \overline{U}_j)) = 0 \tag{1.23}$$

However, it is highly likely that $E(\epsilon_{ijt} | S_{ijt}) \neq 0$. Indeed, endogeneity may stem from the following sources. First, industry-level productivity shocks could be correlated with both the share of workers employed by small firms and the negotiated wage floors. To alleviate this concern, we add industry agreement $\times$ year fixed effects to remove both time-constant and time-varying unobserved industry-level heterogeneity. We therefore exploit the within industry $\times$ year variation, namely the variation across wage floor skill-levels $i$. Yet, the wage floor skill-level $i$ - ie the ranking of the given wage floor amongst all wage floors of an industry agreement and year $jt$ - is naturally correlated to the socio-professional category of the worker. Indeed, the higher the wage floor skill-level $i$, the higher the hierarchy of the worker in the firm. Within industry $\times$ year, the unobserved productivity of an occupation could impact both the share of workers in small firms and the negotiated wage floors $i$. To mitigate this issue, we add socio-professional category fixed effects $\theta_o$ that broadly capture the unobserved variables affecting the demand for some type of workers.

**2SLS estimation** Despite the inclusion of various fixed effects, the OLS estimation may still suffer from endogeneity bias. For instance, the model predicts that the wage floor level has a negative impact on small firms survival,

30. For a formal definition of $S_{ijt}$, see equation 1.19

and therefore on the share of workers employed by small firms. The inclusion of fixed effects does not fix this reverse causality issue. The resulting negative correlation between past wage floor variations, uncontrolled for, and the current share of workers employed in small firms would in turn create an omitted variable bias.

In order to circumvent this endogeneity issue, we construct "shift-share" variables (Bartik (1991), Borusyak and Jaravel (2017) and Goldsmith-Pinkham et al. (2018)) thanks to the share of workers employed by small firms in Denmark and Germany.[31]. Because both $S_{ijt} \times 1(U_j > \overline{U}_j)$ and $S_{ijt} \times 1(U_j < \overline{R}_j)$ are endogenous in equation 1.22, we need to construct at least two instrumental variables. To construct the instruments, we exploit the co-existence within industry agreement $j$ of several 3-digit level sectors $s$. Workers covered by a given wage floor $i$ within industry agreement $j$ may pertain to different sectors $s$[32]. We compute for each 3-digit level sector $s$, country $c \in (D, G)$ and year $t$, the share $T_{cst}$ of workers working in small firms. We then compute, for each country $c \in (D, G)$, the instrument $I_{cijt}$ for each wage floor $i$ within industry agreement $j$ and year $t$ as the weighted average of these sectoral shares. For each country $c \in (D, G)$, the instrument writes :

$$I_{cijt} = \sum_{s=1}^{S} \omega_{ijst} T_{cst} \tag{1.24}$$

where $\omega_{ijst}$ is the share of French workers of wage floor $i$ within industry agreement $j$ in year $t$ pertaining to the 3-digit sector $s$, $T_{cst}$ the share in country $c$, sector $s$ and year $t$ of workers working in small firms and $S$ the total number of sectors.

Our aim is to instrument $S_{ijt} \times 1(U_j > \overline{U}_j)$ and $S_{ijt} \times 1(U_j < \overline{U}_j)$ by the Danish and German instruments $I_{Dijt}$ and $I_{Gijt}$. These Bartik-like instruments thus represent the propensity of a particular skill level $i$ within agreement $j$ to be demanded by small firms. For the instrument to be valid, two conditions must hold : the relevance condition and the exclusion restriction assumption.

The relevance condition states that each instrument $I_{cijt}$ should be correlated with the instrumented variables $S_{ijt} \times 1(U_j > \overline{U}_j)$ and $S_{ijt} \times 1(U_j < \overline{U}_j)$. The intuition behind the construction of our instrument is that sectoral firm size distributions are correlated across countries through a common production technology, thereby inducing a correlation between $I_{cijt}$ and $S_{ijt}$. This relevance assumption can be directly tested : we display in columns (3) and (5) of Table 1.2 the Kleibergen-Paap test statistics for weak instruments. Because tests for weak instruments in a multiple endogenous regressors setting have not yet been formally derived (Andrews et al. (2018)), we report in the robustness section an Anderson-Rubin test (Anderson et al. (1949)), robust to weak instruments.

The exclusion restriction writes : $E(\epsilon_{ijt} | I_{Dijt}, I_{Gijt}) = 0$. It states that the errors from the equation of interest - equation 1.22 - should be independent from the share of workers employed by small firms in Denmark and Germany. In economic terms : we want the Danish sectoral firm size distribution to be uncorrelated with any unobserved factor affecting the French wage bargaining outcomes.

Two conditions are necessary for the exclusion restriction to hold. First, Danish and German sectoral shares $T_{st}$ should not be correlated with a given wage floor-industry agreement pair $(i, j)$ unobserved characteristics. A pair $(i, j)$'s unobserved characteristics could include among others comparative advantage, productivity or past bargaining outcomes. Naturally Danish and German sectoral shares $T_{st}$ are correlated with industry $j$ unobserved comparative advantage. However, industry $\times$ year fixed effects capture such an unobserved comparative advantage, thereby

31. We chose Denmark and Germany for our instrumental strategy mainly because of data availability and precision.

32. For instance, industry agreement number 18 - textile industry - covers among others workers from the 'weaving' sector (sector number 1320Z), the 'textile retailing for specialized shops' sector (sector number 4751Z) and the 'pre-press' sector (sector number 1813Z).
It must be noted though that 3-digit sectors $s$ are not nested within industry agreement $j$, which differentiates our instrument from standard Bartik instruments.

alleviating the endogeneity issue. Endogeneity would arise if a skill-level $\times$ industry competitive advantage existed, which appears relatively implausible (Gaubert and Itskhoki (2018), Melitz (2003)). Another potential threat to identification could be the existence of a technological shock hitting small firms that would be common to France and the country of interest (either Denmark or Germany). Such technological shock would induce a change in the French labor demand by small firms, thus probably changing the wage floors, and would be correlated to both the Danish (for instance) share of workers employed in small firms. We alleviate this concern by controlling for the evolution of the share of workers employed in small firms. Controlling for such evolutions indeed enables to capture labor demand shocks that would affect proportionally more small firms. The conjunction of foreign - Danish and German - data, industry $\times$ year fixed effects and controls of evolution of the share of workers employed in small firms therefore mitigates the concern that sectoral averages $T_{st}$ could be correlated to a given wage floor-industry agreement pair $(i, j)$ unobserved characteristics.
Second, the weights $w_{ijst}$ capture the sectoral heterogeneity of each wage floor-industry agreement pair $(i, j)$. In order for the exclusion restriction to hold, such heterogeneity should not capture other factors that might affect the wage bargaining outcomes. Reverse causality in particular could lead to biased estimates. A wage bargaining agreement in year $t-1$ for wage floor $i$ and industry $j$ that increases the wage floor level might have different employment consequences on sectors $s$ and $s'$ in year $t$. For example, if sector $s$ is initially less productive than sector $s'$, sector $s$ suffers from a greater employment loss in $t$ as compared to sector $s'$. Such differential employment consequences would lead to a decrease of the weight $w_{ijst}$ in year $t$. Hence, the sectoral heterogeneity of each wage floor-industry agreement pair $(i, j)$ may capture past wage bargaining outcomes, and may thus affect the wage bargaining outcome in year $t$. To alleviate this concern, we use lagged values of the instruments $I_{D,ijt}$ and $I_{G,ijt}$.

One caveat is that $I_{Dijt}$ and $I_{Gijt}$ are highly correlated - because they are constructed with the same weights $w_{ijst}$ -, which may lead to a weakly identified model. To reduce the correlation between our two instruments, we construct the German instrument thanks to 3-digit sectors $s$, while we build the Danish instrument with 2-digit sectors $s$[33]. This guarantees that our two instruments add sufficiently different variation in order to identify the effects of interest.

### 1.5.6 Results

Table 1.2 displays IV estimations of equation 1.22, ie the effect of the share of workers working in small firms on wage floor variations for representative and unrepresentative industries. Column (1) displays the results when controlling only for industry $\times$ year fixed effects, column (2) adds occupation fixed-effects, column (3) controls for the lagged value of the wage floor evolution and column (4) for the second lag of the wage floor evolution. Regardless of the controls and fixed effects used, the share of workers operating in small firms has a significant positive effect on wage floor variations only for unrepresentative industries. Column (4) indicates that, for those industries, an increase of the share from 0 to 1 increases the wage floor variations by 1.07 percentage points. For representative industries, no significant effect is found thereby confirming the role of unrepresentativeness for wage floor variations.

33. Data availability precludes us from testing the opposite, ie from constructing the German instrument thanks to 2-digit sectors and the Danish instrument with 3-digit sectors

TABLE 1.2 : The role of unrepresentativeness on wage floor increase (in %)

| | **Wage floor increase (%)** | | | | |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| | IV | IV | IV | IV | IV |
| | t-1 | t-1 | t-1 | t-1 | t-1 |
| $S_{ijt} \times 1(U_j > \overline{U}_j)$ | 1.094** | 1.089** | 1.068** | 1.071** | 0.855* |
| | (0.409) | (0.409) | (0.409) | (0.410) | (0.442) |
| $S_{ijt} \times 1(U_j < \overline{U}_j)$ | -0.132 | -0.0144 | 0.162 | 0.122 | 0.167 |
| | (0.509) | (0.513) | (0.540) | (0.514) | (0.767) |
| $\Delta S_{ijt}$ | | | | -0.00771 | -0.00644 |
| | | | | (0.0116) | (0.0148) |
| $\Delta S_{ijt-1}$ | | | | | 0.00558 |
| | | | | | (0.00764) |
| Cragg-Donald F-stat | 76.08 | 82.39 | 75.70 | 89.56 | 41.57 |
| Kleibergen-Paap F-stat | 4.88 | 5.58 | 5.98 | 7.13 | 4.08 |
| # obs | 9445 | 9440 | 9438 | 9370 | 9252 |
| Occupation FE | No | Yes | No | No | No |
| Occupation × Year FE | No | No | Yes | Yes | Yes |
| Industry × Year FE | Yes | Yes | Yes | Yes | Yes |

Note : The dependent variable is the wage floor variation between $t-1$ and t. $S_{ijt}$ denotes the share of workers employed in small firms for the skill-level position $i$, industry $j$ and year $t$. $1(U_j > \overline{U}_j)$ is a dummy equal to one when the industry $j$ is less representative than the median industry : $U_j$ is a measure of unrepresentativeness (the larger $U_j$, the higher the domination of the employers federations by large firms), and $\overline{U}_j$ is the median unrepresentativeness. Columns (1) exhibits the IV estimation of equation 1.22 when only industry × year fixed effects are used, columns (2) and (3) display the results when adding respectively occupation and occupation × year fixed effects, column (4) exhibits the results when controlling for the evolution of the share of workers employed in small firms and column (5) when controlling for both the evolution and lagged evolution of the share of workers employed in small firms. Two instruments are used in all regressions : the lagged value of the Danish and German instruments. The Danish and German instruments are constructed as Bartik-like instrument thanks to the share of workers employed in small firms in each sector in Denmark and Germany. Standard errors are clustered at the industry × year level. Standard errors are given in brackets.*, **, and *** denote statistical significance at 10, 5 and 1%.

### 1.5.7 Robustness

We conduct a full range of robustness checks to confirm the validity of our findings.

First, we address the issue of potentially-weak instruments. To the best of our knowledge, tests for weak identification in case of multiple endogenous regressors and heteroskedastic errors have yet not been formally derived (Olea and Pflueger (2013), Andrews et al. (2018)). However, because our model is just-identified, we can provide confidence sets that remain valid whether or not the instruments are weak. Namely, we perform an Anderson-Rubin test to test whether our two potentially-weakly identified endogenous regressors are jointly significant (Andrews et al. (2018)). The p-value of the Anderson-Rubin test for joint insignificance being equal to 0.030[34], we reject the null hypothesis of joint insignificance, thus confirming that the effect found in our main specifications is not driven by weak instruments bias.

Second, we perform the IV estimation of equation 1.22 by using the second lag of both instruments. We report such results in Table 1.3. As in the main specification, the share of workers employed in small firms has a significant and positive impact only for unrepresentative industries. We also report results with no lag in Table 1.4.

Third, we use several different definitions of unrepresentative industries : columns (1) and (2) of Table 1.5 display the results defining the unrepresentative industries not as the industries less representative than the median industry, but less representative than two thirds of the industries - ie with another unrepresentativeness threshold $\overline{U}_j$ . Columns (3) and (4) of Table 1.5 display the results using the ratio of bargaining firm size over total firm size within the industry as the unrepresentativeness measure. The higher this measure, the larger the bargaining firms as compared to the other firms of the industry, therefore the larger the domination of the employers federations by large firms. Defining representative industries with these criteria does not substantially change the results : in all the estimations, we find a significant and positive effect of the share of workers employed in small firms only in unrepresentative industries. The magnitudes of the estimates vary only little.

Fourth, we use an alternative definition of small firms. Throughout the analysis we consider a small firm as a firm with less than 50 employees. We perform the estimations when considering a firm small when having less than 100 employees. We display in Table 1.6 the estimates when using this new definition. As for our previous definition, we display the results with a various range of controls and fixed effects. The results are not sensitive at all to the change of small firm definition : the effect of the share of workers employed in small firms is once again only significant for unrepresentative industries, and the magnitudes are very similar to the one found with the main specification - ie very similar to Table 1.2.

34. The p-value of the Wald test, ie not robust to weak instruments, is slighlty lower and equal to 0.022.

TABLE 1.3 : The role of representativeness on wage floor increase (in %) - robustness 1 - using second lag of instrument

| | Wage floor increase (%) | | | | |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| | IV | IV | IV | IV | IV |
| | t-2 | t-2 | t-2 | t-2 | t-2 |
| $S_{ijt} \times 1(U_j > \overline{U}_j)$ | 0.929* | 0.804 | 0.849* | 0.901* | 0.908* |
| | (0.532) | (0.509) | (0.496) | (0.505) | (0.506) |
| $S_{ijt} \times 1(U_j < \overline{U}_j)$ | -0.381 | -0.209 | -0.136 | -0.105 | -0.0869 |
| | (1.002) | (0.916) | (0.876) | (0.861) | (0.852) |
| $\Delta S_{ijt}$ | | | | -0.00237 | -0.00174 |
| | | | | (0.0165) | (0.0178) |
| $\Delta S_{ijt-1}$ | | | | | 0.00695 |
| | | | | | (0.00775) |
| Kleibergen-Paap | 1.53 | 1.98 | 2.22 | 3.15 | 3.04 |
| # obs | 9451 | 9447 | 9444 | 9323 | 9278 |
| Occupation FE | No | Yes | No | No | No |
| Occupation × Year FE | No | No | Yes | Yes | Yes |
| Industry × Year FE | Yes | Yes | Yes | Yes | Yes |

Note : The dependent variable is the wage floor variation between $t-1$ and t. $S_{ijt}$ denotes the share of workers employed in small firms for the skill-level position $i$, industry $j$ and year $t$. $1(U_j > \overline{U}_j)$ is a dummy equal to one when the industry $j$ is less representative than the median industry : $U_j$ is a measure of unrepresentativeness (the larger $U_j$, the higher the domination of the employers federations by large firms), and $\overline{U}_j$ is the median unrepresentativeness. Columns (1) exhibits the IV estimation of equation 1.22 when only industry × year fixed effects are used, columns (2) and (3) display the results when adding respectively occupation and occupation × year fixed effects, column (4) exhibits the results when controlling for the evolution of the share of workers employed in small firms and column (5) when controlling for both the evolution and lagged evolution of the share of workers employed in small firms. Two instruments are used in all regressions : the second lagged value of the Danish and German instruments. The Danish and German instruments are constructed as Bartik-like instrument thanks to the share of workers employed in small firms in each sector in Denmark and Germany. Standard errors are clustered at the industry × year level. Standard errors are given in brackets.*, **, and *** denote statistical significance at 10, 5 and 1%.

TABLE 1.4 : The role of representativeness on wage floor increase (in %) - robustness 1 - using no lag for instrument

| | Wage floor increase (%) | | | | |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| | IV | IV | IV | IV | IV |
| | t | t | t | t | t |
| $S_{ijt} \times 1(U_j > \overline{U}_j)$ | 0.873** | 0.738** | 0.735** | 0.798** | 0.809** |
| | (0.385) | (0.368) | (0.358) | (0.371) | (0.350) |
| $S_{ijt} \times 1(U_j < \overline{U}_j)$ | -0.206 | -0.137 | -0.159 | -0.179 | -0.148 |
| | (0.283) | (0.266) | (0.268) | (323) | (0.414) |
| $\Delta S_{ijt}$ | | | | -0.000618 | -0.000932 |
| | | | | (0.00896) | (0.0106) |
| $\Delta S_{ijt-1}$ | | | | | 0.00659 |
| | | | | | (0.00617) |
| Kleibergen-Paap | 11.55 | 14.36 | 15.47 | 12.15 | 8.20 |
| # obs | 9451 | 9491 | 9487 | 9485 | 9238 |
| Occupation FE | No | Yes | No | No | No |
| Occupation × Year FE | No | No | Yes | Yes | Yes |
| Industry × Year FE | Yes | Yes | Yes | Yes | Yes |

Note : The dependent variable is the wage floor variation between $t-1$ and t. $S_{ijt}$ denotes the share of workers employed in small firms for the skill-level position $i$, industry $j$ and year $t$. $1(U_j > \overline{U}_j)$ is a dummy equal to one when the industry $j$ is less representative than the median industry : $U_j$ is a measure of unrepresentativeness (the larger $U_j$, the higher the domination of the employers federations by large firms), and $\overline{U}_j$ is the median unrepresentativeness. Columns (1) exhibits the IV estimation of equation 1.22 when only industry × year fixed effects are used, columns (2) and (3) display the results when adding respectively occupation and occupation × year fixed effects, column (4) exhibits the results when controlling for the evolution of the share of workers employed in small firms and column (5) when controlling for both the evolution and lagged evolution of the share of workers employed in small firms. Two instruments are used in all regressions : the current values of the Danish and German instruments. The Danish and German instruments are constructed as Bartik-like instrument thanks to the share of workers employed in small firms in each sector in Denmark and Germany. Standard errors are clustered at the industry × year level. Standard errors are given in brackets.*, **, and *** denote statistical significance at 10, 5 and 1%.

TABLE 1.5 : The role of representativeness on wage floor increase (in %) - robustness 2 - using other definitions of representativeness $\widetilde{U_j}$

| | Wage floor increase (%) | | | |
|---|---|---|---|---|
| | (1)<br>IV | (2)<br>IV | (3)<br>IV | (4)<br>IV |
| | measure 1<br>of repres<br>t-1 | measure 1<br>of repres<br>t-2 | measure 2<br>of repres<br>t-1 | measure 2<br>of repres<br>t-2 |
| $S_{ijt} \times 1(U_j > \overline{U}_j)$ | 1.245** | 1.103 | 1.115** | 0.919* |
| | (0.523) | (0.675) | (0.438) | (0.519) |
| $S_{ijt} \times 1(U_j < \overline{U}_j)$ | 0.123 | -0.196 | 0.0835 | -0.129 |
| | (0.524) | (0.982) | (0.543) | (0.893) |
| $\Delta S_{ijt}$ | -0.00693 | 0.000264 | -0.00917 | -0.00393 |
| | (0.0121) | (0.0191) | (0.0112) | (0.0155) |
| Kleibergen-Paap | 6.51 | 2.13 | 6.13 | 2.87 |
| # obs | 9370 | 9323 | 9370 | 9323 |
| Occupation × Year FE | Yes | Yes | Yes | Yes |
| Industry × Year FE | Yes | Yes | Yes | Yes |

Note : The dependent variable is the wage floor variation between $t-1$ and t. $S_{ijt}$ denotes the share of workers employed in small firms for the skill-level position $i$, industry $j$ and year $t$. $1(U_j > \overline{U}_j)$ is a dummy equal to one when the industry $j$ is less representative than the median industry : $U_j$ is a measure of unrepresentativeness (the larger $U_j$, the higher the domination of the employers federations by large firms), and $\overline{R}_j$ is the median unrepresentativeness. Columns (1) and (2) exhibit the IV estimation of equation 1.22 when considering unrepresentative industries as industries in the top tercile of the unrepresentativeness measure. Columns (3) and (4) exhibit the IV estimation of equation 1.22 using as an unrepresentativeness measure the ratio of the average bargaining firm size and the average firm size in the industry. The instruments used are Danish and German instruments are constructed as Bartik-like instrument thanks to the share of workers employed in small firms in each sector in Denmark and Germany. Industry × Year fixed effects and occupation fixed effects are included in all regressions. Standard errors are clustered at the industry × year level. Standard errors are given in brackets.*, **, and *** denote statistical significance at 10, 5 and 1%.

TABLE 1.6 : The role of representativeness on wage floor increase (in %) - robustness 3 - using different definition of small firm

| | Wage floor increase (%) | | | | |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| | IV | IV | IV | IV | IV |
| | t-1 | t-1 | t-1 | t-1 | t-1 |
| $S_{ijt} \times 1(U_j > \overline{U}_j)$ | 0.994** | 0.975** | 0.936** | 0.935** | 0.742** |
| | (0.392) | (0.374) | (0.371) | (0.373) | (0.368) |
| $S_{ijt} \times 1(U_j < \overline{U}_j)$ | 0.0575 | 0.249 | 0.517 | 0.439 | 0.526 |
| | (0.740) | (0.756) | (0.805) | (0.756) | (0.916) |
| $\Delta S_{ijt}$ | | | | -0.0219 | -0.0227 |
| | | | | (0.0185) | (0.0204) |
| $\Delta S_{ijt-1}$ | | | | | -0.00640 |
| | | | | | (0.00585) |
| Kleibergen-Paap | 4.16 | 5.32 | 5.05 | 5.67 | 3.79 |
| # obs | 9445 | 9440 | 9438 | 9415 | 9322 |
| Occupation FE | No | Yes | No | No | No |
| Occupation × Year FE | No | No | Yes | Yes | Yes |
| Industry × Year FE | Yes | Yes | Yes | Yes | Yes |

Note : The dependent variable is the wage floor variation between $t-1$ and t. $S_{ijt}$ denotes the share of workers employed in small firms for the skill-level position $i$, industry $j$ and year $t$. $1(U_j > \overline{U}_j)$ is a dummy equal to one when the industry $j$ is less representative than the median industry : $U_j$ is a measure of unrepresentativeness (the larger $U_j$, the higher the domination of the employers federations by large firms), and $\overline{U}_j$ is the median unrepresentativeness. Columns (1), (2) and (3) exhibit respectively the OLS estimation of equation 1.22, the IV estimation of equation 1.22 using the Danish instrument, and the IV estimation of equation 1.22 using the German instrument. The Danish and German instruments are constructed as Bartik-like instrument thanks to the share of workers employed in small firms in each sector in Denmark and Germany. Industry × Year fixed effects and occupation fixed effects are included in all regressions. Standard errors are clustered at the industry × year level. Standard errors are given in brackets.*, **, and *** denote statistical significance at 10, 5 and 1%.

## 1.6 Conclusion

This paper sheds light on the effect of industry-level wage bargaining on product market competition. We first show theoretically that large firms use collective bargaining as a tool to drive small firms out of the market, thereby decreasing employment and consumers' utility. Furthermore, the higher the over-representation of large firms in employers federations, the higher these cartel effects. Indeed, the larger the domination of large firms, the larger the bargained wage floors, which entail in turn an increased eviction of small firms from the product and labor markets.

In order to confirm those theoretical predictions, we use French administrative data and wage floors information. First, we study the cartel effect by looking at the impact of the share of small firms employees among covered workers on the bargained wage floors increases. The higher this share, the higher the incentives for large firms to raise wage floors. Indeed, when this share is high, the negative impact of wage floors is borne proportionally more by small firms. On this basis, we compute, for each wage floor, the ratio of covered workers operating in small firms to the total number of covered workers. We find that it has a positive and significant effect on the percentage of annual increase of the wage floors. Second, our novel indices of the large firms' domination within federations prove to be positively correlated with the variation of negotiated wages, thereby corroborating the model's predictions. We next devise an instrumental strategy that will enable us to move from correlational to causal evidence.

Consequently, the representativeness of employers federations may be an interesting lever for policy-makers who wish to increase competitiveness in particular sectors. We also encourage policy-makers to further develop their data collection regarding federations representativeness.

## 1.7 Tables and figures

TABLE 1.7 : Summary statistics

| Variable | # Obs. | Mean | Std | Min | Max | Percentiles | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | $25^{th}$ | $50^{th}$ | $75^{th}$ |
| Wage floor annual evolution(%) | 28907 | 1.727 | 0.993 | 0 | 4.495 | 1.091 | 1.737 | 2.373 |
| Share of employees operating in a small firm | 28907 | 0.378 | 0.281 | 0 | 1 | 0.153 | 0.316 | 0.561 |
| Danish Instrument | 28907 | 0.482 | 0.178 | 0 | 1 | 0.365 | 0.465 | 0.614 |
| German Instrument | 28907 | 0.470 | 0.209 | 0 | 1 | 0.288 | 0.443 | 0.660 |
| Index of representativeness | 132 | 0.885 | 0.119 | 0.321 | 0.996 | 0.850 | 0.932 | 0.982 |
| Number of wage floors per agreement | 316 | 12.337 | 6.251 | 2 | 32 | 7 | 11 | 16 |

Notes : The wage floor annual evolution represents the evolution, reported as a percentage, of the average value over a year of the wage floor. The share of employees operating in a small firm is computed over the entire population covered by a wage floor and is given by equation 1.19. Danish and German instrument are given by equation 1.24. The index of representativeness is the percentile of firm size distribution of the industry corresponding to size the firms negotiating at the sector-level. The number of wage floors per agreement corresponds to the number of wage floor for each industry-level agreement.

# Appendix

## 1.A Collective bargaining in OECD countries

FIGURE 1.A.1 : Dashboard of collective bargaining systems, 2015

Countries ordered by predominant level of collective bargaining, degree of centralisation, co-ordination, trade union density in the private sector, collective bargaining coverage, employer organisation density and quality of labour relations

| | Predominant level | Degree of centralisation/ decentralisation | Co-ordination | Trade union density in the private sector | Employer's organisation density | Collective bargaining coverage rate | Quality of labour relations |
|---|---|---|---|---|---|---|---|
| Costa Rica | Company | Decentralised | No | Less than 5% | .. | 5-10% | .. |
| Colombia | Company | Decentralised | No | Less than 5% | .. | 5-10% | Low |
| Turkey | Company | Decentralised | No | Less than 5% | 20-30% | 5-10% | Low |
| Estonia | Company | Decentralised | No | Less than 5% | 20-30% | 10-20% | High |
| Lithuania | Company | Decentralised | No | 5-10% | 10-20% | 5-10% | Medium |
| Mexico | Company | Decentralised | No | 5-10% | .. | 10-20% | Low |
| United States | Company | Decentralised | No | 5-10% | .. | 10-20% | Medium |
| Korea | Company | Decentralised | No | 5-10% | 10-20% | 10-20% | Low |
| Poland | Company | Decentralised | No | 5-10% | 20-30% | 10-20% | Low |
| Latvia | Company | Decentralised | No | 5-10% | 40-50% | 10-20% | Medium |
| Hungary | Company | Decentralised | No | 5-10% | 40-50% | 20-30% | Medium |
| Chile | Company | Decentralised | No | 10-20% | .. | 10-20% | Medium |
| New Zealand | Company | Decentralised | No | 10-20% | .. | 10-20% | Medium |
| Canada | Company | Decentralised | No | 10-20% | .. | 20-30% | Medium |
| United Kingdom | Company | Decentralised | No | 10-20% | 30-40% | 20-30% | Medium |
| Czech Republic | Company | Decentralised | No | 10-20% | 60-70% | 40-50% | High |
| Ireland | Company | Decentralised | No | 20-30% | 50-60% | 40-50% | Medium |
| Japan | Company | Decentralised | High | 10-20% | .. | 10-20% | High |
| Israel | Company/Sectoral | Decentralised | No | 10-20% | .. | 20-30% | Low |
| Slovak Republic | Company/Sectoral | Decentralised | No | 10-20% | 30-40% | 20-30% | Medium |
| Greece | Company/Sectoral | Decentralised | No | 10-20% | 40-50% | 40-50% | Low |
| Australia[a] | Company/Sectoral | Decentralised | No | 10-20% | .. | 50-60% | Low |
| Luxembourg | Company/Sectoral | Decentralised | No | 20-30% | 80-90% | 50-60% | High |
| Spain | Sectoral | Organised decentralised | Low | 10-20% | 70-80% | 70-80% | Low |
| Switzerland | Sectoral | Organised decentralised | High | 10-20% | .. | 40-50% | High |
| Germany | Sectoral | Organised decentralised | High | 10-20% | 50-60% | 50-60% | High |
| Netherlands | Sectoral | Organised decentralised | High | 10-20% | 80-90% | 80-90% | High |
| Austria | Sectoral | Organised decentralised | High | 20-30% | 90% or more | 90% or more | High |
| Norway | Sectoral | Organised decentralised | High | 30-40% | 60-70% | 60-70% | High |
| Denmark | Sectoral | Organised decentralised | High | 60-70% | 60-70% | 80-90% | High |
| Sweden | Sectoral | Organised decentralised | High | 60-70% | 80-90% | 90% or more | High |
| Slovenia | Sectoral | Centralised | No | 10-20% | 60-70% | 60-70% | Low |
| Iceland | Sectoral | Centralised | No | 80-90% | 60-70% | 80-90% | High |
| France | Sectoral | Centralised | Low | 5-10% | 70-80% | 90% or more | Medium |
| Portugal | Sectoral | Centralised | Low | 10-20% | 30-40% | 60-70% | Medium |
| Italy | Sectoral | Centralised | Low | 20-30% | 50-60% | 80-90% | Low |
| Finland | Sectoral/National | Centralised | High | 50-60% | 70-80% | 80-90% | High |
| Belgium | Sectoral/National | Centralised | High | 50-60% | 80-90% | 90% or more | Medium |

## 1.B Aggregate variables

The formulas for the aggregate price index, $P_j$, the aggregate profit, $\Pi_j$, the aggregate revenue, $R_j$, and the aggregate employment, $L_j$, are given by :

$$P_j = \left[\frac{1}{1-G(\phi_j^*)}\int_{\phi_j^*}^{\infty} p^{1-\sigma}(\phi)M_j g(\phi)d\phi\right]^{\frac{1}{1-\sigma}} \tag{1.25}$$

$$R_j = \frac{1}{1-G(\phi_j^*)}\int_{\phi_j^*}^{\infty} r(\phi)M_j g(\phi)d\phi = M_j\bar{r}_j \tag{1.26}$$

$$\Pi_j = \frac{1}{1-G(\phi_j^*)}\int_{\phi_j^*}^{\infty} [\pi(\phi)M_j g(\phi)d\phi] = M_j\left[\frac{\bar{r}_j}{\sigma} - f\right] \tag{1.27}$$

$$L_j = \frac{1}{1-G(\phi_j^*)}\int_{\phi_j^*}^{\infty} \frac{q_j(\phi)}{\phi}M_j g(\phi)d\phi \tag{1.28}$$

## 1.C Firm-level bargaining

### Proof of Proposition 1

**Proposition 1.2 Revenues are increasing with productivity** Equation 1.5 implies

$$\frac{\partial q(\phi,w)}{\partial w} = -\sigma\frac{\partial p(\phi,w)}{\partial w}\frac{q(\phi,w)}{p(\phi,w)} = -\sigma\frac{q(\phi,w)}{w}$$

Using equation 1.8, we can derive

$$\frac{1}{\pi(\phi,w)}\frac{\partial \pi(\phi,w)}{\partial w} = \frac{(1-\sigma)\,r(\phi,w)}{w(r(\phi,w)-\sigma f)}$$

Which directly implies that the wage is given by the following equation

$$\frac{-\beta\sigma}{w} + \frac{\beta}{w-\widetilde{w}} + \frac{(1-\beta)(1-\sigma)\,r(\phi,w)}{w(r(\phi,w)-\sigma f)} = 0 \tag{1.29}$$

Let's suppose that there exists $\phi_1$ and $\phi_2$ such that $\phi_1 < \phi_2$ and $\pi(\phi_1) > \pi(\phi_2)$. The previous equation implies that the wage is equal to

$$w = \widetilde{w}\left[1 + \frac{\beta}{(\sigma-1)(1-\beta)\frac{r(\phi,w)}{r(\phi,w)-\sigma f} + \beta(\sigma-1)}\right] \tag{1.30}$$

This equation implies that, if $\pi(\phi_1) > \pi(\phi_2)$, then $w(\phi_1) > w(\phi_2)$. Therefore, using equations 1.6 and 1.7, $r(\phi_1) > r(\phi_2)$ holds if and only if $\phi_1 > \phi_2$, which is a contradiction. This directly implies that the revenue is non-decreasing functions of productivity.

**Proposition 1.1 Wage is increasing with productivity** Because the revenue is non-decreasing in productivity, equation 1.30 proves that wage is also non-decreasing in productivity.

Moreover, a firm produces if and only if its profits are positive. This gives the lower bound of the wage, equal to $\widetilde{w}$. Finally, values of productivity are in the range of 0 to infinity, which directly implies that profits of firms tend toward infinity.

Using the wage equation 1.30 we derive the higher bound of the wage

$$w_f^{max} = \lim_{\phi \to \infty} w_f(\phi) = \widetilde{w}\left[1 + \frac{\beta}{\sigma - 1}\right] \tag{1.31}$$

## 1.D Industry-level bargaining

### 1.D.1 Equilibrium structure of the industry

We first introduce Proposition 7 and its proof in order to be able then to prove Proposition 2.

**Proposition 7**

Using definition of equation 1.9, it can be derived that :

**Proposition 7.** *When an industry wage floor is implemented, the average profit is equal to* $\overline{\pi}_i = f\left[\Gamma_i(\phi^*, \overline{w}) - 1\right]$ *where* $\Gamma_i(\phi^*, \overline{w})$ *fulfills the following conditions*

$$\begin{cases} \Gamma_i(\phi^*, \overline{w}) = \Gamma_f(\phi^*) \text{ if } \overline{w} \leq \widetilde{w} \\ \Gamma_i(\phi^*, \overline{w}) > \Gamma_f(\phi^*) \text{ and } \frac{\partial \Gamma_i(\phi^*, \overline{w})}{\partial \overline{w}} > 0 \text{ if } \widetilde{w} < \overline{w} < w_f^{max} \\ \Gamma_i(\phi^*, \overline{w}) = \Gamma_i^{max}(\phi^*) = \frac{1}{1 - G(\phi^*)} \int_{\phi^*}^{\infty} \left[\frac{\phi^*}{\phi}\right]^{1-\sigma} g(\phi) d\phi \text{ if } \overline{w} \geq w_f^{max} \end{cases} \tag{1.32}$$

First, if the industry's minimum wage is inferior to the reservation wage, it will be lower than the lowest wage negotiated at the firm-level, implying that it has no impact on the zero cutoff profit condition.

If the industry wage floor is superior to the reservation wage it will increase the labor cost of the less productive firms. For a given $\phi^*$, this wage floor will increase the labor cost of the firm at the productivity cutoff, and will not be binding for the largest companies. As a consequence, the decrease of the labor cost per product, with respect to productivity, will be more significant. Consequently, a rise in the labor cost of less productive firms will increase profits of the most productive ones and so increase the value of the average profit. This implies that, for a given value of the productivity cutoff, there is a positive relation between the average profit and the wage floor.

Finally there is an upper bound reached when the industry-minimum wage is binding for every operating firm.

**Proof of Proposition 7**

We study the following function.

$$\Gamma_i(\phi^*, \overline{w}) = \frac{1}{1 - G(\phi^*)} \int_{\phi^*}^{\infty} \left[\frac{w_i(\phi, \overline{w})\phi^*}{\overline{w}\phi}\right]^{1-\sigma} g(\phi) d\phi$$

The situation where the wage floor is lower than the reservation wage is perfectly obvious, therefore we focus on the situation where $\widetilde{w} < \overline{w} < w_f^{max}$, and we compare, for any value of $\phi^*$, $\Gamma_i(\phi^*, \overline{w})$ and $\Gamma_f(\phi^*)$.

First, we prove that the revenue of firms paying a wage equals to the wage floor increases. We define $\tilde{\phi}_i(\phi^*, \overline{w})$ as the higher productivity level paying a wage equals to the wage floor. For any firm with productivity respecting the condition $\phi \in ]\phi^*; \tilde{\phi}(\phi^*, \overline{w})]$, its revenue is equal to $\left[\frac{\phi^*}{\phi}\right]^{1-\sigma} \sigma f > \left[\frac{w_f(\phi)\phi^*}{\widetilde{w}\phi}\right]^{1-\sigma} \sigma f$.

Secondly, we prove that firms paying a wage higher than the wage floor have a higher revenue. Indeed, let's suppose that the revenue of firms with a productivity level higher than $\tilde{\phi}(\phi^*, \overline{w})$ decreases. Using equation 1.29, this would directly imply that $w_i(\phi, \overline{w}) < w_f(\phi)$. However, as the profit of firms at the productivity cutoff doesn't change and as the wage paid by those firms increases, equation 1.8 would directly imply that the revenue of firms with a productivity level higher than $\tilde{\phi}(\phi^*, \overline{w})$ would increase. This contradiction proves that the revenue of those firms must increase when there is a wage floor.

Building on previous insights, it can easily be derived that, for any value of $\phi^*$, if the wage floor is strictly higher than $\widetilde{w}$

$$\Gamma_i(\phi^*, \overline{w}) = \frac{1}{1 - G(\phi^*)} \left[ \int_{\phi^*}^{\tilde{\phi}_i(\phi^*, \overline{w})} \left( \frac{\phi^*}{\phi} \right)^{1-\sigma} g(\phi) d\phi + \int_{\tilde{\phi}_i(\phi^*, \overline{w})}^{\infty} \frac{r_i(\phi, \overline{w})}{\sigma f} g(\phi) d\phi \right] > \Gamma_f(\phi^*)$$

Finally, it is straightforward to derive that, when the wage is greater or equal to $w_f^{max}$, then

$$\Gamma_i^{max}(\phi^*) = \frac{1}{1 - G(\phi^*)} \int_{\phi^*}^{\infty} \left[ \frac{\phi^*}{\phi} \right]^{1-\sigma} g(\phi) d\phi$$

**Proof of Proposition 2**

Proposition 2.A states that : *As long as the wage floor is between $\widetilde{w}$ and $w_f^{max}$ there is a strictly positive relation between the average revenue and the wage floor, and the same applies to the productivity cutoff.*

Furthermore, the average revenue fulfills the following conditions.

$$\begin{cases} \overline{w} < \widetilde{w} \Rightarrow \left\{ \overline{r}_f = \overline{r}_i(\overline{w}); \frac{\partial \overline{r}_i(\overline{w})}{\partial \overline{w}} = 0 \right\} \\ \overline{w} = \widetilde{w} \Rightarrow \left\{ \overline{r}_f = \overline{r}_i(\overline{w}); \frac{\partial \overline{r}_i(\overline{w})}{\partial \overline{w}} > 0 \right\} \\ \widetilde{w} < \overline{w} < w_f^{max} \Rightarrow \left\{ \overline{r}_f < \overline{r}_i(\overline{w}); \frac{\partial \overline{r}_i(\overline{w})}{\partial \overline{w}} > 0 \right\} \\ w_f^{max} \geq \overline{w} \Rightarrow \left\{ \overline{r}_i(\overline{w}) = \overline{r}_i^{max}; \frac{\partial \overline{r}_i(\overline{w})}{\partial \overline{w}} = 0 \right\} \end{cases} \quad (1.33)$$

where $\overline{r}^{max}$ is the average revenue when the zero cutoff profit condition is given by $\Gamma_i^{max}$.

Using Proposition 7, the proof of Proposition 2.1 is straightforward so we focus on Proposition 2.2. We first derive that the price charged by firms at the productivity cutoff increases with the wage floor. Consequently, as the revenue of firms at the productivity cutoff is constant and equals to $\sigma f$, this directly implies that the revenues of firms paying a wage higher than the wage floor increase with the wage floor.

**Price charged by the firms at the productivity cutoff** First, we prove that the price charged by the firms at the productivity cutoff is an increasing function of the wage floor. At the equilibrium situation, both the free entry condition and the production cutoff condition hold. Then we derive

$$\frac{\partial \left[ f \left( \Gamma_i(\phi^*, \overline{w}) - 1 \right) \right]}{\partial \overline{w}} = \frac{\partial \left[ \frac{f_e}{1 - G(\phi^*)} \right]}{\partial \phi^*} \frac{\partial \phi^*}{\partial \overline{w}}$$

It can be derived that

$$\frac{\partial \left[ f \left( \Gamma_i(\phi^*, \overline{w}) - 1 \right) \right]}{\partial \overline{w}} =$$

$$\left[\underbrace{\frac{fg(\phi^*)}{[1-G(\phi^*)]^2}\int_{\phi^*}^{\infty}\left[\frac{w_i(\phi,\overline{w})\phi^*}{\overline{w}\phi}\right]^{1-\sigma}-\frac{fg(\phi^*)}{1-G(\phi^*)}}_{=\frac{g(\phi^*)}{1-G(\phi^*)}(f\Gamma_i(\phi^*,\overline{w})-1)}-\frac{f}{1-G(\phi^*)}\int_{\phi^*}^{\infty}\frac{\partial\left[\frac{w_i(\phi,\overline{w})}{\overline{w}}\frac{\phi_i^*}{\phi}\right]^{1-\sigma}}{\partial\phi^*}g(\phi)d\phi\right]\left[\frac{\partial\phi^*}{\partial\overline{w}}\right]+\frac{f}{1-G(\phi_i^*)}\int_{\phi^*}^{\infty}\frac{\partial\left[\frac{w_i(\phi,\overline{w})}{\overline{w}}\frac{\phi^*}{\phi}\right]^{1-\sigma}}{\partial\overline{w}}g(\phi)d\phi$$

Therefore, using that $\frac{\partial\left[\frac{fe}{1-G(\phi^*)}\right]}{\partial\phi^*}=\frac{\overline{\pi}_i\,g(\phi^*)}{1-G(\phi^*)}=\frac{g(\phi^*)}{1-G(\phi^*)}\left(f\Gamma_i\left(\phi^*,\overline{w}\right)-1\right)$ and the previous equation implies that

$$\left|\frac{f}{1-G\left(\phi_i^*\right)}\int_{\phi^*}^{\infty}\frac{\partial\left[\frac{w_i(\phi,\overline{w})}{\overline{w}}\frac{\phi^*}{\phi}\right]^{1-\sigma}}{\partial\overline{w}}g(\phi)d\phi\right|=$$

$$\left|\left[\frac{f}{1-G\left(\phi_i^*\right)}\int_{\phi^*}^{\infty}\frac{\partial\left[\frac{w_i(\phi,\overline{w})}{\overline{w}}\frac{\phi_i^*}{\phi}\right]^{1-\sigma}}{\partial\phi^*}g(\phi)d\phi\right]\left[\frac{\partial\phi^*}{\partial\overline{w}}\right]\right|$$

Furthermore, it can be derived that

$$\left|\frac{f}{1-G\left(\phi_i^*\right)}\int_{\phi^*}^{\infty}\frac{\partial\left[\frac{w_i(\phi,\overline{w})}{\overline{w}}\frac{\phi^*}{\phi}\right]^{1-\sigma}}{\partial\overline{w}}g(\phi)d\phi\right|=$$

$$\left|\frac{f}{1-G\left(\phi_i^*\right)}\left[\underbrace{\int_{\phi^*}^{\tilde{\phi}(\phi^*,\overline{w})}\frac{\partial\left[\frac{w_i(\phi,\overline{w})}{\overline{w}}\frac{\phi^*}{\phi}\right]^{1-\sigma}}{\partial\overline{w}}g(\phi)d\phi}_{=0}+\int_{\tilde{\phi}(\phi^*,\overline{w})}^{\infty}\left[\frac{w_i(\phi,\overline{w})}{\overline{w}}\frac{\phi^*}{\phi}\right]^{1-\sigma}\frac{\sigma-1}{\overline{w}}g(\phi)d\phi\right]\right|$$

And therefore

$$\left|\frac{f}{1-G\left(\phi_i^*\right)}\int_{\phi^*}^{\infty}\frac{\partial\left[\frac{w_i(\phi,\overline{w})}{\overline{w}}\frac{\phi^*}{\phi}\right]^{1-\sigma}}{\partial\phi^*}g(\phi)d\phi\right|=$$

$$\left|\frac{f}{1-G\left(\phi_i^*\right)}\int_{0}^{\infty}\left[\frac{w_i(\phi,\overline{w})}{\overline{w}}\frac{\phi^*}{\phi}\right]^{1-\sigma}\frac{\sigma-1}{\phi^*}g(\phi)d\phi\right|$$

The previous equations, combined with the fact a strictly positive number of firm pay a wage equal to the wage floor, directly implies that

$$\left|\frac{\partial\phi^*}{\partial\overline{w}}\frac{\overline{w}}{\phi^*}\right|<1 \tag{1.34}$$

*ie*

$$\left|\frac{\partial\phi^*}{\phi^*}\right|<\left|\frac{\partial\overline{w}}{\overline{w}}\right| \tag{1.35}$$

Recall that $p(\phi,w)=\frac{w}{\rho\phi}$. Therefore

$$\frac{\mathrm{d}p(\phi^*(\overline{w}),w)}{\mathrm{d}\overline{w}}=\frac{1}{\rho\phi^*(\overline{w})^2}\left(\phi^*(\overline{w})-\frac{\partial\phi^*(\overline{w})}{\overline{w}}\overline{w}\right)$$

Equation 1.35 then implies that $\frac{\mathrm{d}p(\phi^*(\overline{w}),w)}{\mathrm{d}\overline{w}}>0$. In other words, the price charged by the firms at the productivity cutoff is an increasing function of the wage floor.

**Revenues of firms paying a wage higher than the wage floor increase with the wage floor** Using the fact that the revenue of the firm at the productivity cutoff is a constant, we can derive that

$$\frac{r_i\left(\phi,\overline{w}\right)}{r_f(\phi)}=\left[\frac{\overline{w}}{\tilde{w}}\cdot\frac{\phi_f^*}{\phi_i^*(\overline{w})}\cdot\frac{w_f(\phi)}{w_i(\phi,\overline{w})}\right]^{\sigma-1}$$

Using this equation it is straightforward to establish that as long as $w_i(\phi)>\overline{w}$ the revenue and the wage paid by a firm of productivity $\phi$ are increasing functions of the wage floor. Figure 1.5 depicts both the situation where there is no wage floor and the one where there is a wage floor respecting the following condition $\tilde{w}<\overline{w}<w_f^{max}$.

## 1.D.2 Value of the wage floor

### Proof of Proposition 3.1

**Proof that $\overline{w} > \widetilde{w}$**

If the wage floor was equal to the reservation wage, then the composition of the industry would be the same than the one with the decentralized bargaining. Therefore, the derivative of the industry bargaining problem evaluated at $\overline{w} = \widetilde{w}$ is given by

$$\frac{\beta\left[\int_{\phi^*}^{\infty}\frac{\partial[(w(\phi,\overline{w})-\widetilde{w})l(\phi,\overline{w})]}{\partial\overline{w}}g(\phi)d\phi-\underbrace{(w(\phi^*,\overline{w})-\widetilde{w})}_{=0}l(\phi^*,\overline{w})g(\phi^*)\frac{\partial\phi^*}{\partial\overline{w}}\right]}{\int_{\phi^*}^{\infty}\left[(w(\phi,\overline{w})-\widetilde{w})l(\phi,\overline{w})\right]g(\phi)d\phi}$$
$$+\frac{(1-\beta)\left[\int_{\phi^*}^{\infty}\frac{\partial\pi(\phi,\overline{w})}{\partial\overline{w}}g(\phi)d\phi-\underbrace{\pi(\phi^*,\overline{w})}_{=0}g(\phi^*)\frac{\partial\phi^*}{\partial\overline{w}}\right]}{\int_{\phi^*}^{\infty}\pi(\phi,\overline{w})g(\phi)d\phi}$$

Using previous results, the wage floor increase will raise the productivity cutoff, and the wages paid by every remaining firms. This will have a strictly positive effect on the industry aggregate price $P_j$, which directly implies that for any firm, when $\overline{w} = \widetilde{w}$

$$\frac{1}{(w_i(\phi,\overline{w})-\widetilde{w})l_i(\phi,\overline{w})}\frac{\partial(w(\phi,\overline{w})-\widetilde{w})l_i(\phi,\overline{w})}{\partial\overline{w}} > \frac{1}{(w_f(\phi)-\widetilde{w})l_f(\phi)}\frac{\partial(w_f(\phi)-\widetilde{w})l_f(\phi)}{\partial w} \tag{1.36}$$

and

$$\frac{1}{\pi_i(\phi,\overline{w})}\frac{\partial\pi_i(\phi,\overline{w})}{\partial\overline{w}} > \frac{1}{\pi_f(\phi)}\frac{\partial\pi_f(\phi)}{\partial w} \tag{1.37}$$

Recall that the firm-level bargaining solution solves :

$$\underset{w}{max}\left\{\left[(w-\widetilde{w})\,l_f(\phi,w)\right]^{\beta}\left[\pi_f(\phi,w)\right]^{1-\beta}\right\} \tag{1.38}$$

ie :

$$\beta\frac{1}{(w_f(\phi)-\widetilde{w})l_f(\phi)}\frac{\partial(w_f(\phi)-\widetilde{w})l_f(\phi)}{\partial w}+(1-\beta)\frac{1}{\pi_f(\phi)}\frac{\partial\pi_f(\phi)}{\partial w}=0 \tag{1.39}$$

Equations 1.36 and 1.37 lead to :

$$\beta\frac{1}{(w_i(\phi)-\widetilde{w})l_i(\phi)}\frac{\partial(w_i(\phi)-\widetilde{w})l_i(\phi)}{\partial w}+(1-\beta)\frac{1}{\pi_i(\phi)}\frac{\partial\pi_i(\phi)}{\partial w} > \tag{1.40}$$
$$\beta\frac{1}{(w_f(\phi)-\widetilde{w})l_f(\phi)}\frac{\partial(w_f(\phi)-\widetilde{w})l_f(\phi)}{\partial w}+(1-\beta)\frac{1}{\pi_f(\phi)}\frac{\partial\pi_f(\phi)}{\partial w}=0 \tag{1.41}$$

Therefore, when the wage floor is equal to the reservation wage, the derivative of the industry-level bargaining problem is strictly positive. The reservation wage is therefore not a solution of industry-level bargaining maximization problem. Consequently, $\overline{w} > \widetilde{w}$.

**Proof that the wage floor equation has a finite solution**

If the wage floor is high enough to be binding for every firm operating in the economy, the bargaining problem becomes

$$\beta\left[\frac{-\xi}{\overline{w}}+\frac{1}{(\overline{w}-\widetilde{w})}\right]+\frac{(1-\beta)(1-\xi)\overline{r}^{max}}{\overline{w}\,(\overline{r}^{max}-\sigma f)}=0$$

The previous equation has a finite solution.

### Proof of Proposition 3.2

Results of Proposition 2 and of Proposition 3.1 directly imply Proposition 3.2

## 1.E General Equilibrium

### Proof of Proposition 4

The price equation implies that the national aggregate revenue is constant equal to $E$. Moreover, $E$ is equal to

$$E = \frac{1}{1-G(\phi_k^*)} \int_{\phi_k^*}^{\infty} w_k(\phi) \frac{q_k(\phi)}{\phi} g(\phi) d\phi M_k$$

Where $k \in \{f, i\}$. The employment level is given by

$$\frac{1}{1-G(\phi_k^*)} \int_{\phi_k^*}^{\infty} \frac{q_k(\phi)}{\phi} g(\phi) d\phi M_k$$

When there is a wage floor the wage of every firm and the productivity cutoff increase. Consequently, as wages are always increasing in productivity, it can be derived that for any given level of employment :

$$\frac{1}{1-G(\phi_k^*)} \int_{\phi_k^*}^{\infty} w_k(\phi) \frac{q_k(\phi)}{\phi} g(\phi) d\phi M_k$$

is higher when $k = i$ than when $k = f$. This directly implies that the level of employment decreases under industry-level bargaining.

Furthermore, when the wage floor increases, the average revenue increases. Therefore, equation 1.4 and the condition on the numeraire imply that the mass of firms decreases and, as the productivity cutoff increases, the diversity of products decreases. Finally, the price of remaining products increases. Building on previous insights, we conclude that the utility of the consumer decreases.

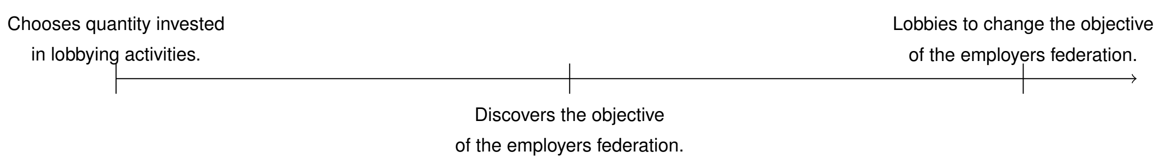
## 1.F Impact of the representativeness of bargaining institutions

### 1.F.1 Micro-foundation for the existence of employers federations dominated by large firms

In this section, we micro-found the fact that employers federations are dominated by large firms - ie attribute higher weights to larger firms. We sketch a model in which firms compete, through lobbying activities, to ensure that the objective of the employers federation is as close as possible to their objective. Our assumptions are very similar to the standard assumptions of the political literature focusing on lobby and competition for representation (see Persson and Tabellini (2002)). We find that the more productive a firm is, the higher its investment in lobbying activities, and therefore the higher its weight in the employers federation's objective.

#### Timing of events

FIGURE 1.F.2 : Timeline of an entrepreneur



We suppose that lobbying activities occur before the wage bargaining. Entrepreneurs observe the quantity invested by others, but, following the literature on political economics (see Persson and Tabellini (2002), Grossman and Helpman (1996), Baron (1994)), we assume that entrepreneurs face uncertainty about the preferences of the representative agent. For simplicity, we suppose that they have complete uncertainty. Formally, a firm expects the wage floor negotiated by the employers federation to be randomly distributed over $[\tilde{w};\infty[$. The entrepreneur first chooses the quantity of money to invest in lobbying activities, then she discovers the objective of the employers federation.

Once the entrepreneur has discovered the objective of the industry representative, she uses the money she invested in lobbying activities to ensure that the objective of the latter will be as close as possible to its own (in terms of the previous model, this corresponds to the function $h(.)$). Formally, investments enable firms to change the wage negotiated at the sector level, $\overline{w}$. We denote the level of investments by $I$, and we assume that the efficiency of lobbying activities is an increasing function of the the firm's investment effort relative to competitors. More precisely, we assume that :

$$\left|\frac{\partial \overline{w}}{\partial I}\right| = z\left(\frac{I}{\overline{I}}\right) \tag{1.42}$$

where $\overline{I}$ is the total amount of investments made by all firms of the sector, and $z(.)$ is an increasing and concave function. The use of $\frac{I}{\overline{I}}$ implies that it is not the level of investment *per se* that matters, but the effort relative to competitors. We assume that this function is independent of both the size and revenues of the firm.

While this assumption is relatively restrictive, it is likely that were the function dependent on the firm's size, it would be increasing in firm's size (see Offerlé (2009) which develops the idea that employers federations encourage the participation of large firms). As a result, taking into account such a larger efficiency of investments for large firms would only strengthen our results.

Finally, we assume that if $I$ is inferior to an exogenous parameter $c$, the firm invests nothing and is not member of the employers federation. This represents the fixed cost associated with participation to the federation.

**Quantity invested in lobbying activities**

The objective of the entrepreneurs is given by

$$\begin{aligned} max_I \left\{\mathbb{E}_{\overline{w}}\left(\pi(\phi,\overline{w})\right) - I\right\} \\ s.t. \left|\frac{\partial \overline{w}}{\partial I}\right| = z\left(\frac{I}{\overline{I}}\right) \end{aligned} \tag{1.43}$$

We denote $\hat{w}(\phi))$ the wage negotiated at the firm level, by firms with a level of productivity equal to $\phi$. It can be derived that

$$\frac{\partial \pi(\phi,\overline{w})}{\partial \overline{w}} = \begin{cases} \frac{(\sigma-1)f}{\sigma} \frac{|\epsilon^{\phi^*}_{\overline{w}}|}{\overline{w}} r(\phi,\overline{w}) \text{ if } \overline{w} < \hat{w}(\phi) \\ \frac{(\sigma-1)f}{\sigma} \frac{|\epsilon^{\frac{\phi^*}{\overline{w}}}_{\overline{w}}|}{\overline{w}} r(\phi,\overline{w}) \text{ if } \overline{w} > \hat{w}(\phi) \end{cases} \tag{1.44}$$

Where $\epsilon_y^x$ is the elasticity of $y$ with respect to $x$. If the objective of the employers federations implies a wage lower to the wage negotiated by the entrepreneur at the firm level (*i.e.* if $\overline{w} < \hat{w}(\phi)$) the entrepreneur lobbies to increase the negotiated wage. The opposite is true if the objective of the employers federations implies a wage higher to the wage negotiated by the entrepreneur at the firm level (*i.e.* if $\overline{w} > \hat{w}(\phi)$).

It must be noted that the incentive is higher when the wage is binding for the firm. Indeed, it means that this firm pays a wage equal to the wage floor. Therefore, when lobbying, the firm will directly decrease its labor cost. However, when the firm negotiates at the firm level a wage higher than the wage floor, it only benefits from the higher labor cost of small competitors.

Moreover, the incentives are proportional to the revenue of a firm. As a consequence, the higher the revenue, the stronger the incentive to engage in lobbying activities.

Equations 1.43 and 1.44 imply that

$$\frac{\sigma}{f(\sigma-1)}\frac{1}{z\left(\frac{I}{\overline{\overline{I}}}\right)} = \int_{\tilde{w}}^{\hat{w}(\phi)} \frac{\mid \epsilon_w^{\frac{\phi^*}{w}} \mid}{w} r(\phi,w)dw + \int_{\hat{w}(\phi)}^{\infty} \frac{\mid \epsilon_w^{\phi^*} \mid}{w} r(\phi,w)dw$$

(1.45)

We compute the evolution of the money invested in lobbying activities when the productivity, or equivalently the size, of the firm increases. It can be derived that

$$\begin{aligned}\frac{\sigma}{f(\sigma-1)}\frac{\partial\left[\frac{\partial\left(\mathbb{E}_{\overline{w}}\{\pi(\phi,\overline{w})\}\right)}{\partial\overline{w}}\right]}{\partial\phi} &= \int_{\tilde{w}}^{\hat{w}(\phi)} \frac{|\epsilon_w^{\frac{\phi^*}{w}}|}{w}\frac{\partial r(\phi,w)}{\partial\phi}dw + \frac{\partial\hat{w}(\phi)}{\partial\phi}\frac{|\epsilon_{\hat{w}(\phi)}^{\frac{\phi^*}{\hat{w}(\phi)}}|}{\hat{w}(\phi)}r(\phi,\hat{w}(\phi)) \\ &- \frac{\partial\hat{w}(\phi)}{\partial\phi}\frac{|\epsilon_{\hat{w}(\phi)}^{\phi^*}|}{\hat{w}(\phi)}r(\phi,\hat{w}(\phi)) + \int_{\hat{w}(\phi)}^{\infty}\frac{|\epsilon_w^{\phi^*}|}{w}\frac{\partial r(\phi,w)}{\partial\phi}dw\end{aligned} \quad (1.46)$$

The first term is positive. It states that the higher the firms revenue, the higher its incentive to invest in lobbying activities. Moreover, the efficiency of investments is independent of the firms size ($z(.)$ is independent of $\phi$). Therefore, as large firms generate higher revenues, a given level of investment represents a lower share of their revenue. This effect also drives up investments made by large firms. The same line of reasoning applies to the last term.

The difference between the second and the third term embodied the fact that, as described previously, that the incentive is higher when the wage is binding for the firm.

The only negative factor of this equation is $-\frac{\partial\hat{w}(\phi)}{\partial\phi}\frac{|\epsilon_{\hat{w}(\phi)}^{\phi^*}|}{\hat{w}(\phi)}r(\phi,\hat{w}(\phi))$. Using equation 1.30, it can easily be derived that $\frac{\partial\hat{w}(\phi)}{\partial\phi}\frac{\phi}{\hat{w}(\phi)} < \frac{\partial r(\phi,\hat{w}(\phi))}{\partial\phi}\frac{\phi}{r(\phi,\hat{w}(\phi))}$. Then, it is straightforward to establish that $\frac{\sigma}{f(1-\sigma)}\frac{\partial\left[\frac{\partial\left(\mathbb{E}_{\overline{w}}\{\pi(\phi,\overline{w})\}\right)}{\partial\overline{w}}\right]}{\partial\phi} > 0$

### 1.F.2 Proof of Proposition 5.1

In the following, we compare the wage floor under an unrepresentative employers federation, ie the solution of :

$$\max_{\overline{w}}\left\{\left[\frac{1}{1-G(\phi^*(\overline{w}))}\int_{\phi^*}^{\infty}(w(\phi,\overline{w})-\tilde{w})l_f(\phi,\overline{w})Mg(\phi)d\phi\right]^{\beta}[V_h(\overline{w})]^{1-\beta}\right\} \quad (1.47)$$

with the wage floor under a representative employers federation, ie the solution of :

$$\max_{\overline{w}} \left\{ \left[ \frac{1}{1-G(\phi^*(\overline{w}))} \int_{\phi^*}^{\infty} (w(\phi,\overline{w}) - \widetilde{w}) l_f(\phi,\overline{w}) M g(\phi) d\phi \right]^{\beta} [V_i(\overline{w})]^{1-\beta} \right\} \quad (1.48)$$

We thus compare

$$\frac{\frac{1}{1-G_h(\phi^*)} \int_{\phi^*}^{\infty} \frac{\partial \pi(\phi,\overline{w})}{\partial \overline{w}} g_h(\phi) d\phi}{\frac{1}{1-G_h(\phi^*)} \int_{\phi^*}^{\infty} \pi(\phi,\overline{w}) g_h(\phi) d\phi}$$

and

$$\frac{\frac{1}{1-G(\phi^*)} \int_{\phi^*}^{\infty} \frac{\partial \pi(\phi,\overline{w})}{\partial \overline{w}} g(\phi) d\phi}{\frac{1}{1-G(\phi^*)} \int_{\phi^*}^{\infty} \pi(\phi,\overline{w}) g(\phi) d\phi}$$

First we focus on the difference of the denominators, ie :

$$\frac{1}{1-G_h(\phi^*)} \int_{\phi^*}^{\infty} \pi(\phi,\overline{w}) g_h(\phi) d\phi - \frac{1}{1-G(\phi^*)} \int_{\phi^*}^{\infty} \pi(\phi,\overline{w}) g(\phi) d\phi$$

Following the properties of $h(.)$, given in definition 2, we must have

$$a \in [\phi^*, \infty[\,, \begin{cases} x \leq a \Rightarrow \frac{g_h(x)}{1-G_h(\phi^*)} \leq \frac{g(x)}{1-G(\phi^*)} \\ x \geq a \Rightarrow \frac{g_h(x)}{1-G_h(\phi^*)} \geq \frac{g(x)}{1-G(\phi^*)} \end{cases}$$

Therefore, as profit is an increasing function of productivity, we have

$$\frac{1}{1-G_h(\phi^*)} \int_{\phi^*}^{\infty} \pi(\phi,\overline{w}) g_h(\phi) d\phi - \frac{1}{1-G(\phi^*)} \int_{\phi^*}^{\infty} \pi(\phi,\overline{w}) g(\phi) d\phi \geq$$

$$\pi(a,\overline{w}) \int_{\phi^*}^{a} \left[ \frac{g_h(x)}{1-G_h(\phi^*)} - \frac{g(x)}{1-G(\phi^*)} \right] d\phi + \pi(a,\overline{w}) \int_{a}^{\infty} \left[ \frac{g_h(x)}{1-G_h(\phi^*)} - \frac{g(x)}{1-G(\phi^*)} \right] d\phi = 0$$

This implies that for every wage floor level,

$$\frac{1}{1-G_h(\phi^*)} \int_{\phi^*}^{\infty} \pi(\phi,\overline{w}) g_h(\phi) d\phi \geq \frac{1}{1-G(\phi^*)} \int_{\phi^*}^{\infty} \pi(\phi,\overline{w}) g(\phi) d\phi$$

Then, we focus on the difference of the numerators :

$$\frac{1}{1-G_h(\phi^*)} \int_{\phi^*}^{\infty} \frac{\partial \pi(\phi,\overline{w})}{\partial \overline{w}} g_h(\phi) d\phi - \frac{1}{1-G(\phi^*)} \int_{\phi^*}^{\infty} \frac{\partial \pi(\phi,\overline{w})}{\partial \overline{w}} g(\phi) d\phi$$

We define $c$ as the productivity level such that $\frac{\partial \pi(c,\overline{w})}{\partial \overline{w}} = \max_{x \in [\phi^*,a]} \{\frac{\partial \pi(x,\overline{w})}{\partial \overline{w}}\}$ and $d$ such as the productivity level such that $\frac{\partial \pi(d,\overline{w})}{\partial \overline{w}} = \min_{x \in [a,\infty]} \{\frac{\partial \pi(x,\overline{w})}{\partial \overline{w}}\}$.

Using those definitions, we have

$$\frac{1}{1-G_h(\phi^*)}\int_{\phi^*}^{\infty}\frac{\partial\pi(\phi,\overline{w})}{\partial\overline{w}}g_h(\phi)d\phi - \frac{1}{1-G(\phi^*)}\int_{\phi^*}^{\infty}\frac{\partial\pi(\phi,\overline{w})}{\partial\overline{w}}g(\phi)d\phi \geq$$

$$\frac{\partial\pi(c,\overline{w})}{\partial\overline{w}}\int_{\phi^*}^{a}\left[\frac{g_h(x)}{1-G_h(\phi^*)}-\frac{g(x)}{1-G(\phi^*)}\right]d\phi + \frac{\partial\pi(d,\overline{w})}{\partial\overline{w}}\int_{a}^{\infty}\left[\frac{g_h(x)}{1-G_h(\phi^*)}-\frac{g(x)}{1-G(\phi^*)}\right]d\phi \geq$$

$$\frac{\partial\pi(c,\overline{w})}{\partial\overline{w}}\int_{\phi^*}^{\infty}\left[\frac{g_h(x)}{1-G_h(\phi^*)}-\frac{g(x)}{1-G(\phi^*)}\right]d\phi = 0$$

This implies that for every wage floor level,

$$\frac{1}{1-G_h(\phi^*)}\int_{\phi^*}^{\infty}\frac{\partial\pi(\phi,\overline{w})}{\partial\overline{w}}g_h(\phi)d\phi \geq \frac{1}{1-G(\phi^*)}\int_{\phi^*}^{\infty}\frac{\partial\pi(\phi,\overline{w})}{\partial\overline{w}}g(\phi)d\phi$$

Finally, as already demonstrated $\frac{1}{1-G(\phi^*)}\int_{\phi^*}^{\infty}\frac{\partial\pi(\phi,\overline{w})}{\partial\overline{w}}g(\phi)d\phi$ is negative. Therefore :

$$\frac{\frac{1}{1-G_h(\phi^*)}\int_{\phi^*}^{\infty}\frac{\partial\pi(\phi,\overline{w})}{\partial\overline{w}}g_h(\phi)d\phi}{\frac{1}{1-G_h(\phi^*)}\int_{\phi^*}^{\infty}\pi(\phi,\overline{w})g_h(\phi)d\phi} \geq \frac{\frac{1}{1-G(\phi^*)}\int_{\phi^*}^{\infty}\frac{\partial\pi(\phi,\overline{w})}{\partial\overline{w}}g(\phi)d\phi}{\frac{1}{1-G(\phi^*)}\int_{\phi^*}^{\infty}\pi(\phi,\overline{w})g(\phi)d\phi}$$

Therefore, for all function respecting the condition of definition 2, the negotiated wage floor is higher than in the "equal weights" scenario.

Using definition 3, the proof of Proposition 5,2 is derived using the same method as previously.

## 1.G Descriptive statistics

TABLE A1 : Industry agreements most dominated by large firms

| Industry $i$ | Industry label | Percentile of bargaining firm size within industry distribution | Bargaining firms $x$ times larger than average firm | % of firms which bargain |
|---|---|---|---|---|
| 0440 | Temporary work | 1.00 | 6.14 | 0.40 |
| 2148 | Telecommunications | 1.00 | 46.76 | 0.04 |
| 2060 | Canteens and related (chains) | 1.00 | 34.13 | 0.03 |
| 2198 | E-commerce firms | 1.00 | 32.70 | 0.02 |
| 1225 | Departmental businesses of La Reunion | 1.00 | 9.11 | 0.01 |
| 2098 | Service providers in tertiary sector | 0.99 | 25.34 | 0.03 |
| 1618 | Camping industry | 0.99 | 19.66 | 0.02 |
| 0086 | Advertising and related | 0.99 | 12.85 | 0.02 |
| 2156 | Department and variety stores | 0.99 | 19.63 | 0.06 |
| 2412 | Cartoons production | 0.99 | 8.95 | 0.12 |

TABLE A2 : Industry agreements least dominated by large firms

| Industry $i$ | Industry label | Percentile of bargaining firm size within industry distribution | Bargaining firms $x$ times larger than average firm | % of firms which bargain |
|---|---|---|---|---|
| 1875 | Veterinary offices and cliniques | 0.18 | 0.25 | 0.47 |
| 1631 | Outdoor hotel business | 0.32 | 0.44 | 0.85 |
| 1978 | Florists | 0.44 | 0.61 | 0.63 |
| 3168 | Photography industry | 0.49 | 0.44 | 0.44 |
| 2704 | Guadeloupe, St-Martin and St-Barthelemy banks | 0.50 | 1.09 | 1.00 |
| 2701 | Guyane banks | 0.50 | 1.27 | 0.50 |
| 1182 | Marinas staff | 0.52 | 0.46 | 0.69 |
| 2335 | Insurance companies staff | 0.55 | 0.63 | 0.96 |
| 1619 | Dental practices | 0.56 | 0.62 | 0.80 |
| 1671 | Students homes | 0.58 | 0.66 | 0.36 |

## 1.H OLS results

TABLE A3 : The role of representativeness on wage floor increase (in %) - OLS results

| | Wage floor increase (%) | | | | |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| | OLS | OLS | OLS | OLS | OLS |
| $S_{ijt} \times 1(U_j > \overline{U}_j)$ | 0.523*** | 0.428*** | 0.425*** | 0.428*** | 0.423*** |
| | (0.0897) | (0.0887) | (0.0891) | (0.0891) | (0.0894) |
| $S_{ijt} \times 1(U_j < \overline{U}_j)$ | 0.446*** | 0.345*** | 0.341*** | 0.349*** | 0.371*** |
| | (0.0948) | (0.0905) | (0.0916) | (0.0955) | (0.101) |
| $\Delta S_{ijt-1}$ | | | | -0.00690 | -0.00709 |
| | | | | (0.0.00745) | (0.00801) |
| $\Delta S_{ijt-2}$ | | | | | 0.00319 |
| | | | | | (0.00565) |
| # obs | 9804 | 9800 | 9798 | 9664 | 9543 |
| Adj R2 | 0.87 | 0.87 | 0.87 | 0.87 | 0.87 |
| Occupation FE | No | Yes | No | No | No |
| Occupation $\times$ Year FE | No | No | Yes | Yes | Yes |
| Industry $\times$ Year FE | Yes | Yes | Yes | Yes | Yes |

Note : The dependent variable is the wage floor variation between $t-1$ and t. $S_{ijt}$ denotes the share of workers employed in small firms for the skill-level position $i$, industry $j$ and year $t$. $1(U_j > \overline{U}_j)$ is a dummy equal to one when the industry $j$ is less representative than the median industry : $U_j$ is a measure of unrepresentativeness (the larger $U_j$, the higher the domination of the employers federations by large firms), and $\overline{U}_j$ is the median unrepresentativeness. Standard errors are clustered at the industry $\times$ year level. Standard errors are given in brackets.*, **, and *** denote statistical significance at 10, 5 and 1%.

# Chapter 2

# Impact of sectoral agreements on creative destruction

I study the impact of industry-level wage floors on innovation. I use a model with monopolistic competition between products of an industry on the one hand, and between industries on the other hand. First, I find that when the bargaining process occurs at the industry level, negotiating parties take into account that a wage increase will deter investments of competitors. As it reduces the probability to be outperformed, this effect generates a wage surplus when the bargaining takes place at the industry-level, reducing both production and employment. Furthermore, it decreases the research effort of the industry reducing the productivity growth.

## 2.1 Introduction

*Productivity isn't everything, but in the long run it is almost everything. A country's ability to improve its standard of living over time depends almost entirely on its ability to raise its output per worker.*
Paul Krugman, *The age of Diminishing expectations*, 1994

*A country's economic growth may be defined as a long-term rise in capacity to supply increasingly diverse economic goods to its population, this growing capacity based on advancing technology and the institutional and ideological adjustments that it demands.*
Simon Kuznet, *Nobel Prize Lecture*, 1971

The first quote from Paul Krugman states that productivity growth is the main objective, if not the only, of economic policy. However, as highlighted by Simon Kuznet in the second quote, it's not a natural process. But, how can it be enhanced ? Why are some countries so close in terms of wealth, and so different in terms of productivity growth ? What are the institutions that foster economic development ? In this paper, I focus on the impact of wage bargaining institutions on productivity growth.

Acemoglu et al. (2005) persuasively argue that the institutions of a country are the main forces generating economic growth. The reason is that they modify the rewards of innovations, and so the incentives of economic actors to pay the cost of research activities. The economic theory vastly backs up this theory (see Aghion and Griffith (2008) for a summary). Likewise, this has been highlighted empirically. For example Alesina et al. (2005) studied the effect of suppressing entry barriers and state ownership on innovation in India, and found that it increased long-run capital investments in those sectors. Therefore, it clearly appears in economic history that institutions are key parameters to explain the capacity of a country to raise its level of output per worker.This paper focus on the effect of labor market institutions, and more specifically on the level at which bargaining takes place, on the benefits extracted from innovations, and therefore on productivity growth. Entrepreneurs use binding minimum wages negotiated at the industry-level in order to increase the labor cost of competitors and, in doing so, to reduce the returns of innovations. As a consequence the research effort of competitors decreases, as do the probability to become technologically obsolete. On the employees side, this is associated with a reduction of the probability to be dismissed from the firm.

In the first part, I use a model, which is built on the previous work of Klette and Kortum (2004), Aghion et al. (2014) and Lentz and Mortensen (2008), where growth is generated by Schumpetarian creative destruction process. There are two industries, one that produces a single homogeneous good, and the other one which is composed of a continuum of products, of a fixed size, between which exists a monopolistic competition. Furthermore, within the differentiated industry, there is a continuum of firms which produce several distinct products. In order to increase its size a firm must innovate, and , symmetrically, in order to start to produce a potential entrant must also innovate. For each of them, the probability to do so is a positive function of investments and past innovations. In case of success the entrepreneur has a monopoly over a product, and surpasses the former producer in terms of productivity. Consequently, innovation is sensitive to its returns, as entrepreneurs arbitrate between the cost of R&D and its potential payoffs.

The model has several implications. First, when negotiating at the industry-level, incumbent firms and the union take into account the lowering effect of a decrease of profits on the research effort of competitors. Therefore, this decreases the negative impact of a labor cost increase on a firm's objective, as as it drives down the probability to be replaced. Furthermore, a lower probability for the firm to be outperformed implies that workers have a lower probability to loose their job. This rent-sharing between incumbent firms and their workers generates a wage surplus when it's negotiated at the industry-level, compared to the situation where the wage is negotiated at the firm-level. The raise of the labor cost in turn reduces employment and production. The use by incumbent firms of labor market institutions to reduce the returns of innovations decreases the overall national research effort, and so the GDP growth.

Secondly, I focus on potential entrants. I assume that their innovative process is similar to the one of incumbent firms. In addition, in order to correspond to empirical evidences (see Earle and Sakova (1999)), I assume that the size of the cohort of potential entrants is positively correlated with the returns of innovations. Those two elements imply that the total investments made in R&D by potential entrants are more sensitive to the reward of innovation than those of incumbent firms. Consequently, the share of new entrants is lower when the wage is negotiated at the industry-level, compared to the situation where it's negotiated at the firm level. At the equilibrium, this lower share of entrants leads to a situation where the distribution of firms size is more skewed. Indeed, the proportion of large firms increases. As a consequence, the rent-sharing between negotiating firms and their workers contributes to foster the domination of very large firms. This impact on the distribution of firms size has, to the best of my knowledge, never been highlighted. Due to this force, which fosters the domination of large firms, the economy departs from the situation of perfect competition.

In the second part of this paper, I assess numerically the magnitude of the previous effects by calibrating the model to the Danish economy. This country is chosen because Lentz and Mortensen (2008) estimated the value of several parameters used in the model on Danish data. I first estimate the significance of the effect on the negotiated wage. I find that the wage surplus generated is important and equals to 2.8% which, in turn, reduces employment by 6.2% and production by 4.8%. Then, I estimate the effect on endogenous variables related to growth. I find that the effect is less significant, as the reduction of growth when the wage is negotiated at the industry-level is estimated as being equal to 2.4%.

The main conclusion of the paper is that labor market institutions, through their impacts on the reward of innovations, largely affect productivity growth. However, the economic literature mainly focused on the impact of innovation on labor market outcomes. Indeed, this effect has been vastly studied (see Cahuc and Zylberberg (2009) for a summary), and even if in the short run evidences suggest that technological progress increases unemployment (see Acemoglu and Restrepo (2017) for example), in the long run there are no proof of such an effect. This paper addresses the reverse question and focuses on the impact of the labor market on innovation, and more specifically I consider the level at which the wage negotiation takes place. This can be related to the literature on the effect of rent-sharing on innovation (see Acemoglu et al. (2005)). Indeed, labor market institutions are used by economic actors to secure their position, at the expense of productivity growth. To the best of my knowledge, this is the first paper to focus on the effect of industry-level wage bargaining on productivity growth.

## 2.2 Demand, supply and Schumpeterian growth

In the first subsection, I present the demand side. Consumers allocate their consumption baskets between an industry which produces a single good, and a differentiated one. In the second subsection, I describe the production process of firms of the latter. There are several periods. During each of them, each producer produces a finite number of goods, and has to incur costs in support of the research activities in order to increase its size during the following period.

I present the variables driving investments decisions in the final subsection. The entrepreneur arbitrates between the returns of an innovation, and the cost of research activities. Returns of innovation, and therefore the level of R&D activities, are driven by two variables. They increase with the level of expected profits of a line of production, and decrease with the level of research activities of competitors. Indeed, the more competitors invest in research activities, the higher the probability to become technologically obsolete.

### 2.2.1 Aggregate Demand

In this model, I use a discrete setting. The representative consumer's utility depends on the consumption of the output of two industries. The first one produces, during period $t$, a single homogeneous good $q_{0,t}$ which is the numeraire. The second one is composed of a continuum of differentiated goods, produced by heterogeneous firms, whose real consumption index is $Q_t$, equals to

$$Q_t = \left[\int_{\omega\in\Omega} q_t(\omega)^{\frac{\sigma-1}{\sigma}} d\omega\right]^{\frac{\sigma}{\sigma-1}}$$

Where $\Omega$ is the set of products considered as constant. $\sigma$ is the elasticity of substitution between products of the same industry (I also define $\rho = \frac{\sigma-1}{\sigma}$). $q_t(\omega)$ is the consumption of variety $\omega$, during period $t$. The representative agent allocates its consumption basket between the industries by maximizing the following quasi-linear utility function

$$U_t = q_{0,t} + \frac{\xi}{\xi - 1} Q_t^{\frac{\xi-1}{\xi}}$$

where $\xi$ is the elasticity of substitution between products of different industries. I impose $\sigma > \xi$ (see Lewis and Poilly (2012), Oberfield and Raval (2012), Broda and Weinstein (2006) and Bernard et al. (2003) for empirical evidences). This ensures that products of the differentiated industry are closer substitutes with each other than with the homogeneous product. The maximization of this utility implies that a representative agent facing an aggregate price of $P_t$ for the differentiated industry, chooses the aggregate quantity

$$Q_t = \left[ \frac{P_t}{P_{0,t}} \right]^{-\xi} \tag{2.1}$$

where $P_{0,t}$ is the numeraire and $P_t$ is given by

$$P_t = \left[ \int_{\omega \in \Omega} p_t(\omega)^{1-\sigma} d\omega \right]^{\frac{1}{1-\sigma}} \tag{2.2}$$

The consumption of goods of the differentiated industry decreases with the prices of goods, and increases with the size of the set of products. This reflects the taste for variety of consumers. It directly follows that the aggregate revenue of the industry producing the differentiated good is given by

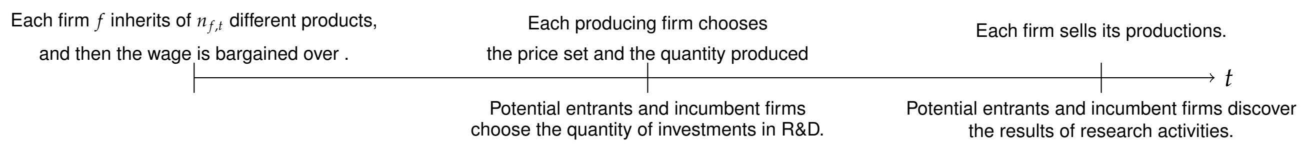
$$R_t = Q_t P_t = \left[ \frac{P_t}{P_{0,t}} \right]^{1-\xi} \tag{2.3}$$

### 2.2.2 Production

In this subsection, I present the production process of the differentiated industry. In the first part, I present the features of the industry, and the timeline of events. Then, I present the firms objectives, the prices they charge and the quantities produced.

#### Production process

FIGURE 2.1 : Timeline of events




Following the literature (see Klette and Kortum (2004), or Grossman and Helpman (1991)), I assume that the differentiated industry is composed of a continuum of goods and has a constant size equal to 1. Therefore, the aggregate production is equal to

$$Q_t = \left[ \int_0^1 q_{i,t}^{\frac{\sigma-1}{\sigma}} di \right]^{\frac{\sigma}{\sigma-1}} \tag{2.4}$$

Furthermore, a firm $f$ operates in a single industry, and is defined by the number of products it produces during period $t$, denoted $n_{f,t}$. A firm manufactures a product if and only if it outperforms competitors for this particular good.

Figure 2.1 represents the different steps faced by the entrepreneur during each period. First, a firm inherits of $n_{f,t}$ production units from the past. Then, the wage is bargained over by employers and unions (the different bargaining scenarios are presented in the next section). Taking into account the negotiated wage, each employer chooses, for each of its products, the quantities he produces and the price he charges. Moreover, incumbent firms and potential entrants choose the quantity of money invested in R&D activities.

At the end of the period, once an entrepreneur has sold its production, he discovers the result of research activities. If the firm innovates, it will be dominant on a new product. Consequently, it hires workers for this new line of production. It will bargain the wage over and start to produce next period. However, if a competitor innovates on one of its goods, the entrepreneur closes this production unit and dismisses, at zero cost, the corresponding workers. At the same time, potential entrants discover the results of there R&D investments. If a potential entrant innovates, he will be dominant, during next period, over a product selected at random. Each of the previous steps is developed below.

### Firms objectives and production decisions

All goods are produced with labor, the only factor of production. During period $t$, each good $i$ is produced by a monopoly supplier which has, for this particular product, a productivity level $A_{i,t}$. It charges the price $p_{i,t}$, therefore, the demand's structure implies that the firm produces quantities $q_{i,t}$ and obtains the revenues $r_{i,t} = p_{i,t}q_{i,t}$ which are equal to

$$q_{i,t}(p_{i,t}) = Q_t \left[\frac{p_{i,t}}{P_t}\right]^{-\sigma} \tag{2.5}$$

$$r_{i,t}(p_{i,t}) = R_t \left[\frac{p_{i,t}}{P_t}\right]^{1-\sigma} \tag{2.6}$$

The firm decides each period, and for each of its products, the charged price and the quantity produced. It takes into account its productivity level, $A_{i,t}$, the characteristics of the industry it operates in $(R_t, Q_t, ...)$, and its demand curve given by the last two equations. Moreover, the wage, denoted $w_t$, is bargained collectively, so the firm takes it as given.

On this basis, the prices equation can be derived from the structure of the demand.

**Lemma 1.** *The price charged by a firm for product $i$, which it produces with productivity $A_{i,t}$, and the profits associated to it, are given by :*

$$p_{i,t} = \frac{w_t}{\rho A_{i,t}} \tag{2.7}$$

$$\pi_{i,t} = P_t^{1-\xi} \underbrace{\frac{1}{\sigma}\left(\frac{p_{i,t}}{P_t}\right)^{1-\sigma}}_{=\tilde{\pi}_{i,t}} \tag{2.8}$$

Where $\tilde{\pi}_{i,t}$ represents the profits that a firm generates by the production of product $i$, in proportion to the industry's aggregate revenue. The profits of a firm are therefore driven by two factors. First, the industry's aggregate revenue which decreases with the industry's aggregate price. Second, profits are negatively correlated with the ratio of the price charged by the firm to the industry's aggregate price. Those two elements embody the competition between industries, and within the differentiated industry.

### 2.2.3 Innovation

In this section, I present the process of innovation. There are two sources of innovation : incumbent firms and new entrants.

I first focus on incumbent firms. I describe the flow of innovations which depends positively on the quantity of investments and on successes of past research. If research activities of a firm are successful, it will produce one more product during the following period. However, it can lose one of its units of production if a competitor innovates on one of them. Then, I focus on the program of an incumbent firm. I find that investments are driven by the value of an innovation, which increases with the expected flow of future profits and decreases with the probability of being replaced.

Finally, I study the program of potential entrants. There is a mass of identical potential entrants, and each of them faces the same cost function of innovation as that faced by incumbent. Furthermore, if they innovate, they will produce one product chosen at random. As a consequence, the level of investments of potential entrants is driven by the same variables.

#### Innovation process

A firm enters the market with only one product, and leaves the market when it's outperformed by competitors on every product. In order to innovate firms combine their knowledge stock accumulated in the past, with investments. Following Aghion et al. (2014), I assume that when the firm $f$ produces $n_{f,t}$ different products and invests $I_{f,t}$ during period $t$, it has the Poisson innovation flow rate

$$Z_{f,t} = \left[\frac{I_{f,t}}{\theta}\right]^{\frac{1}{\eta}} n_{f,t}^{1-\frac{1}{\eta}} \tag{2.9}$$

Where $\theta$ is a scale parameter. Those assumptions are made to reflect the positive impact of the quality of firms past researches, of firms size and of investments, on the probability to innovate.

A firm producing $n_{f,t}$ products will produce $n+1$ products during the next period with probability $n_{f,t}z_{f,t}$ where $z_{f,t} = \frac{Z_{f,t}}{n_{f,t}}$. Furthermore, it will be outperformed by a competitor and it will produce $n-1$ products during the next period with probability $n_{f,t}\chi_t$, where $\chi_t$ is constant across firms.

I assume that, if research activities of a firm are successful, the firm innovates over a random product. If he does so, it improves the productivity of this line by a factor $1+\gamma$ (*i.e.* if a firm innovates in period $t$ on product $i$, productivity increases from $A_{i,t}$ to $A_{i,t+1} = (1+\gamma)A_{i,t}$). Furthermore, I also assume that the innovating firm manufactures monopolistically the product, and the incumbent stops to produce it[1]. It can be interpreted as the fact that in addition

1. It is straightforward to establish that the classic assumption of competition a la Bertrand wouldn't change theoretical conclusions (see Lentz and Mortensen (2008) for a model using those assumptions), but this would complicate the model without relevant economic contributions. Therefore, I consider the simple monopolist case.

to a productivity increase, innovation corresponds to a quality increase, which implies that the market for the former product no longer exists.

#### Incumbent firms program

During each period, a firm chooses how much it invests, which impacts the probability to increase its size. I assume that the market is large enough to neglect the probability that a firm innovates on a good it already produces. Furthermore, a firm with size $n_{f,t} = 0$ exits the market forever, so has a value function equals to zero.

If R&D activities conducted by a firm during period $t$ are successful, it will produce one more product in period $t+1$. Therefore, the expectations about the potential revenues of future periods are essential when deciding the level of research activities. In what follows, I describe the formation of expectations by entrepreneurs. Then, I focus on the program of the firms.

##### The Formation of expectations

In order to derive the optimal level of research investments, the firm must evaluate the future value of the industry's aggregate price. This is driven by two factors, the wages paid by firms and their level of productivity.

First, I focus on the evolution of the aggregate price generated by the productivity increase. Each firm is considered as being small enough not to internalize its impact on both industry level variables and national level variables. Consequently, it considers that the productivity associated to each product of the industry evolves according to the following equation

$$A_{i,t+1} = A_{i,t}(1-\chi_t) + \chi_t(\gamma+1)A_{i,t} \tag{2.10}$$

This implies that the productivity increase generates a reduction of the industry aggregate price equal to

$$P_{t+1} = \frac{P_t}{1+\chi_t\gamma}$$

Equation 2.6 implies that the reduction of the industry aggregate price has two effects.

First, it modifies the industry aggregate revenue through the competition between industries. I assume, at no cost for the results[2], that $P_{0,t}$ evolves at the same rate as $P_t$. The impact of the productivity increase on prices is fully captured by the evolution of the numeraire.

Secondly, it intensifies the within industry competition. When the value of the industry aggregate price decrease, it decreases the revenue of the firm with an elasticity of $1-\sigma$.

Wages paid by competitors also affect the industry's aggregate price. I assume that entrepreneurs form their expectations on the future wage paid by competitors using only their current values[3]. This assumption is made to reflect two facts. First, an entrepreneur do not know the other firms strategy. Consequently, he can't perfectly foresee the evolution of variables driven by the decisions of competitors, and only have access to their past and current values. Secondly, firms always adapt their expectations and mainly focus on the most recent information (see Johnson et al. (1995) or Anderson and Salisbury (2018) for empirical evidences supporting this view).

2. As $\sigma > \xi$ it's straightforward to establish that there would still be a negative correlation between the industry aggregate price and the profits of firms even if both prices were not evolving at the same rate.

3. See the appendix for a scenario where entrepreneurs are perfectly forward looking

Consequently, I assume that they consider that the distribution of wages paid by competitors during the following period divided by the numeraire will be exactly the same as its actual value[4]. The numeraire captures the productivity increases, therefore this assumption corresponds to the fact that the wages conditional on productivity level are the same from one period to another.

Finally, if the firms doesn't innovate on a productivity line, its future level of profits is given by

$$\tilde{\pi}_{i,t+1} = \tilde{\pi}_{i,t} \left[1 + \gamma\chi_t\right]^{1-\sigma} \tag{2.11}$$

This equation implies that the value of being the technology leader for a product, conditional on being not replaced from one period to another, decreases with the growth rate of the industry aggregate productivity. Furthermore, the more intense the within industry competition (*i.e.* the higher $\sigma$), the higher the sensitivity of this value to the growth rate.

**The objectives of the firms**

I define $V_t(\overline{A}_{n,t}, n)$ as the value function of a firm. It's characterized by the number of products it manufactures, $n$, and a vector containing its different productivity levels, $\overline{A}_{n,t} = [A_{1,t}; ...; A_{n,t}]$. Finally, I define $\hat{\theta}_t = \frac{\theta}{P_t^{1-\xi}}$. The program of a firm is :

$$V_t(\overline{A}_{n,t}, n) = \max_z \frac{1}{1+r} \left\{ \begin{array}{l} \left[\sum_{i=1}^n \tilde{\pi}_{i,t} - \hat{\theta}_t n z^\eta\right] P_t^{1-\xi} \\ + nz\left[\mathbb{E}(V_{t+1}(\overline{A}_{n+1,t+1}, n+1)) - V_{t+1}(\overline{A}_{n,t+1}, n)\right] \\ + n\chi_t \left[\frac{1}{n}\sum_{i=1}^n V_{t+1}(\overline{A}^{[-i]}_{n-1,t+1}, n-1) - V_{t+1}(\overline{A}_{n,t+1}, n)\right] \\ + V_{t+1}(\overline{A}_{n,t+1}, n) \end{array} \right\} \tag{2.12}$$

Where $\overline{A}^{[-i]}_{n-1,t}$ refers to $\overline{A}_{n,t}$ without the $i$th element. The first term of the previous equation corresponds to the current profit minus the cost of R&D activities. The second term corresponds to the probability to innovate multiplied by the expected gains associated with the production of one more product. The entrepreneur innovates on a random product, therefore the utility associated with an innovation is the expectation of the potential gain over all lines of production. The third term is the probability to lose a production unit multiplied by the loss associated to it. The final term corresponds to the value of the firm if it still has the same number of production units one period later. It can be derived that (see appendix for proof)

**Proposition 1.** *When a firm produces at least one product, it fulfills the following propositions :*

**Proposition 1.A** *The value function is equal to*

$$V_t(\overline{A}_{t,n}, n) = n \left[ \frac{1}{n} \sum_{i=1}^n \underbrace{\frac{\tilde{\pi}_{i,t}}{1 + r - [1-\chi_t][1+\gamma\chi_t]^{1-\sigma}}}_{\tilde{\pi}_{i,t}} + \frac{z_t^i \overline{v}_t - \hat{\theta}_t (z_t^i)^\eta}{r + \chi_t} \right] P_t^{1-\xi} \tag{2.13}$$

Where $\overline{v}_t$ is the average value of an innovation, given by

$$\overline{v}_t = \frac{\mathbb{E}_i(\tilde{\pi}_{i,t+1})}{1 + r - [1-\chi_t][1+\gamma\chi_t]^{1-\sigma}} + \frac{z_t^i \overline{v}_t - \hat{\theta}_t (z_t^i)^\eta}{r + \chi_t} \tag{2.14}$$

And $\mathbb{E}_i(\tilde{\pi}_{i,t+1})$ is the expected value of the value of $\tilde{\pi}_{i,t+1}$ one period ahead, over all products $i$.

4. This assumption has no cost on the results. Indeed, as it will be demonstrated later on, wages aren't changing across periods. This assumption is made for purpose of simplification.

**Proposition 1.B** *The innovation rate of incumbents fulfills the following equation*

$$z_t^i = \left[\frac{\overline{v}_t P_t^{1-\xi}}{\eta\theta}\right]^{\frac{1}{\eta-1}} \tag{2.15}$$

$\hat{\pi}_{i,t}$ is the discounted profit of a production unit. It takes into account the interest rate, the probability to be replaced and the decreasing value of a production unit due to the innovations on other products of the industry. The first term of the value of a firm corresponds to the sum of those discounted profits. The second part is defined in Lentz and Mortensen (2008) as *"the innovation option value embodied in each product"*. It corresponds to the probability to innovate multiplied by the average value of an innovation, minus the costs of research activities, discounted by the interest rate and the probability to be replaced. The value of the innovation option arises from the fact that the marginal cost of innovation equalizes its marginal value. First, it decreases with the inverse of the elasticity of the Poisson innovation flow rate with respect to investments, $\eta$. Indeed, it represents the sensitivity of innovation to investments, therefore when it increases investments are less efficient. Moreover, it increases with the average value of an innovation, $\overline{v}_t$.

The expected value of an innovation corresponds to the utility of producing one good, averaged over all production units. This arises because the entrepreneur innovates over a product selected at random. It's first made of the expected profit associated with an innovation. When the average potential profit in the industry raises, the willingness to invest in research activities increases. Finally, the expected value of an innovation also embeds the innovation option.

**Firms creation**

I assume that there is a mass of identical potential entrants and, following Acemoglu and Cao (2015), I assume that its size is positively correlated with the value of future profits. This assumption is made in order to capture several effects. Inter alia, potential profits increase the probability that economic agents become entrepreneurs (see Earle and Sakova (1999) for empirical evidences). Moreover, when potential profits increase, the importance of the credit constraint decreases, which has a positive impact on the size of the cohort of entrepreneurs (see Earle and Brown (2017) for empirical evidences). I assume that the measure of potential entrants is given by

$$\mu_t = \mu_0 \left[\frac{\overline{v}_t P_t^{1-\xi}}{\theta\eta}\right]^{\frac{\alpha-1}{\eta-1}} \tag{2.16}$$

Where $\alpha > 1$. Furthermore, in order to start out as a single product firm, a potential entrant must innovate. I assume that it faces the same cost function as that of incumbents. A potential entrant doesn't know, when investing, in which line it will innovate. Therefore, defining $\hat{z}_e$ as the probability that a potential entrant innovates and using equation 2.9, the free entry condition implies that

$$\hat{z}_t^e = \left[\frac{\overline{v}_t P_t^{1-\xi}}{\theta\eta}\right]^{\frac{1}{\eta-1}} \tag{2.17}$$

Finally, as the total rate of innovation of entrant is equal to $\mu\hat{z}^e = z^e$, the free entry condition is equivalent to the following equation

$$z_t^e = \mu_0 \left[\frac{\overline{v}_t P_t^{1-\xi}}{\theta\eta}\right]^{\frac{\alpha}{\eta-1}} \tag{2.18}$$

The last equation implies that the determinants of innovation intensity of potential entrants are the same than the one of incumbent firms. However, the sensitivity to the average value of an innovation is higher, as in addition to the quantity of investments, the size of the cohort of potential entrants varies with it. The two only sources of innovation are the research activities of incumbents and the one of entrant firms, which implies that the aggregate rate of innovation is equal to

$$\chi_t = z_t^e + \int_0^1 z_t^i di = \mu_0 \left[\frac{\overline{v_t} P_t^{1-\xi}}{\eta}\right]^{\frac{\alpha}{\eta-1}} + \int_0^1 \left[\frac{\overline{v}_t P_t^{1-\xi}}{\eta\theta}\right]^{\frac{1}{\eta-1}} di \tag{2.19}$$

## 2.3 Wage bargaining

I study the impact of the level at which the negotiation takes place. I first describe the objective of the union, then I focus on firm-level bargaining, and finally I consider industry-level bargaining where a binding wage is negotiated for all firms.

In both cases, the wage is negotiated at the beginning of the period, and impacts the profit of the current period. However, when the wage is negotiated at the industry-level, as the wage is binding for all firms of the industry, the elasticity of substitution with the closest competitors becomes $\xi$ instead of $\sigma$. The relevant competition is between industries, not within the differentiated industry.

Moreover, in the firm bargaining scenario, the industry's aggregate price is considered as constant. However, when the bargaining takes place at the industry-level, the effect of the wage on the industry-level aggregate price is endogenized. Therefore, the negotiating parties take into account the negative impact of a wage increase on the quantity of R&D activities of competitors. Indeed, when the wage increases, the industry's aggregate price increases. This in turns reduces the anticipated reward of an innovation and so the aggregate level of investments[5].

The reduction of the flow of innovation decreases the probability that an incumbent firm loses a line of production, and that the workers producing it are dismissed.

Those two effects generate a wage surplus when it's negotiated at the sector-level, in comparison with the firm-level bargaining scenario.

### 2.3.1 Workers objective

During a period a worker can be either employed or unemployed. If she is employed she is paid $w_t$ during the period and looses his job with probability $\chi_t$, which is independent of the firm she works in. The discounted expected utility of a worker who is earning a wage $w$ is

$$W_t^e(w) = \frac{1}{1+r}\left[w + \chi_t W_t^u + (1-\chi_t) W_{t+1}^e\right] \tag{2.20}$$

where $W_t^u$ is the expected utility of being unemployed during period $t$, and $W_{t+1}^e$ is the expected utility of being employed during period $t+1$.

5. In the appendix, I derive a scenario where the wage increase directly decreases the profits of the next period, not only through anticipations.

Following Helpman and Itskhoki (2010), I assume that a person not employed by the firm can always be hired in the other industry. Furthermore, as in Cahuc and Zylberberg (2009), I consider the labor market of this industry as a perfectly competitive labor market offering the constant wage $\frac{W^u}{r}$ to every employee. Therefore, the only source of variation of the wage in the homogeneous industry is the productivity increase, which is embodied in the numeraire.

Moreover, I don't consider scenarios where the objectives of the negotiating parties vary with time. This, combined with the fact that all assumptions don't vary from one period to another, directly implies that the utility of an employed person is time-constant.

Consequently, the individual worker surplus is standard

$$W_t^e(w) - W^u = \frac{w - rW^u}{r + \chi_t} \tag{2.21}$$

The utility of the worker increases with the difference between its actual wage, and the wage equivalent to the utility of being employed in the homogeneous industry. It decreases with $\chi_t$, which corresponds to the probability of loosing its job.

### 2.3.2 Firm-level bargaining

I use a right-to-manage model where the entrepreneur chooses the level of employment of its firm. This assumption is made in order to increase the comparability between both bargaining scenarios. Indeed, it would be highly counterfactual to assume that, when negotiating at the sector-level, unions and employers federation, bargain over the level of employment. Furthermore, I assume that, when the bargaining takes place at the firm level, the impact of the wage on industry-level variables ($P_t$...) is neglected.

If an agreement is reached, the entrepreneur pays workers, produces, and invests in R&D activities. Otherwise, the firm doesn't pay the workers and produces nothing but the entrepreneur still invests in R&D activities. The wage is negotiated at the beginning of each period, therefore it has no impact on the potential profits of following periods. Finally, I assume that there are no financial constraints for the entrepreneur, which implies that the negotiated wage has no impact on the investments. Building on previous insights, the wage equation is given by Lemma 2.

**Lemma 2.** *When the negotiation takes place collectively, at the firm level, the bargaining problem, for firm $f$ with n production units, is given by*

$$\max_{w} \left\{ \left[ \sum_{i=1}^{n} \frac{q_i(w)}{A_{i,t}} \right]^{\beta} \left[ \frac{w - rW^u}{r + \chi_t} \right]^{\beta} \left[ \sum_{i=1}^{n} \frac{\tilde{\pi}_{i,t}(w)}{1 + r - [1 - \chi_t][1 + \gamma\chi_t]^{1-\sigma}} P_t^{1-\xi} \right]^{1-\beta} \right\} \tag{2.22}$$

Where $\beta$ is the bargaining power of unions, considered as constant and identical across firms. It's straightforward to derive that the wage fulfills the following proposition

**Proposition 2.** *When the wage is negotiated at the firm level, it's constant across firms, and it's given by the following formula*

$$w = rW^u \left[ 1 + \frac{\beta}{\sigma - 1} \right] \tag{2.23}$$

It is made of two components, the reservation wage, and the workers share of the joined surplus. It increases with the bargaining power of workers, and it decrease with the elasticity of substitution between products of the same industry. Indeed, when products of competitors are closer substitutes, competition increases which implies that the rent to be shared between negotiation parties decreases.

### 2.3.3 Industry-level bargaining

When the negotiation takes place at the industry level, an industry-wide employers federation representing all operating firms of an industry, and an industry-wide union representing all workers of the industry, bargain over a wage that will be binding for the entire industry. Following Jimeno and Thomas (2013), I assume that the employer federation cares about the aggregate profits of firms of the industry.

The wage bargaining occurs at the beginning of the period (see figure 2.1). Therefore, as in the firm-level bargaining scenario, the wage negotiated in period $t$ impacts the profit generated during period $t$. However, the wage is binding for all firms of the industry. Therefore, negotiators don't account for the within industry competition, but for the competition between industries.

Moreover, once this wage has been bargained over, the entrepreneurs choose the quantity invested in R&D activities. As has been displayed above, when evaluating the future flow of profits associated with a line of production, entrepreneurs expect that the value of the wage divided by the numeraire won't change from one period to another[6]. Therefore, the wage negotiated in period $t$ impacts the anticipation of profits in period $t+1$, and therefore the quantities invested in research activities in period $t$.

Finally, as it is depicted in figure 2.1, entrants enter at the end of the period. Therefore, their objective is not taken into account. The following Lemma can be derived

**Lemma 3.** *When the negotiation takes place collectively, at the industry level, the bargaining problem fulfills following conditions*

**Lemma 3.A** *The objective of the union is*

$$\left[\int_0^1 \frac{q_i(w)}{A_{i,t}} di\right] \left[\frac{w - rW^u}{r + \chi_t(w)}\right] \tag{2.24}$$

**Lemma 3.B** *The objective of the employer association is*

$$\int_0^1 \frac{\tilde{\pi}_{i,t}(w)}{1 + r - [1 - \chi_t(w)][1 + \gamma\chi_t(w)]^{1-\sigma}} P_t^{1-\xi}(w) di \tag{2.25}$$

**Lemma 3.C** *The bargaining game solves the following equation*

$$\underset{w}{max} \left\{ \left[\int_0^1 \frac{q_i(w)}{A_{i,t}} di\right]^\beta \left[\frac{w - rW^u}{r + \chi_t(w)}\right]^\beta \left[\int_0^1 \frac{\tilde{\pi}_{i,t}(w)}{1 + r - [1 - \chi_t(w)][1 + \gamma\chi_t(w)]^{1-\sigma}} P_t^{1-\xi}(w) di\right]^{1-\beta} \right\} \tag{2.26}$$

I assume that, when the wage is negotiated at the industry level, actors take into account the effect of a wage increase on the R&D investments of competitors and, in doing so, on the aggregate research effort of the industry. I define $\Lambda(\chi_t) = \frac{1}{1+r-[1-\chi_t][1+\gamma\chi_t]^{1-\sigma}}$ and $\Phi(\chi_t) = \frac{1}{r+\chi_t}$. I also define $\epsilon_w^\Lambda$ and $\epsilon_w^\Phi$, which are respectively the elasticity of $\Lambda$ with respect to $w$, and the elasticity of $\Phi$ with respect to $w$. Using previous results, it can be derived that

6. In appendix I present an alternative scenario where the wage negotiated in period $t$ is paid in period $t+1$. In this scenario, the negotiated wage directly changes the profit extracted during the following period. This has no impact on the results.

**Proposition 3.** *When wage is negotiated at the industry level, it fulfills the following propositions (Proof are given in the appendix)*

**Proposition 3.A** *The wage is given by*

$$w = rW^u \left[ 1 + \frac{\beta}{\xi - \underbrace{(1-\beta)\epsilon_w^{\Lambda}}_{>0} - \underbrace{\beta\epsilon_w^{\Phi}}_{>0} - 1} \right] \tag{2.27}$$

**Proposition 3.B** *The wage is finite and strictly higher than the wage negotiated at the firm level*

There are three distinct channels leading to a wage surplus compared to the firm-level bargaining scenario. First there is the well known effect of the difference between the elasticity of substitution between products of the same industry and the elasticity of substitution between products of different industries (*i.e.* between $\sigma$ and $\xi$). As products of a same industry are closer substitutes, the rent-sharing decreases, therefore the wage decreases when the bargaining process is decentralized (see Calmfors and Driffill (1988)).

Secondly, negotiating parties take into account the research effort of competitors. On the employer side, it is embodied in the elasticity of the effective discount rate with respect to wage. When the negotiated wage increases, the aggregate price of the industry increases. The structure of the demand implies that it reduces the anticipated future aggregate revenue of the industry. Therefore, using equation 2.14, the reduction of the anticipated flow of profit generates a decrease of the average value of an innovation $\overline{v}_t$. As the potential gain from successful investments decreases, the research effort of entrepreneurs decreases, which implies that, for an incumbent firm, the probability to be outperformed decreases. This has a positive effect on the objective of the firm.

Furthermore, when the probability to be outperformed by a competitor decreases, it reduces the probability of employed workers to be dismissed. This effect will also raise the negotiated wage, and it's embodied in the elasticity of the effective discount rate of workers with respect to wage.

Consequently, a wage increase has a lower negative effect on the objectives of employers and of unions. This generates a wage surplus when the bargaining takes place at the industry-level.

## 2.4 Impact of level of bargaining on the equilibrium

In this section I first define the general equilibrium. Then, I focus on the impact of the level at which the bargaining takes place. The wage surplus generated by the industry-level negotiation decreases employment, production and therefore the utility of consumers. Furthermore, it reduces the overall intensity of research activities made by firms of the differentiated industry, and therefore reduces the growth rate. Secondly, I focus on the equilibrium distribution of firms. I find that the centralization of the bargaining process generates an industry with a distribution of firms size that is more skewed. Indeed, the industry-level bargaining act as a barrier to entry as it deters the innovation of new firms. Consequently, when the labor cost increases, the share of innovation made by entrants decreases. This generates an equilibrium with less entrants, and larger firms.

### 2.4.1 Definition of the general equilibrium

I define $L$ as the size of the employed labor force, and $g$ as the growth rate of the industry. It must be noted that, with both types of wage bargaining, wages are the same across firms, and are constant. This implies that the same goes for $\overline{v}$ and, using equation 2.15, for the innovation rate of incumbents firms. Finally, equation 2.18 implies that the reward taken into account by entrants is the same as the one of incumbent firms. Finally, the aggregate innovation of the industry is given by

$$\chi_t = z_t^e + z_t^i = \mu_0 \left[ \frac{\overline{v}_t P_t^{1-\xi}}{\eta} \right]^{\frac{\alpha}{\eta-1}} + \left[ \frac{\overline{v}_t P_t^{1-\xi}}{\eta\theta} \right]^{\frac{1}{\eta-1}} \tag{2.28}$$

The equilibrium can be defined as follows

**Definition 1** :*A steady state equilibrium is characterized by a vector* $\{w, \overline{v}, z^i, z^e, R, L, g\}$ *that satisfies equations 2.7, 2.10, 2.15, 2.18, 2.14 and 2.23 if the wage is negotiated at the firm level and 2.27 if the wage is negotiated at the industry level*

I define the aggregate productivity of the industry as follows

$$\frac{1}{\overline{A}} = \left[ \int_0^1 \left[ \frac{1}{A_i} \right]^{1-\sigma} \right]^{\frac{1}{1-\sigma}}$$

This definition is given in order to correspond to the demand structure of the economy. Building on previous insights, the following propositions can be derived (see appendix for proof).

**Proposition 4.A** *When the wage is negotiated at the industry level, for the same aggregate level of productivity (i.e. for the same* $\overline{A}$*), the industry aggregate revenue is lower than when the wage is negotiated at the firm level.*

**Proposition 4.B** *When the wage is negotiated at the industry level, for the same aggregate level of productivity (i.e. for the same* $\overline{A}$*), the size of the labor force employed in the differentiated industry is smaller than when the wage is negotiated at the firm level*

**Proposition 4.C** *When the wage is negotiated at the industry level, for the same aggregate level of productivity (i.e. for the same* $\overline{A}$*), the utility is lower than when the wage is negotiated at the firm level.*

**Proposition 4.D** *When the wage is negotiated at the industry level, both the effort research (i.e.* $\chi$*) and the growth rate (i.e.* $\chi\gamma$*) are lower than when the wage is negotiated at the firm level.*

When the negotiation takes place at the industry level the wage increases, which lowers the demand faced by the industry in the good market and, therefore, it decreases the industry demand in the labor market. Furthermore, the price increase lowers the real consumption index and, consequently, reduces the utility of consumers.

Finally, incumbent firms use the industry-level negotiation to reduce the investments of competitors and consequently to lower the probability to lose a production unit. This generates a decrease in the research effort of the industry, and therefore a decrease of the growth rate.

### 2.4.2 Effect on the size distribution

I denote by $s_n$ the share of firms having $n$ different products. At the equilibrium, this share is constant, which directly implies that

$$s_1\chi = z_e$$

$$ns_n(\chi + z_i) = s_{n+1}(n+1)\chi + s_{n-1}(n-1)z_i$$

The first equation equates entry and exit. The left part of the second equation corresponds to the outflows of firm operating with $n$ different products. The right part is composed of the inflow coming from firms with $n+1$ different products which lose one, and then from those which have $n-1$ different products and which gain one. This implies that

$$s_n\left(\frac{z_e}{z_i}\right) = \frac{\frac{z_e}{z_i}}{n}\left[\frac{1}{1+\frac{z_e}{z_i}}\right]^n \tag{2.29}$$

Combining the last results with equations 2.15 and 2.18, the following propositions can be derived

**Proposition 5.A** *When the wage is negotiated at the industry level the distribution of firms size is more skewed than when it is negotiated at the firm level*

**Proposition 5.B** *When the wage is negotiated at the industry level the share of research activities made by incumbents is higher than when the wage is negotiated at the firm level*

The higher sensitivity of the innovation intensity of potential entrants to potential gains from innovation implies that a reduction of the aggregate revenue of the industry will have a stronger effect on their research effort. Therefore, this will increase the share of innovation made by incumbent firms. Furthermore, this will secure the position of incumbent firms, as when there is relatively less entry, the probability to be replaced decreases.

## 2.5 Quantitative analysis

The previous sections provide several theoretical results on the effect of the bargaining scenario on the innovation process and on the firms' size distribution. With the purpose of assessing the magnitude of those effect, I calibrate the model. The values of several parameters used in the model have been evaluated by Lentz and Mortensen (2008) using Danish data. Therefore, the model is calibrated on this country. On this basis, I investigate how the main endogenous variables of the model respond to a change of the bargaining setup.

### 2.5.1 Calibration

First, I take $\alpha = 3$ following the work of Acemoglu and Cao (2015). Other parameters related to the Schumpetarian process, ($\mu_0$, $\eta$ and $\theta$), are calibrated using the values found by Lentz and Mortensen (2008), and are displayed in table 2.1.

I set the size of the labor force equal to 1. This enables to calibrate the value of $W^u$ so that the unemployment is equal to 7 % when the wage is negotiated at the firm-level. Moreover, I impose that the discount rate $r$ has a value of $5\%$ per annum , and the value of $\gamma$ is set to target a growth rate of $3\%$ when the wage is negotiated at the firm level. Those values are set to target the Danish economy during the 1990's. This country and this period are chosen because it corresponds to the data used by Lentz and Mortensen (2008). During this period the wage was negotiated at the firm-level in Denmark (the decentralization of the wage bargaining occured at the end of the 1980's has it's described in Dahl et al. (2013)).

The value of $\sigma$ and $\xi$ are extracted from Broda and Weinstein (2006). Finally, the average value of productivity $\frac{1}{A}$ is set to 1 and the bargaining power of employees $\beta$ is set to 0.5 (Petrongolo and Pissarides (2001)). The value of the different parameters given in the table 2.1.

TABLE 2.1 : Values of parameters

| Parameter | Notation | Value | Source |
|---|---|---|---|
| Discount factor | $r$ | 0.05 | Real interest rate of $5\%$. |
| Elasticity of substitution between differentiated products | $\sigma$ | 2.7 | Broda and Weinstein (2006) |
| Elasticity of substitution between industries | $\xi$ | 2.4 | Broda and Weinstein (2006) |
| Improvement of an innovation | $\gamma$ | 0.223 | $3\%$ growth rate |
| Bargaining power of employees | $\beta$ | 0.5 | Petrongolo and Pissarides (2001) |
| Utility of being unemployed | $W^u$ | $rW^u = 1.13$ | $7\%$ of unemployment |
| Level of productivity | $\frac{1}{A}$ | 1 | |
| Inverse of the elasticity of innovation with respect to investments | $\eta$ | 4.72 | Lentz and Mortensen (2008) |
| Scale Parameter | $\theta$ | 4.02 | Lentz and Mortensen (2008) |
| Size of the cohort of entrants | $\mu_0$ | 1.12 | Lentz and Mortensen (2008) |
| Sensitivity of the size of the cohort of entrants | $\alpha$ | 3 | Acemoglu and Cao (2015) |

### 2.5.2 Impact of the level at which the bargaining takes place

Using previous parameters, I calculate the impact of moving from an industry-level bargaining scenario to a firm-level bargaining scenario. All results are given in table 2.2. First, the wage negotiated at the industry level is $7.6\%$ higher than the one negotiated at the firm level. Using equation 2.27, if the negotiating parties were not taking into account the impact of the wage on the research effort of competitors, the wage would be given by

$$w = rW^u \left[1 + \frac{\beta}{\xi - 1}\right]$$

Therefore, it can be calculated that the fact that the impact of the wage floor on competition is taken into account generates a 2.8 percentage point increase of the wage. Furthermore, the labor force of the industry decreases by $15.9\%$ and the quantity produced by $9.2\%$ when the bargaining process is centralized. Using the same reasoning as previously, it can be derived that the fact that the impact of the wage floor on competition is taken into account generates a 6.2 percentage point decrease of the labor force, and a 3.6 percentage point decrease of the production.

Then, I focus on variables related to creative destruction. It must first be noted that, in both cases, the values obtained are in line with the literature. Indeed, the overall creative destruction rate is estimated at an annual rate around $10\%$, which is consistent with the annual flow of workers from employment to unemployment (Rosholm and Svarer (2000)). Furthermore, using formula 2.29, the values of $z^e$ and $z^i$ imply that the fraction of firms with $1$ product is around $17\%$, which corresponds to the literature (see Aghion et al. (2014) for a summary on the distribution of firms size).

Second, the level at which the bargaining takes place has an effect on the value of those variables, which is in line with theoretical conclusions. Indeed, the value of an innovation increases by $1.8\%$ when the wage is negotiated at the industry level. Furthermore, the overall creation destruction rate decreases by $2.4\%$. The effect on the research efforts of incumbent firms is, in proportion, lower as it decreases by $2.2\%$ whereas the innovation rate of entrants decreases by $3.3\%$.

The quantitative analysis highlights several points. First, the fact that the impact of the wage on the research efforts of competitors is taken into account by the negotiating parties when the wage is negotiated at the industry level has an important impact on the wage, and so on the labor force employed by the industry, and on the production level. Furthermore, if the impact of this effect on variable related to creative destruction is non negligible, it appears as being of low magnitude.

However, the model doesn't take into account all effects of industry-level negotiation. Inter alia, the wage compression due to the wage floor will impede less productive firms to produce (see Jimeno and Thomas (2013)) and therefore will be an entry barrier, which has a negative effect on innovation (see Alesina et al. (2005)). Consequently the model underestimates the overall effect of the level at which the bargaining takes place on the innovation rate.

Finally, I test the sensitivity of the model to the value of the elasticities of substitution. Results are displayed in table 2.3. The previous conclusions remain valid.

TABLE 2.2 : Value of endogenous variables

| Parameter | Notation | Bargaining scenario | |
|---|---|---|---|
| | | Firm-level | Sector-level |
| wage | $w$ | 1.462 | $1.573(7.6\%)$ |
| Labor force | $\int_0^1 \frac{q_i}{A_i} di$ | 1 | $0.841(-15.9\%)$ |
| Production | $\int_0^1 q(i) di$ | 1.291 | $1.120(-9.2\%)$ |
| Creation and destruction rate | $\chi$ | 0.111 | $0.108(-2.4\%)$ |
| Innovation of Incumbent firms | $z^i$ | 0.0835 | $0.0815(-2.2\%)$ |
| Innovation of entrants | $z^e$ | 0.0193 | $0.0186(-3.3\%)$ |
| Value of an innovation | $v$ | 2.283 | $2,324(1.8\%)$ |

TABLE 2.3 : Sensitivity analysis

| Parameter | $\sigma = 2.5$ ; $\xi = 2.4$ | | $\sigma = 2.7$ ; $\xi = 2.2$ | |
|---|---|---|---|---|
| | Firm-level | Sector-level | Firm-level | Sector-level |
| wage | 1.506 | 1.573(4.4%) | 1.462 | 1.600(9.4%) |
| Labor force | 0.983 | 0.841(−14.5%) | 1 | 0.921(−7.9%) |
| Production | 1.201 | 1.120(−6.8%) | 1.291 | 0.6240(−12.134%) |
| Creation and destruction rate | 0.110 | 0.108(−2.0%) | 0.111 | 0.107(−2.8%) |
| Innovation of Incumbent firms | 0.0850 | 0.0835(−1.8%) | 0.0835 | 0.0814(−2.5%) |
| Innovation of entrants | 0.0191 | 0.0186(−3.0%) | 0.0193 | 0.0185(−4.1%) |
| Value of an innovation | 2.356 | 2.324(1.4%) | 2.283 | 2.232(2.2%) |

# Appendix

## 2.A Incumbent firm program

### Proof of proposition 1

I focus on the solution of equation 2.2.3. I suppose that the solution is of the form

$$V_t(\overline{A}_{t,n}, n) = \left[\sum_{i=1}^{n} \frac{\tilde{\pi}_{i,t}}{1 + r - [1 - \chi_t][1 + \gamma\chi_t]^{1-\sigma}} + n\Gamma\right] P_t^{1-\xi}$$

Using equations 2.2.3 and 2.11, this implies

$$(1+r)V_t(\overline{A_{t,n}}, n) = P_t^{1-\xi} \max_z \left\{ \begin{array}{l} \sum_{i=1}^{n} \tilde{\pi}_{i,t} - \hat{\theta}_t nz \\ +nz \left[\frac{\mathbb{E}_i(\tilde{\pi}_{i,t+1})}{1+r-[1-\chi_t][1+\gamma\chi_t]^{1-\sigma}} + \Gamma\right] \\ -n\chi_t \left[\frac{1}{n}\sum_{i=1}^{n} \frac{\tilde{\pi}_{i,t}}{1+r-[1-\chi_t][1+\gamma\chi_t]^{1-\sigma}} [1+\gamma\chi_t]^{1-\sigma} + \Gamma\right] \\ +\sum_{i=1}^{n} \frac{\tilde{\pi}_{i,t}}{1+r-[1-\chi_t][1+\gamma\chi_t]^{1-\sigma}} [1+\gamma\chi_t]^{1-\sigma} + n\Gamma \end{array} \right\}$$

This is equivalent to

$$\left[1 + r - [1-\chi_t][1+\gamma\chi_t]^{1-\sigma}\right] \sum_{i=1}^{n} \frac{\tilde{\pi}_{i,t}}{1 + r - [1-\chi_t][1+\gamma\chi_t]^{1-\sigma}} - \sum_{i=1}^{n} \tilde{\pi}_{i,t} + n\,(r + \chi_t)\,\Gamma =$$

$$\max_z \left\{ nz \left[\frac{\mathbb{E}_i(\tilde{\pi}_{i,t+1})}{1 + r - [1-\chi_t][1+\gamma\chi_t]^{1-\sigma}} + \Gamma\right] - \hat{\theta}_t nz^{\eta} \right\}$$

Using the previous equation, it's straightforward to derive the results.

## 2.B Effect of the aggregate Industry revenue

### Proof of Proposition 3

It is straightforward to derive the expression of Proposition 3.A.

**Proof that $\epsilon_w^{\Lambda} > 0$**

I focus on the sign of $\epsilon_w^{\Lambda}$. First, it's straightforward to derive that the industry aggregate price increases when the wage negotiated at the industry-level increases. Therefore, the industry aggregate revenue decreases.

I suppose that, following an industry aggregate revenue decrease, the probability to be outperformed increases (*i.e.* $\chi_t$ increases). Using equations 2.15 and 2.18 this would imply that the research efforts made by both potential entrants and incumbent firms increase (*i.e.* $^i_t$ and $z_t^e$ increase). Furthermore, equations 2.14 and 2.15 yield

$$\overline{v}_t = \frac{r + \chi_t}{1 + r - [1-\chi_t][1+\gamma\chi_t]^{1-\sigma}} \frac{1}{r + z_t^e + \frac{z_t^i}{\eta}}$$

Therefore, if $\chi_t$ was increasing, this would imply that $\overline{v}_t$ would decrease, and so that the research effort mad by both incumbents and entrants would decrease. This directly contradicts the original assumption. Therefore, using contraposition, this implies that if the industry aggregate revenue decreases, the probability to be outperformed decreases.

Finally, the previous result and the fact that $\frac{\partial \Lambda}{\partial \chi_t} < 0$ yield

$$\epsilon_w^{\Lambda} > 0$$

It is straightforward to derive that $\epsilon_w^{\Phi} > 0$. Consequently, the previous results, and the fact $\sigma > \xi$, imply that, for the same value of $W_t^u$, the wage is higher when it's negotiated at the industry level. Therefore, previous results directly imply that the wage negotiated at the industry-level is strictly higher than the wage negotiated at the firm level.

Finally, when the wage increases toward infinite, the value of $\chi_t$ decreases toward zero. Therefore, the continuity of $\frac{\partial \chi_t}{\partial w}$ implies that $\epsilon_w^{\Lambda}$ and $\epsilon_w^{\Phi}$ decreases toward zero, which implies that equation 2.27 has a finite solution.

# 2.C Equilibrium

## Proof of Proposition 4.A

First, the wage is higher when the negotiation takes place at the industry level which, using equation 3.1, implies that the aggregate revenue of the industry decreases, which corresponds to Proposition 4.A.

## Proof of Proposition 4.B

It can be derived that

$$R = \int_0^1 p_i q_i di = \int_0^1 \frac{w}{\rho A_i} q_i di = \frac{w}{\rho} L$$

When the negotiation takes place at the industry level the wage is higher and the aggregate revenue is lower, therefore the size of the employed labor force decreases.

## Proof of Proposition 4.C

Using proposition 4.A and the structure of the utility, it's straightforward to derive proposition 4.C.

## Proof of Proposition 4.D

This can be derived using the same methodology as explained in the proof of Proposition 3.

# 2.D Alternative scenario

In this section, I consider an alternative specification of the model. I suppose the agents to be perfectly forward looking. They negotiate their wage one period of time in advance. That is, the employers commit to pay, during the period $t+1$, the wage bargained at time $t$. The timeline faced by entrepreneurs is considered as being the same as previously. As a consequence, the only difference is during the wage bargaining.

**Impact of the level at which the bargaining takes place**

When the wage is negotiated at the firm-level, the objective of the entrepreneur is modified, as the wage impacts its future level of investment. Furthermore, the wage negotiated during period $t$ will prevail during period $t+1$. Consequently, the negotiating parties maximizes the surplus generated one period ahead, conditional on the fact the the firm has not been outperformed on each of its producing line. The problem becomes

$$\max_{w} \left\{ \left[ \sum_{i=1}^{n} \frac{q_i(w)}{A_{i,t+1}} \right]^{\beta} \left[ \frac{w - rW^u}{r + \chi_{t+1}} \right]^{\beta} \left[ \sum_{i=1}^{n} \frac{\tilde{\pi}_{i,t+1}(w)}{r + \chi_{t+1}} P_{t+1}^{1-\xi} + n \frac{z_{t+1}^{i}(w)\overline{v}_{t+1}(w) - \hat{\theta}_{t+1}(z_{t+1}^{i}(w))^{\eta}}{r + \chi_{t+1}} \right]^{1-\beta} \right\} \tag{2.30}$$

When the wage is negotiated at the industry-level, the problem is given by

$$\max_{w} \left\{ \left[ \sum_{i=1}^{n} \frac{q_i(w)}{A_{i,t+1}} \right]^{\beta} \left[ \frac{w - rW^u}{r + \chi_{t+1}(w)} \right]^{\beta} \left[ \sum_{i=1}^{n} \frac{\tilde{\pi}_{i,t+1}(w)}{r + \chi_{t+1}(w)} P_{t+1}^{1-\xi} + n \frac{z_{t+1}^{i}(w)\overline{v}_{t+1}(w) - \hat{\theta}_{t+1}(z_{t+1}^{i}(w))^{\eta}}{r + \chi_{t+1}(w)} \right]^{1-\beta} \right\} \tag{2.31}$$

The difference with the firm-level case is that the effect of the wage on the $\chi_{t+1}$ is taken into account. Using the same line of reasoning as in the proof of proposition 3, it can be derived that a wage increase generates a decrease of $\chi_{t+1}$. This in turn will decrease the negative effect of a wage increase on the objective of entrepreneurs. Secondly, when computing the impact of a wage on $\tilde{\pi}_{i,t+1}(w)P_{t+1}^{1-\xi}$, contrary to the firm-level bargaining scenario, the elasticity of substitution that matters is the one between products of different industries. As $\xi < \sigma$ this will also decrease the negative impact of a labor cost increase on the objective of the entrepreneur, and on the employment level. Finally, on the union's side, the decrease of $\chi_{t+1}$ also generates a wage surplus, as it decreases the probability to lose the job during the next period.

# Chapter 3

# Collusion in the Labor Market and International Competition

Collective Wage Bargaining allows firms of a given industry to coordinate. This paper argues that international competition makes this collusive equilibrium unsustainable. As a consequence, decentralizing the bargaining process has an impact only through the non-tradeable industries. To support this argument, a Melitz-type model is developed and its implications tested on French data using the China Shock as a source of exogenous variation. It's found that the higher the competition with Chinese firms, the lower the wage-floors, confirming theoretical results.

## 3.1 Introduction

Collective Bargaining Agreements cover 75% of the European workforce (see OECD (2018)). They provide an institutional setting through which firms can collectively agree on the industry wages. There are no incentives to deviate from these agreements because they are compulsory by law. This sustains a collusive equilibrium. However, international competitors are not bound by these agreements. Their ability to undercut domestic firms annihilates the cartel's *raison d'être*. With international trade, competition is restored to the level observed under firm-level bargaining. Exploring this mechanism allows us to address the following questions. How are sector-level wage agreements impacted by international trade ? Are the gains associated with decentralization still existent in present of foreign competitors ? We argue that international trade impedes the restraint of market forces, bringing wage floors to their decentralized level.

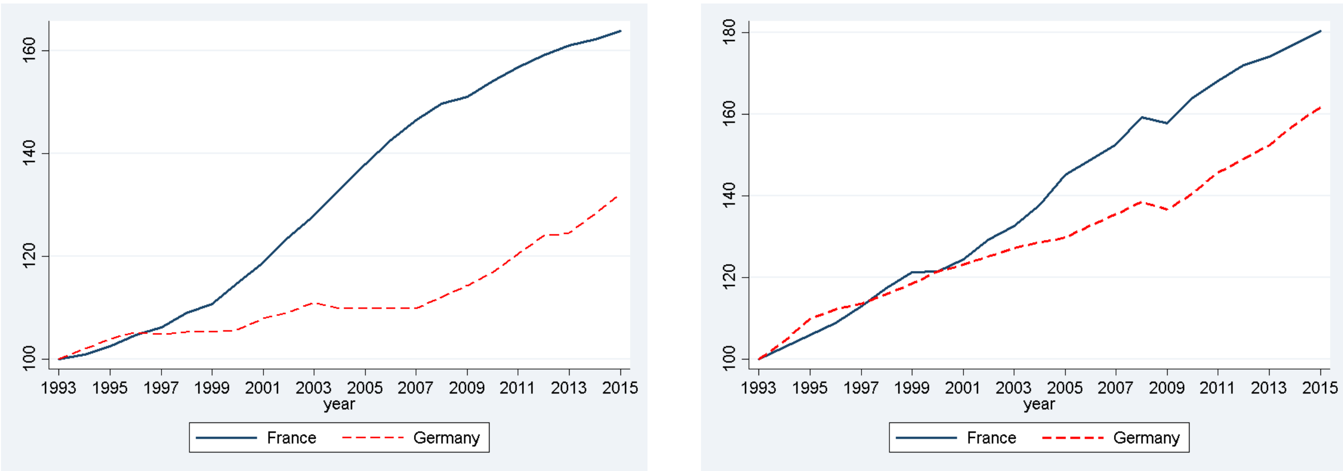
Indeed, first suppose that a country is in autarky and wages are set at the firm level. In a situation of monopolistic competition, a rise in wages, and therefore in price, generates a large loss in revenue. In contrast, when wages are set at the sector level, a rise in wages leads all firms of the industry to increase their price. Revenue falls only in so far as consumers prefer to buy goods from another sector. Market forces are restrained, which decreases the price elasticity of the demand. Competition is therefore lowered by the ability of firms to coordinate : there is a quasi-cartel effect. However, when there are no trade barriers, domestic firms face competition with foreign ones. The latter are not covered by industry-level agreement and produce highly substituable goods. This means that they can easily undercut the domestic firms' prices. In response, domestic firms and unions must lower the negotiated wage in order to be competitive. In this sense, trade liberalization is equivalent to a decentralization of the wage bargaining process.

To illustrate this process, consider the case of the German decentralisation of the wage bargaining process during the mid 1990s'. Initially, German Collective Bargaining Agreements were compulsory and negotiated at the industry level (the so called *Allgemeinverbindlicherklärung* (AVE)). The reform allowed one to freely deviate from those agreements. France, in contrast, maintained sector level agreements. If our theory is right, we should observe that German labor costs should deviate from the French. This deviation should be particularly strong within the non-tradeable sector. The reason being that the tradeable sectors should have already been exposed to international competition in the first place and, in turn, have little economic rent to share among its employees. This is evident in graph 3.1 which presents the average wage in France and Germany in the tradeable and non-tradeable sectors across time[1]. After 1995, the average normalized wage in Germany falls well below the French one in the non-tradeable sector, as seen in graph 3.1a. This is much less apparent in the case of the tradeable sector of graph 3.1b. Thus, in so far as the gains from decentralization stem from the reduction of the workers' economic rent, decentralization takes effect mainly through the non-tradeable sector.

FIGURE 3.1 : Evolution of wages in France an Germany (all values are expressed in base 100 in 1993)

(a) Non tradeable sectors

(b) Tradeable Sectors




In this paper, we show this formally through a Melitz-type model (Melitz (2003)) which incorporates features found in Helpman and Itskhoki (2010). That is, we assume competition between and among firms of two distinct countries. In each country, there is an industry composed of a continuum of firms which differ according to their productivity levels. Each firm either serves solely the domestic market or both the domestic and the foreign market. In one country, the wage is negotiated collectively at the firm-level, through a standard right-to-manage model. The other country is perfectly symmetric but each firm pays a single wage negotiated at the sector-level. Through it, we reach two main conclusions. First, the workers' wage surplus (the difference between the workers' wage and reservation value) is mainly determined by the market share of the negotiating parties. Foreign competition reduces this market share because foreign firms are not bound by collective agreements. This impedes the collusive effect of sector level bargaining. Second, the lower the trade barriers, the lower the wage surplus and the closer are industry wages to those obtained under the decentralization of the bargaining process. In this sense, international trade is akin to wage decentralization.

1. The appendix describes the method used to construct these time series.

We test the previous results estimating the effect of movement in the exposition to foreign competition on wage floors and on the revenue of firms. The entry of China in the WTO is used as a source of movements in exposition of french firms to international competition. We use the French Registry of Wage Floors (2003-2016) to derive the effect of those movements. First, we compute for each skill-level wage floor, an index of penetration of Chinese product. For each industry (2-digit level of the NACE classification), we compute the ratio of Chinese imports to the total french consumption. We only have data on manufacturing sector. Then, we use a data set containing, for a representative sample of french employee, the two digit level of the NACE classification and the wage floor covering the employee (ACEMO). To obtain our final index of penetration of Chinese goods, we average the value of the previous ratio over the entire population covered by a wage floor. We regress the annual evolution of this index on the negotiated wage floor. We use the fact that when employers federations and unions bargain at the sector-level, they agree on several skill-level wage floors. This enables us to use industry-level fixed effect to control for industry-specific shocks. We find a negative and significant impact of the increase of Chinese imports on wage floors.

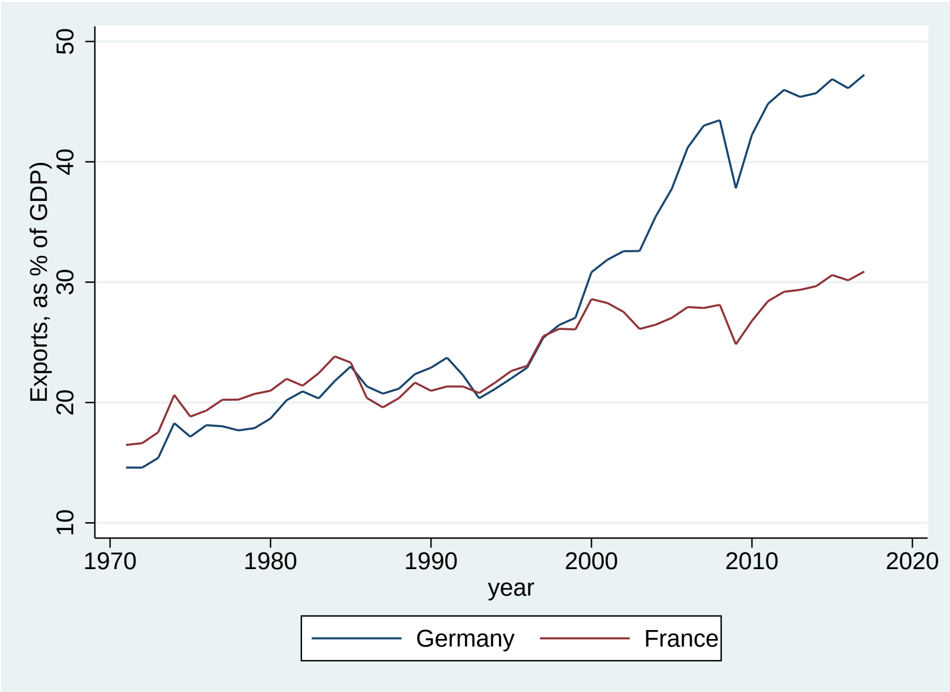
However, the OLS estimation may still suffer from endogeneity bias. For instance, a french domestic demand shock would both affect wages and penetration of Chinese products. To tackle this issue, we use an instrument strategy. We proceed as previously to compute the index of penetration of Chinese goods, except that the values of Chinese imports and domestic consumption are computed for several foreign countries. We find that a rise in 1% in the Chinese Penetration Index lowers wage floors by 0.05%.

In a second step, we use a data set that contains the tax returns for french firms (FICUS and FARE). Matching this data set with the index of penetration of Chinese goods computed at the industry-level (2 digit level of the NACE classification), we estimate the impact of the evolution of foreign competition on revenues of domestic firms. As previously, we use an instrument strategy based on the presence of Chinese goods in other countries. We find that a rise of 1% of the Chinese Penetration Index lowers wage floors by 0.04%.

This paper contributes to three literatures. First, it provides evidence supporting the Calmford-Driffill hypothesis. That is, that sector level agreements allow firms to coordinate and generate a collusive outcome on the goods and labor market. This is evidenced by observing that international competition lowers rents and moves outcomes closer to their competitive levels.

Second, it clarifies where to expect gains from decentralization. There is a long tradition of economists studying where these gains stem from (see for example Cahuc and Zylberberg (2009), or Jimeno and Thomas (2013)). However, past studies take it as given that all relevant parties must be bound by a collective agreement. In the more realistic setting with international trade and competition, it becomes apparent that the *direct* benefits from bargaining decentralization are actually confined to wages negotiated in the non-tradeable sectors. The are, nonetheless, *indirect* benefits from decentralization for the exporting sectors. Indeed, Dustmann et al. (2014) argue that exporting firms indirectly benefited from decentralization through their domestic supply chain. The lower labor cost in domestic sectors reduce the inputs cost of exporting firms. German Wage Decentralization lends credence to this theory. Indeed, figure 3.2 presents the evolution of exports in Germany and in France, as a share of GDP, over the period 1970-2017. It clearly appears that just after German decentralization, in the mid 90's, exports drastically increased compared to France. Our paper is crucial to the understanding of the channels through which a country benefits from the decentralization of the bargaining process.

FIGURE 3.2 : Exports (% GDP)




Third, this paper identifies a new gain from trade. To wit, that international trade can restore a competitive equilibrium and, in doing so, prevent collusive behaviors. The benefits of trade are well established (see Krugman et al. (2015) for a summary). In particular, the literature highlights that trade can limit labor market imperfections. This takes place through several mechanisms. First, this can be generated by the allocation of Foreign Direct Investment (FDI)[2]. Second, the literature focused on the theoretical impact of lower trade barriers on the wage negotiated by unions. However, there is no clear consensus on the subject[3]. Third, the empirical literature suggests that the high product market competition generated by the presence of foreign firms reduces the rent extracted by unions (for example, Abowd and Lemieux (1993) show that wages are lower in Canadian firms exposed to international trade, as does Fontagne and Harrison (2017) using firm-level data in France). We focus on a complementary mechanism. Given that domestic firms can reduce competition in the product market through sector-level agreements[4], international competition can prevent this collusive behavior. As such, trade can be understood as a political tool capable of preventing domestic restrictions to competition.

2. See Mejean et al. (2014) for an empirical study documenting that labor market rigidities significantly reduce the country's attractiveness in the eyes of foreign investors. Haaland and Wooton (2007) studies bargaining centralization lowers FDI.

3. Huizinga (1993) and Sorensen (1993) argue that trade generates a wage decrease, whereas the opposite is found in Naylor (1998) and Naylor (1999). Bastos and Kreickemeier (2009) find that in presence of unionized workers and non-unionized workers, the non-unionized wage increases when trade increases, whereas the effect on the unionized wage is ambiguous.

4. Haucap et al. (2001) and Patault and Valtat (2018) argue that large firms use sector-level agreements to impede the entry of new competitors

## 3.2 The model

This section presents the theoretical model. There are two countries. They only differ by the level at which the wage bargaining takes place (sector-level or firm level). In each country, there are two industries. The first sector produces a single homogeneous tradeable good and the other sector produces a continuum of differentiated products. The firms' decisions are made sequentially and, assuming them to be forward-looking, this requires us to use backward induction. Therefore, (1) we present the consumption decisions, (2) the entry decision of firms, (3) their decision to export, and finally (4) how these previous decisions impact the wage bargaining process.

### 3.2.1 Product Market Structure

This section describes the demand and supply of goods and services. We first assume that agents allocate their consumption between a homogeneous good, considered to be the numeraire, and a continuum of brands of a differentiated product. All products can be traded. Second, we derive the firms' prices and profits for the differentiated sector.

#### Consumption and Demand

There are two countries $a$ and $b$. Their consumers derives utility from the consumption of the goods produced from two industries. The first produces a single homogeneous good $q_0$, treated as the numeraire. The second industry contains a large number of differentiated goods produced by heterogeneous firms. For the latter, the workers' real consumption index is denoted $Q$. It equals to

$$Q = \left[ \int_{\omega \in \Omega} q(\omega)^{\frac{\sigma-1}{\sigma}} d\omega \right]^{\frac{\sigma}{\sigma-1}}$$

Where $\Omega$ is the set of products. $\sigma$ is the elasticity of substitution between products of the industry exposed to international trade. (We also define $\rho = \frac{\sigma-1}{\sigma}$). $q(\omega)$ is the consumption of variety $\omega$. The representative agent allocates its consumption basket between the homogeneous and the differentiated product by maximizing a quasi-linear utility function

$$U = q_0 + \frac{\xi}{\xi - 1} Q^{\frac{\xi-1}{\xi}}$$

where $\xi$ is the elasticity of substitution between products of different industries. We impose[5] $\sigma > \xi$. This ensures that products of the differentiated industry are closer substitutes with each other than with the homogeneous product. The maximization of the utility implies that a representative agent, with total spending $E$ and facing an aggregate price of $P$ for the differentiated product, will choose

$$Q = P^{-\xi}$$

where $P$ is given by

5. See Lewis and Poilly (2012), Oberfield and Raval (2012), Broda and Weinstein (2006) and Bernard et al. (2003) for empirical evidence.

$$P = \left[ \int_{\omega \in \Omega} p(\omega)^{1-\sigma} d\omega \right]^{\frac{1}{1-\sigma}}$$

It directly follows that the aggregate revenue of the industry producing the differentiated good is given by

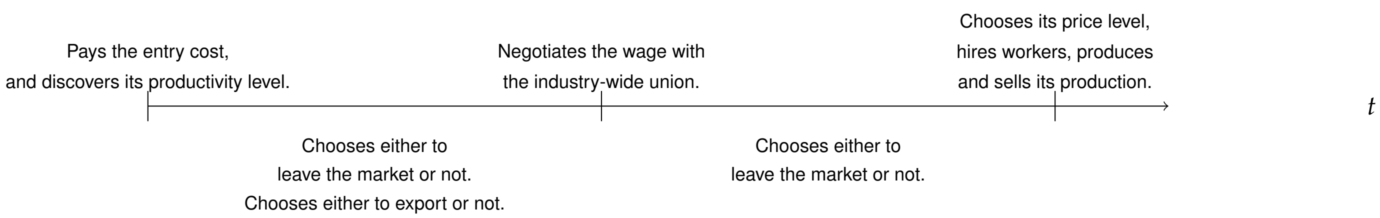
$$R = QP = P^{1-\xi} \tag{3.1}$$

We assume that the homogeneous good can be traded at no cost. This ensures that the numeraire has the same value in each country. Furthermore, this assumptions also ensures that, at the equilibrium, the balance of payments sums to zero.

**Production and Supply**

**Timeline**

FIGURE 3.3 : Timeline




We now focus on the sector characterized by differentiated products. The market structure is the same in each country. The timeline faced by the entrepreneur is presented in figure 3.3, and is developed below. First, there is a large pool of identical prospective entrants. In order to supply a brand, an entrant bears an entry cost $f_e$. Then, it draws its productivity level $\phi$ from a distribution $g(\phi)$ which applies across countries. We denote $G(\phi)$ the cumulative distribution function of $g(\phi)$.

After entry, the entrepreneur can leave the market. If she does not, she must pay a fixed production cost $f$ once she has sold her production. Furthermore, the entrepreneur can choose to export her products at a fixed cost $f_x > f$. This cost does not vary with the volume exported. It can be interpreted as the cost of acquiring information on the foreign market or adapting the product to the requirements of the foreign legislation.

The next step is for the entrepreneur to bargain over the wage with an industry-wide union[6]. Then, the firm chooses its price and the quantities it produces, sells it, and pays off the fixed costs. Assuming that all economic agents are forward-looking, we solve the model for its subgame perfect Nash equilibirum using backward induction.

6. The bargaining process is studied later

**Firms objectives and prices** All goods are produced with labor, the only factor of production. Each firm produces a single good and, if it has a productivity level $\phi$ and employs $l$ workers, it produces $l\phi$ units of output. As the differentiated industry is monopolistically competitive, the optimal consumption decision implies that the firm charging price $p$, will sell, in country $c \in \{a;b\}$ a quantity $q_c$ and will have a revenue $r_c = pq_c$ given by

$$q_c(\omega) = Q_c \left[\frac{p(\omega)}{P_c}\right]^{-\sigma} \tag{3.2}$$

$$r_c(\omega) = R_c \left[\frac{p(\omega)}{P_c}\right]^{1-\sigma} \tag{3.3}$$

The firm faces a residual demand curve with constant elasticity. Furthermore, as the wage is bargained over with an industry-wide union, it is taken as given. If the firm chooses to export, it will face variable trade costs, which take the *iceberg* form. A fraction $\tau > 1$ units of good must be exported in order for $1$ unit to be sold abroad. Profit maximization implies the following lemma

**Lemma 1.** *The price charged by a firm of productivity $\phi$, paying a wage equals to $w$, is given by*

$$p(\phi, w) = \begin{cases} \frac{w}{\rho\phi} & \text{for products sold in the domestic market} \\ \frac{\tau w}{\rho\phi} & \text{for products sold in the foreign market} \end{cases} \tag{3.4}$$

So, the price charged abroad takes into account the iceberg cost. This implies that a good's price abroad is strictly superior to its domestic price. If a firm operates in country $c \in \{A, B\}$, with productivity $\phi$ and only serves its domestic market, its revenue is equal to

$$\pi_{d,c}(\phi) = \frac{R_c}{\sigma}\left[\frac{w}{\rho\phi P_c}\right]^{1-\sigma} - f \tag{3.5}$$

If it exports it has a revenue from abroad given by

$$\pi_{x,c}(\phi) = \frac{R_{(-c)}}{\sigma}\tau^{1-\sigma}\left[\frac{w}{\rho\phi P_{(-c)}}\right]^{1-\sigma} - f_x \tag{3.6}$$

The revenue of a firm depends on the ratio between her price and the aggregate price in the market where the product is sold ($P_{(c)}$ or $P_{(-c)}$). The lower this ratio, the greater is her market share. That is, the higher is the elasticity of substitution between products (*i.e.* the higher $\sigma$). Indeed, when the industry is highly competitive (*i.e.* when $\sigma$ is high), the price elasticity of the demand is large. Equivalently, a movement of the price charged by the firm, in terms of the aggregate price of the industry, generates a large change in demand.

Finally, defining $\mathbb{1}_x$ as a dummy variable equal to one if the firm exports, zero otherwise, the profit of a firm operating in country $c$ is equal to

$$\pi_c(\phi) = \pi_{d,c}(\phi) + \mathbb{1}_x\pi_{x,c}(\phi) \tag{3.7}$$

### 3.2.2 International Trade

#### Decision to produce and to export

There are two productivity cutoffs. First, a firm produces for the domestic market if and only if the profits from domestic sales, given by equation 3.5, are positive. This defines a home productivity cutoff $\phi_d^*$, above which firms produce for the domestic market. Moreover, a firm exports if and only if the profits from foreign sales, given by equation 3.6, are positive. This defines an exporting productivity cutoff $\phi_x^*$, above which firms produce for the domestic and foreign markets. Finally, those productivity cutoffs are given by

$$\begin{cases} \pi_{d,c}(\phi_{d,c}^*) = 0 \Rightarrow R_c^{\frac{\sigma-\xi}{1-\xi}} \left[\frac{w_c}{\rho\phi_{d,c}^*}\right]^{1-\sigma} = \sigma f & \text{Home productivity cutoff} \\ \pi_{x,c}(\phi_{x,c}^*) = 0 \Rightarrow R_{(-c)}^{\frac{\sigma-\xi}{1-\xi}} \left[\frac{\tau w_c}{\rho\phi_{x,c}^*}\right]^{1-\sigma} = \sigma f_x & \text{Exporting productivity cutoff} \end{cases} \tag{3.8}$$

Moreover, equation 3.8 implies that

$$\frac{\phi_{d,c}^*}{\phi_{x,(-c)}^*} = \frac{w_c}{w_{(-c)}} \frac{1}{\tau} \left[\frac{f}{f_x}\right]^{\frac{1}{\sigma-1}} \tag{3.9}$$

One should note that only the relative labor cost impacts the productivity cutoffs. In addition, the higher the relative labor cost in a country, the closer its home productivity cutoff to the exporting productivity cutoff of the foreign country[7].

Finally, a prospective firm enters the industry if and only if expected profits from entry are at least equal to the entry cost $f_e$. Therefore, the free entry condition is given by the equality between the expected profitability of producing and the entry cost. Mathematically speaking,

$$f_e = f \int_{\phi_{d,c}^*}^{\infty} \left[\left(\frac{\phi}{\phi_{d,c}^*}\right)^{\sigma-1} - 1\right] g(\phi) d\phi + f_x \int_{\phi_{x,c}^*}^{\infty} \left[\left(\frac{\phi}{\phi_{x,c}^*}\right)^{\sigma-1} - 1\right] g(\phi) d\phi \tag{3.10}$$

Equations 3.10 and 3.9 directly imply that values of the four productivity cutoffs are perfectly pinned down by the ratio of labor costs and the cost of exporting. As countries differ only with respect to their labor cost, the country with the higher wage have a higher exporting productivity cutoff. In other words, high wage firms compensate the labor cost surplus with higher productivity in order to export. Then, the country with the highest wage has the lowest home productivity cutoff. Indeed, firms paying those wages have lower expected profits in the foreign market. To incline an entrepreneur to pay the entry cost, she must be compensated with higher expected profits in the domestic market. Finally, the higher the labor cost ratio, the larger the difference in productivity cutoffs.

#### Aggregation

The equilibrium structure of the industry in country $c$ will be characterized by a mass of firms $M_c$ and the productivity cutoffs. First, the aggregate price is given by

7. We don't consider the situation of complete specialization. This implies that it's impossible to have $w_c(\phi_{d,c}^*) > \tau w_{(-c)}(\phi_{x,(-c)}^*) \left(\frac{f_x}{f}\right)^{\frac{1}{\sigma-1}}$

$$P_c = \left[ \frac{1}{1-G(\phi^*_{d,c})} \int_{\phi^*_{d,c}}^{\infty} (\frac{w_c}{\rho\phi})^{1-\sigma}(\phi) M_c g(\phi) d\phi + \frac{\tau^{1-\sigma}}{1-G(\phi^*_{d,(-c)})} \int_{\phi^*_{x,(-c)}}^{\infty} (\frac{w_{(-c)}}{\rho\phi})^{1-\sigma}(\phi) M_{(-c)} g(\phi) d\phi \right]^{\frac{1}{1-\sigma}} \quad (3.11)$$

This aggregate price increases with the prices charged by firms. Furthermore, as the representative consumer has a taste for variety, there is a decreasing relation between this aggregate price and the mass of firms, and a positive relation between the two productivity thresholds and this aggregate price. Let us denote the average revenue generated from domestic sales, $\overline{r}_{d,c}$, the average revenue generated from foreign sales, $\overline{r}_{x,c}$, and the average revenue of domestic firms $\overline{r}_c$.

$$R_c = \underbrace{\frac{1}{1-G(\phi^*_{d,c})} \int_{\phi^*_{d,c}}^{\infty} r_{d,c}(\phi) M_c g(\phi) d\phi}_{=M_c \overline{r}_{d,c}} + \underbrace{\frac{1}{1-G(\phi^*_{d,(-c)})} \int_{\phi^*_{x,(-c)}}^{\infty} r_{x,(-c)} M_{(-c)} g(\phi) d\phi}_{=M_{(-c)} \overline{r}_{x,(-c)}} \quad (3.12)$$

$$\overline{r}_c = \overline{r}_{d,c} + \overline{r}_{x,c} \quad (3.13)$$

We call the aggregate revenue generated from domestic sales, $\tilde{R}_{d,c} = M_c \overline{r}_{d,c}$, the aggregate revenue generated from foreign sales, $\tilde{R}_{x,c} = M_c \overline{r}_{x,c}$, and the aggregate revenue of domestic firms $\tilde{R}_c = M_c \overline{r}_c$. Aggregate employment of country $c$ is

$$L_c = \frac{1}{1-G(\phi^*_{d,c})} \int_{\phi^*_{d,c}}^{\infty} \frac{q_c(\phi)}{\phi} M_c g(\phi) d\phi \quad (3.14)$$

### 3.2.3 Labour Market

In this section we present the features of the labour market by focusing on the differentiated industry. There is an industry-wide union representing the entire labor force. We consider first the bargaining process, and its outcome, when the wage is negotiated at the firm level. We then compare the latter to the case of an industry-level wage negotiation. We find that there is a wage surplus at the industry-level due to rents being shared among the negotiating parties. This arises because $\xi < \sigma$. Indeed, the ability of consumers to avoid a high price is measured through the elasticity of substitution. When wages are negotiated at the industry level, this is given by the elasticity of substitution between industries which is lower than the one between products of the same industry. Thus, the firms' market power increases in all markets. This, in turn, creates a rent to be shared with workers.

#### Union's objective

We suppose the industry's labor force is composed of a continuum of identical workers. Following the literature (see Cahuc and Zylberberg (2009)), they are all represented by a single union. We also suppose that the objective of the union is to maximize the expected utility of each of its members. It knows that as long as the demand for labor is inferior to the number of potential employees, workers will be hired randomly. Moreover, we assume that an individual who is hired has a utility equal to its wage, and an unemployed worker has a utility corresponding to her reservation wage $\tilde{w}$ which is considered exogenous[8]. Therefore, the objective of the union in country $c$ is to maximize $L_c(w)[w - \tilde{w}]$.

8. We assume that workers can not move from one industry to another. We can still find exactly the same results assuming that workers can freely move from one industry to another, and that the industry producing the numeraire has a perfectly competitive labor market offering the wage $\tilde{w}$ to each employee.

### Firm level bargaining

We use the index $f$ to refer to the outcomes from firm level bargaining.

The employer negotiates with the union after having discovered its productivity level and before choosing its labor input. Both the union and the employer anticipate the evolution of firm level variables (employment, profit...). They do not take into account general equilibrium effects on wages that occur through aggregate variables. In case of disagreement, there is no production and so employees get the level of utility of an unemployed person. Furthermore, if the negotiating parties do not reach an agreement, the employer does not pay wages, produces nothing, and still has to pay the fixed cost (the fixed cost is considered sunk). The wage solves the following optimization problem.

**Lemma 2.** *When the negotiation takes place at the firm level in country $c$, the wage solves*

$$\max_{w} \left[\frac{q_c(\phi,w)}{\phi}(w-\tilde{w})\right]^{\beta}\left[p(\phi,w)q_c(\phi,w)-w\frac{q_c(\phi,w)}{\phi}\right]^{1-\beta} \tag{3.15}$$

where $\beta$ is the bargaining power of the union, considered to be constant across firms and countries.

**Proposition 1.** *When the bargaining process is decentralized, the wage is equal to*

$$w_f = \tilde{w}\left[1+\frac{\beta}{\sigma-1}\right] \tag{3.16}$$

The wage is the same across countries and is made up of two components. One is the reservation utility $\tilde{w}$ and the other is the worker's share of bargaining surplus. When products of competitors are poorly substituable, or equivalently when $\sigma$ is close to one, the market power of the firm is important. As a consequence, the bargaining surplus is large.

Moreover, the same wage is set for every firm inside a given industry. This arises because the optimal price is proportional to the cost of an employee divided by her productivity. Then the surplus created by an employee is the same for every firm, regardless of the firm's productivity. Therefore, as each worker has the same share of the same surplus and the same wage.

Finally, the wage increases when the reservation wage increases as the employee can further make use of her outside option, and increases with the bargaining power of the union.

### Industry level bargaining

#### Wages

We now focus on industry level wage bargaining. Outcomes from the latter are denoted $i$.

Suppose a sector-wide employers' federation bargains with a sector-wide union over a wage that will be applied to the entire industry. Based on the previous work of Moene and Wallerstein (2016), assume the employers' federation's utility is the sum of the utilities of every entrepreneur operating in the industry (i.e, its profits). The wage is binding for every domestic firm. Furthermore, following the literature (see Jimeno and Thomas (2013) for example), the negotiating parties take the production cutoffs and the mass of firms[9] as fixed. This simplifying assumption allows us to focus on the main source of industry-level wage surplus, the difference between $\xi$ and $\sigma$. Furthermore, the employers' federations are dominated by large firms (see Barry and Wilkinson (2011), Mortimer et al. (2004), Thelen (2003) or Silvia and Schroeder (2007) for evidence) and, for them, there is almost no risk of exit following a change in the wage floor. The bargaining problem is summarized by the following lemma

**Lemma 3.** *When the negotiation takes place at the industry level, the wage solves*

$$\max_{w} \left[L_c(w)\,(w-\tilde{w})\right]^{\beta}\left[\frac{\tilde{R}_c(w)}{\sigma}\right]^{1-\beta} \tag{3.17}$$

The following proposition can be derived (see appendix for proof).

**Proposition 2** *When the bargaining process takes place at the industry level in country $c$, the wage is equal to*

$$w_i = \tilde{w}\left[1+\frac{\beta}{\sigma+\mu\,(\xi-\sigma)-1}\right] \tag{3.18}$$

where

$$\mu=\left[\frac{\tilde{R}_{d,c}x+\tilde{R}_{x,c}y}{\tilde{R}_c}\right],\quad x=\frac{\tilde{R}_{d,c}}{R_c},\quad y=\frac{\tilde{R}_{x,c}}{R_{(-c)}}$$

$x=\frac{\tilde{R}_{d,c}}{R_c}$ are the revenues of domestic firms derived from the domestic market as a share of the size (in terms of revenue) of the domestic market. In other words, $x$ is the market share of domestic firms in the domestic market. Under autarky, only domestic firms serve the domestic market. Then, $x$ is $1$. Symmetrically, $y=\frac{\tilde{R}_{x,c}}{R_{(-c)}}$ is the market share (in terms of revenue) of domestic firms in the foreign market.

Therefore, the function $\mu$ is the average value of $x$ and $y$ weighted by the relative importance of each market. Indeed, for $x$, the weight is $\frac{\tilde{R}_{d,c}}{\tilde{R}_{d,c}+\tilde{R}_{x,c}}$. It corresponds to the revenues of domestic firms derived from the domestic market as a share of the total revenues of domestic firms. Symmetrically, the weight for $y$ corresponds to the revenues of domestic firms deriving from the foreign market as a share of the total revenues of domestic firms. In a country in autarky, the weight corresponding to $x$ is equal to $1$ and the weight corresponding to $y$ is equal to $0$. Consequently, the higher $\mu$ the greater the market power of domestic firms.

$\mu$ has values between $0$ and $1$, the latter corresponds to a situation of perfect monopoly which arises if the country is in autarky. The higher it is, the lower the competition with firms not covered by the industry agreement. Therefore, when $\mu$ increases domestic firms operate in a market where consumers have access to a lower variety of goods produced by firms that are not covered by the wage floor. This implies that, when $\mu$ increases, the market power of domestic firms decreases. Thus, the rents to be shared between parties decreases.

Finally, for a given value of $\mu$, the higher the value of $\xi-\sigma$, the higher the industry-level wage surplus. Indeed, the wage increases when it is negotiated at the industry level because it captures a share of the firm's profits. These profits, in turn, depend on the level of competition in the product market. To summarize, the relevant measure of the degree of competition in the product market depends on the way that wages are set. When they are set at the industry level, the relevant measure is $\sigma$. When negotiated at the firm level, the relevant measure is $\xi$.

9. In the model developed in Patault and Valtat (2018) actors take into account those two elements, and using it would lead to the same conclusion.

### 3.2.4 Equilibrium structure

The trade equilibrium is referenced by a vector containing the following variables : $\{\phi^*_{d,c}, \phi^*_{x,c}, w_c, p_{d,c}, p_{x,c}, P_c, R_c\}$ *for* $c \in \{a, b\}$. All other endogenous variables can be written as a function of those quantities. The equilibrium vector is determined by the following equations for both countries : the aggregate revenue equation (3.1), the price equation (3.4), the iceberg form of the variable trade cost, the productivity cutoff equation (3.8), the free entry condition (3.10) and the wage equation (3.16 or 3.18).

Noticing that the free entry condition and equation 3.9 imply the equilibrium values of the productivity cutoffs, we get :

$$\frac{d\phi^*_{d,c}}{\phi^*_{d,c}} = \frac{\bar{r}_{x,c}}{\bar{r}_{d,c}\bar{r}_{d,(-c)} - \bar{r}_{x,c}\bar{r}_{x,(-c)}} \left[ \left(\bar{r}_{d,(-c)} + \bar{r}_{x,(-c)}\right) \left(\frac{dw_{(-c)}}{w_{(-c)}} - \frac{dw_c}{w_c}\right) - \left(\bar{r}_{d,(-c)} - \bar{r}_{x,(-c)}\right) \frac{d\tau}{\tau} \right] \tag{3.19}$$

$$\frac{d\phi^*_{x,c}}{\phi^*_{x,c}} = \frac{\bar{r}_{d,c}}{\bar{r}_{d,c}\bar{r}_{d,(-c)} - \bar{r}_{x,c}\bar{r}_{x,(-c)}} \left[ \left(\bar{r}_{d,(-c)} + \bar{r}_{x,(-c)}\right) \left(\frac{dw_c}{w_c} - \frac{dw_{(-c)}}{w_{(-c)}}\right) + \left(\bar{r}_{d,(-c)} - \bar{r}_{x,(-c)}\right) \frac{d\tau}{\tau} \right] \tag{3.20}$$

.

The previous equations highlight that the a change in productivity cutoffs can be formally derived from changes in the labor cost and changes in the iceberg cost. It is not the labor cost *per se* that matters, but how it compares to the labor cost of the foreign competitor. As the relative labor cost is higher in the country negotiating wage at the industry level, it can be shown

**Proposition 3 :** *When wages are negotiated at the industry level in country $a$, and at the firm level in country $b$, the trade equilibrium implies*

**Proposition 3.A** *The home productivity cutoff is lower in country $a$ than in country $b$, (the other way around for the export productivity cutoff)*

$$\phi^*_{d,a} < \phi^*_{d,b} < \phi^*_{x,b} < \phi^*_{x,a}$$

**Proposition 3.B** *Both the average profit and the average revenue are higher in country $b$*

$$\overline{\pi}_b > \overline{\pi}_a \quad and \quad \bar{r}_b > \bar{r}_a$$

**Proposition 3.C** *The aggregate revenue in country $a$ is lower than the average revenue in country $b$*

$$R_a < R_b$$

**Proposition 3.D** *The mass of firm is lower in country $a$ than in country $b$*

$$M_a < M_b$$

**Proposition 3.E** *The aggregate revenue of firms producing in country $a$ is lower than the one of firms producing in country $b$*

$$\tilde{R}_a < \tilde{R}_b$$

**Proposition 3.F** *The unemployment is higher in country a than in country b.*

As explained previously, Proposition 3.A shows that in the country negotiating wages at the industry level, firms have to be more productive in order to be able to export. Proposition 3.B implies that, on average, firms are more profitable in the country negotiating wages at the firm level. This is quite intuitive as Proposition 3.A suggests that firms of this country are, on average, more productive, and a higher share of them export.

Proposition 3.C shows that consumers are better off in the country where the bargaining is decentralized. Indeed, as the domestic firms charge lower prices, they consume more products of the differentiated industry.

Finally, Proposition 3.D implies that domestic firms produce a wider range of products in the country negotiating wages at the firm level. Moreover, Proposition 3.E and Proposition 3.F show that the wage surplus harms the competitiveness of domestic firms and reduces their aggregate revenue, and therefore, their aggregate labor demand.

## 3.3 Impact of trade frictions on wage floors

After a cross-country analysis, we now turn to the impact of trade frictions on the negotiated wage floor. When trade frictions decrease, the market power of domestic firms over the domestic market decreases. Furthermore, a higher share of their revenue is earned abroad (where markets are more competitive). These two effects imply that the monopoly power of domestic firms decreases when trade costs decrease. In turn, wages fall.

Trade frictions are represented through the variable trade costs (*i.e.* $\tau$). We now suppose a Pareto distribution of *ex ante* firm productivity. The Pareto *ex ante* assumption is made in order to simplify results. Furthermore, it gives a good approximation of the observed distribution of productivity (see Helpman et al. (2004), Bernard et al. (2007) or Melitz and Ghironi (2005)).

$$G(\phi) = 1 - \left(\frac{\tilde{\phi}}{\phi}\right)^a$$

$\tilde{\phi}$ is the minimum value of productivity and $a$ controls the dispersion of productivity. We suppose $a > \sigma - 1$.

### 3.3.1 Equilibrium value of $\mu$

First, we focus on the equilibrium value of $\mu$. It is given by the two following conditions (see Appendix for proof)

**Proposition 4 :** *When the wage is negotiated at the industry level in country $a$, at the firm level in country $b$, and $\tau$ is constant, the equilibrium value of $\mu$ is pinned down by the following conditions*

**Proposition 4.A** *If the relative labor cost of country $a$ to country $b$ increases (i.e. if $\mu$ increases), the relative revenue of firms of country $a$ (i.e. $\frac{\tilde{R}_a}{\tilde{R}_b}$) decreases.*

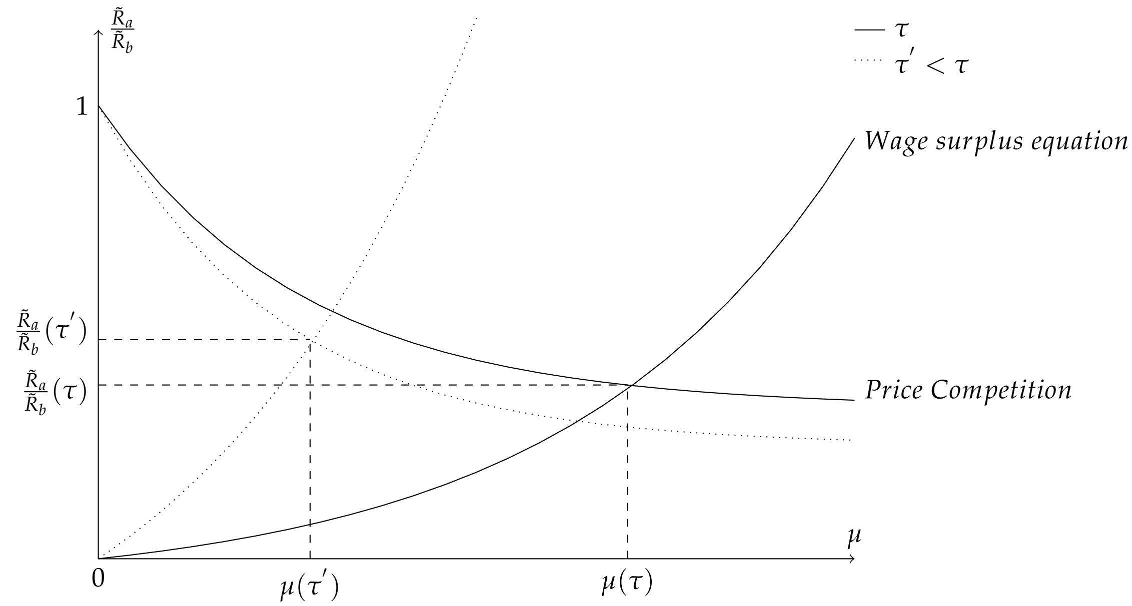
**Proposition 4.B** *If the relative revenue of firm of country $a$ to country $b$ (i.e. $\frac{\tilde{R}_a}{\tilde{R}_b}$) increases, $\mu = \left[\frac{\tilde{R}_{d,c}x+\tilde{R}_{x,c}y}{\tilde{R}_c}\right]$ increases.*

The two conditions are depicted by solid lines in figure 3.4. The result of Proposition 4.A is quite intuitive. It states that when the relative labor cost of country $a$ increases, the competitiveness of domestic firms decreases, which implies that they lose market shares. It is represented by the decreasing curve and it is denoted *Price Competition*.

Proposition 4.B is based on the definition of $\mu$. Indeed, when firms of country $a$ increase their relative aggregate revenue, revenues of domestic firms derived from the domestic market as a share of the total revenues extracted in it increase. It is the same in the foreign market. Therefore, firms of country $a$ increase their monopoly power, implying that $\mu$ increases. It is is represented by the rising curve, and it is denoted *Wage surplus equation*.

Finally, the equilibrium values of $\mu$ and of $\frac{\tilde{R}_a}{\tilde{R}_b}$ are given by the intersection of the two curves.

FIGURE 3.4 : Equilibrium value of $\mu$




### 3.3.2 Variation of wage floors in response to trade frictions

Suppose a fall in the trade cost $\tau$. Building on the previous insights,

**Proposition 5 :** *When the wage is negotiated at the industry level in country $a$, at the firm level in country $b$, and $\tau$ decreases, the trade equilibrium fulfills the following conditions*

**Proposition 5.A** *If the relative labor cost of country $a$ is constant (i.e. if $\mu$ is constant), the relative revenue of firms of country $a$ (i.e. $\frac{\tilde{R}_a}{\tilde{R}_b}$) decreases.*

**Proposition 5.B** *If the relative revenue is constant (i.e. $\frac{\tilde{R}_a}{\tilde{R}_b}$ is constant), $\mu = \left[\frac{\tilde{R}_{d,c}x+\tilde{R}_{x,c}y}{\tilde{R}_c}\right]$ decreases.*

The situation after a variable trade costs decrease is depicted by dotted lines in figure 3.4. First, Proposition 5.A implies that for the same relative labor cost (fixed $\mu$), the aggregate profit share of country $a$ decreases when trade frictions decrease. That is, a fall in trade cost intensifies international competition. When there is high competition, profits become very sensitive to price changes and, in turn, to the wage bill. In figure 3.4, this corresponds to a downwards movement of the *Price Competition* curve.

Proposition 5.B states that for the same relative revenue (i.e. $\frac{\tilde{R}_a}{\tilde{R}_b}$ is constant), when variable trade costs decrease, $\mu$ decreases. This arises for two reasons. First, when trade frictions decrease, foreign sales represent a higher share of aggregate profits (see equations 3.19 and 3.20). Domestic firms loose control over the foreign market in comparison to their control over the domestic market. Second, as trade intensifies, the control of domestic firms over the home market decreases. Indeed, the share of products sold by foreign firms increases when trade frictions decrease (equation 3.19 and 3.20). In figure 3.4, this is depicted by an upwards movement of the *Wage surplus equation*. Finally, on the basis of previous results, this implies :

**Proposition 6 :** *When the wage is negotiated at the industry level in country $a$, at the firm level in country $b$, and $\tau$ decreases, the trade equilibrium fulfills*

**Proposition 6.A** *The relative labor cost difference decreases (i.e. $\mu$ decreases).*

**Proposition 6.B** *Both country gain from trade. Moreover, consumers of country $a$ gain more than those of country $b$ (i.e. $\frac{R_a}{R_b}$ increases).*

When trade frictions decrease, the increasing competition with firms that are not subject to the wage floor agreement has a negative impact on the wage surplus. Indeed, the monopoly power of domestic firms falls, the demand curve is more sensitive to a price increase, and in turn, the size of the pie (or rents) to be shared between the negotiating parties falls.

A standard result in the trade literature is that, in presence of non-convexities and distortions, the gains from trade are not automatic (see Helpman and Krugman (1985)). However, first, when trade frictions decrease, the price of goods sold abroad falls. This generates an access to wider variety of products, and also decreases the price of goods that were already accessible. Second, one can notice that the relative wage paid in country $a$ decreases, whereas the labor cost in country $b$ is constant. This, combined with the fact that the market share of firms of country $a$ is higher in the domestic country than abroad, implies that the reduction of the rent benefit more to consumers of the country negotiating wage at the sector-level.

## 3.4 Empirical implications

In the previous section, we derived that a reduction of trade frictions is associated with a reduction of the rent generated by sector-level agreements. In order to test this conclusion, we estimate the impact of the rise of Chinese competition, that occurred in the 2000s', on the wage negotiated at the sector-level in France.

This section is structured as follows. First, we discuss our identification strategy based on the rise of Chinese goods in international markets. Second, we present the data and its characteristics. Third, we test the relationship between Chinese competition, wage floors, and firm revenue.

### 3.4.1 Identification using the *China Shock*

We want to test the implications of the model. Its main implication is that international trade lowers the rent extracted during sector-level bargaining. Our theory implies that wage floors and the firm revenue must decrease when trade competition increases.

To test this, we had to select a country where economic rents are large and where wages are negotiated at the sector level. France is an ideal case to study because wages are negotiated at the industry level, data is available on wage floors, and academic studies find evidence of economic rents[10]. We exploit France's cross-industry temporal variation in exposition to a trade shock.

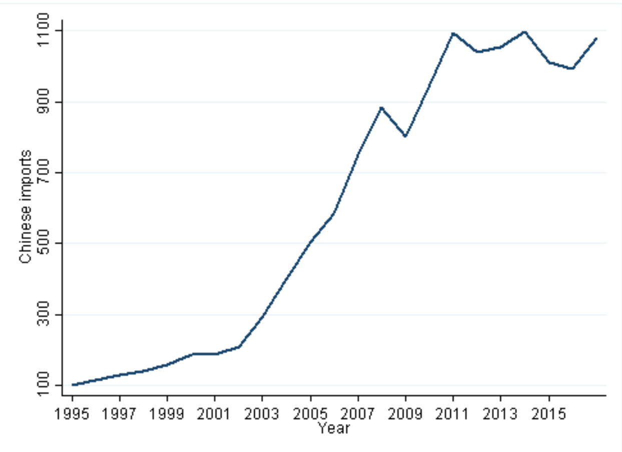
We prefer to use variation across time as a source of variation in order to avoid capturing constant unobservable variables affecting both our wages or revenue of firms, and the imports of Chinese products. For instance, initial differences in productivity may be correlated with both.

The main threat to identification now stems from potential correlation between foreign competition movements and the rate of change in unobservables. Our main concern is the fact that domestic variables might generates trade movements. First, we use the China, which is large enough to ensure that french market didn't drove Chinese exports growth. Secondly, we use the an instrumental variable strategy to prevent the issue of domestic demand shock. This is developed below.

We select as trade shock the rise of Chinese goods in international markets. We use it because this rise is significant and unexpected. Moreover, France is far from being the main commercial partner of China, which ensures that this rise is not driven by french domestic movements.

By being significant, we hope to have large amounts of variation in our data and therefore statistical power. Indeed, figure 3.5 represents the evolution of the french imports of manufactured goods from China. It clearly appears that there is a large appreciation of those imports after the entry of China in the World Trade Organization (WTO). During the 2000s', the quantity of products imported from China has grown more than ten-fold.

FIGURE 3.5 : Evolution of french imports of manufactured goods from China (all values are expressed in base 100 in 1995)




The value of french imports of manufactured products are expressed at current prices. Values of imports are defined as index relative to 1995. All values can be found at in https://stats.oecd.org/Index.aspx?DataSetCode=STANI4_2016&lang=fr.

10. For example, see Cahuc, Postel-Vinay, and Robin (2006)

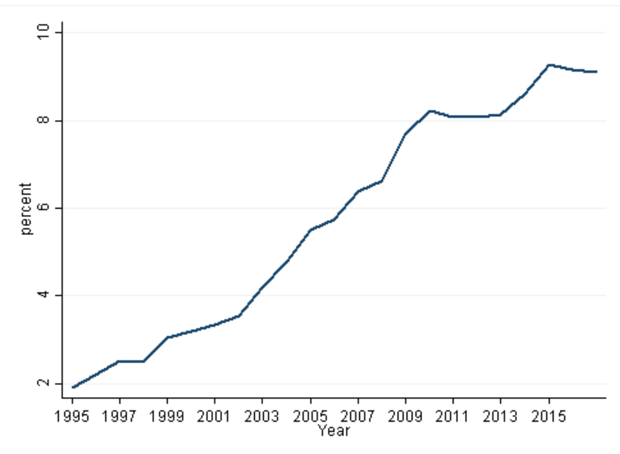
By being unexpected, we hope that the trade shock will not be fraught with endogeneity. In other words, we hope that the correlation between Chinese trade and unobserveable French demand will be weak. The literature in international trade has already vastly exploited the exogeneity of the China's rise (see Autor et al. (2016)). It is believed that the rise of Chinese goods was unexpected by economic actors, in France and abroad. This is best illustrated by the following quotations from the French newspaper *Les Echos* in 1995. The article is entitled *"The Chinese reassure the Occident on the future of the reforms after Den Xaoping."* :

*"Will China self-withdrawal after the Death of Den Xaoping ? Economic leaders were concerned about this issue [...]."*

*"The only potential issue about the dynamic and reasonable China is the following : The interruption of the negotiations about its entry in the WTO."*

The first quote highlights the fear in the Western world, and in particular in France, that China would stop developing after the death of Den Xaoping. The second suggests China might not become a member of the World Trade Organization (WTO). China nevertheless entered the Organization in 2001. This means that trade barriers fell. In turn, this was one of the main reasons China succeeded in increasing its share in manufacturing trade. As shown in figure 3.6 representing the evolution of the share of manufactured goods from China in French imports, Chinese imports initially only represented 2% of imports. It is unlikely that French firms were paying such close attention to China at the time.

FIGURE 3.6 : Evolution of the share manufactured goods coming from China among French Imports




The value of french imports of manufactured products are expressed at current prices. For each year, values of imports of Chinese products are expressed as a share of the total imports of manufactured products in France. All values are collected in https ://stats.oecd.org/Index.aspx ?DataSetCode=STANI4$_2016 lang = fr$.

Nonetheless, a country's trade policy is often driven by external factors. Our main concern is a domestic French demand shock lead to China's rise. We must then ensure that the derived effect is generated by the studied shock. However, as manufacturing exports from China towards France represents less than 2% of Chinese manufacturing exports[11], it appears unlikely that the rise of those exports were driven by features of the french market.

11. see https ://stats.oecd.org/Index.aspx ?DataSetCode=STANI4$_2016 lang = fr$

We nevertheless instrument for this possibility by considering the Chinese goods' penetration in comparable foreign markets (Germany, Finland, Sweden, Spain, Great-Britain, Denmark, USA, Japan, Netherlands and Norway). The logic runs as follows. If there were a positive demand shock in the french market, the demand for goods would increase. The greater the demand for a good, the greater would be revenue and workers' wages. Also, the higher would be the imports of Chinese products. So, if the impact of foreign competition is as predicted by the model, the ordinary least squares would be upwards bias. In other words, the estimated coefficient underestimates the impact of Chinese competition on revenues and wages.

To prevent this issue we use the penetration of Chinese imports in other countries. Economically speaking, we argue that the penetration of Chinese imports in those countries are uncorrelated with french domestic demand shock, and represent incentives of Chinese companies to export. In other words, Chinese supply shocks. These shocks can be measured through the correlated change in penetration of Chinese goods in foreign markets. Moreover, they should be uncorrelated with French demand shocks because what impacts supply shocks in China are unlikely to be related with what affects consumer demand in France. This exclusion restriction can then be used for a consistent estimate of Chinese penetration on French firm revenues and wages by means of the two stage least squares. We use, as foreign countries, Germany, Denmark, USA, UK, Japan, Finland, Spain, Sweden, Norway and Netherlands.

### 3.4.2 Data

**Firm Revenue and Chinese Penetration Index**

**Revenue of firms**

We use a french administrative database that contains the tax returns for french firms (*FICUS* and *FARE*). This annual dataset covers the period 2002-2010. We treat this data as a panel and compute the percentage evolution in revenue. This data also provides us with firm size, headquarter's location at the regional level, and its industry classification (4-digit NACE). We only consider firms with more than one employee.

**International trade data**

We build a dataset containing, for each industry, the penetration of Chinese imports. To do so, we use the *"STAN bilateral trade in goods by industry"* database, publicly available on the OECD website[12]. It contains, for each country and for each industry, the total amount of exports and of imports. An industry corresponds to the division level of the CITI Rev.4 classification. Only manufacturing industries are available. It includes the total value of imports from China, the total values of imports, the total value of exports and the production for those sectors. As is common in the literature, for each year, we build an index of penetration for industry $k$ by

$$IP_{k,t} = \frac{Imports_k^C}{Production_k - Exports_k^W + Imports_k^W} \tag{3.21}$$

Where $k$ is an industry, $t$ a year and $Imports_k^C$ is the total value of imports from China for sector $k$ during year $t$. Furthermore, $Exports_k^W$ is the total value of exports, with the rest of the world, of french firms of industry $k$ during year $t$, and $Imports_k^W$ is the total value of imports. We also compute, for each year and for each industry, the percentage of evolution of the index.

12. see http ://stats.oecd.org/Index.aspx ?lang=enSubSessionId=b798f1d7-0a2a-4f40-acb5-34bc099706d5themetreeid=10

Using the two digit Nace code of each firm, we link this information to the French Revenue Data for the period 2002-2010. In addition, we collect a set of instruments which are constructed following the same method. However, the relevant Chinese Penetration Index is now for the same industry but in a another country. In the final database, we have the firm's annual growth in revenues, the annual growth in its associated Chinese Penetration Index, the firm's number of employees, and a record for the industry of the firm.

Table 3.7 summarizes statistics on the final dataset obtained. The final data include 435,902 observations at the firm $\times$ year level. On average the revenue of a firm evolve of 0.416% from one year to another. These revenue, the penetration index of Chinese competition (see equation 3.21) and the instrument display enough variation to be used.

### Sector-level Wage Floors and Chinese Penetration Index

#### Sector-level agreements

We use the publicly available French National Registry for Wage Floors (*Base des minima de Branche*)[13] that contains 275 industries, and covers the period 2003-2015.

For each industry agreement, negotiators define an industry-specific classification of representative occupations, constructed on the basis of several variables like seniority, education, work content... In a For each classification, a wage floor is negotiated. This implies that an industry agreement (coded by the IDCC number, which is a administrative identifier of the industry agreement) contains several wage floors.

Our data base, which has been constructed by the French Ministry of Labour, contains, for each industry-agreement, the value of the wage floors and the yearly rate of increase.

#### International trade

We link the wage floor data with the international trade data. To do so, one must consider that wage floors are organized by *IDCC* code. It differs from industry code because some industries have more than one collective agreement (but such cases are rare). Each IDCC has several hierarchical positions.

To go from industry trade data to IDCC position data, we use the ACEMO survey (*Activité et conditions d'emploi de la main-d'œuvre*). Collected at a quarterly frequency over the period 2002Q1-2010Q4, it is carried out by the French Ministry of Labour on a representative sample of French firms. The survey contains the administrative number of the sector-level agreement covering the employee (IDCC), the individual monthly base wage excluding bonuses, and industry classification.

Each employee is assigned a position assuming that the percentile of the distribution of the base wages corresponds to those of the positions set by collective bargaining. Finally, for each employee, using the industry classification, we are able to link workers with their relevant Chinese Penetration Index given by equation 3.21. We can then calculate, for each wage floor, an average Chinese Penetration index for the covered population. Mathematically speaking, we compute the following index

$$I_{i,j,t} = \frac{\sum_{z\in\Psi_{i,j,t}} IP_z}{\sum_{z\in\Psi_{i,j,t}} 1} \tag{3.22}$$

Where $\Psi_{i,j,t}$ is the set of employees covered by the position $i$ of the industry agreement $j$ during year $t$. $z$ is one of its elements, and $IP_z$ is the value of the index, given by equation 3.21, of the industry (computed at the 2 digit level

13. see http://nesstar.progedo-adisp.fr/webview/index.jsp?v=2&submode=abstract&study=http%3A%2F%2Fnesstar.progedo-adisp.fr%2Fobj%2FfStudy%2Flil-0853&mode=documentation&top=yes

of the CITI rev. 4 classification) where he works. Therefore, for every position of each sector-level agreement, the index given by equation 3.22 reflects the importance of competition with China. The final database also contains the percentage evolution, from one year to another, of the index given by equation 3.22.

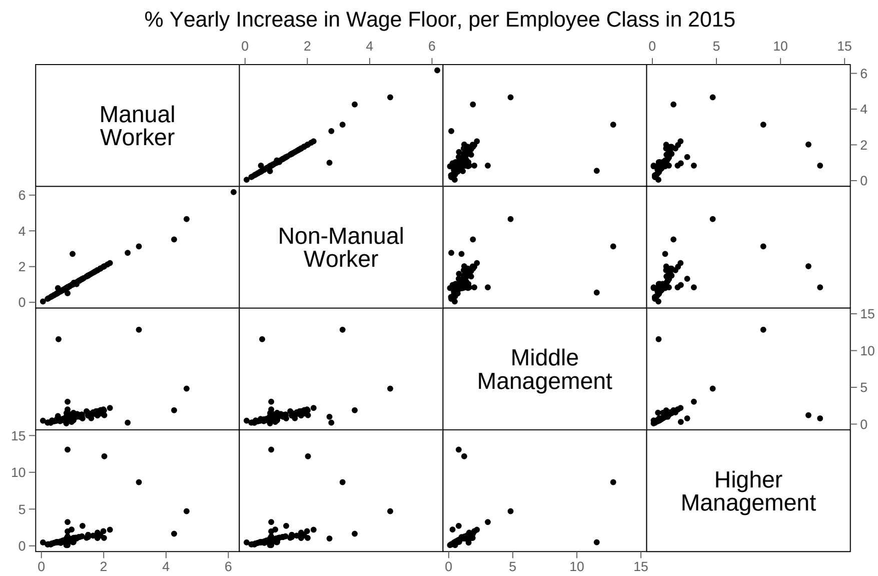
In the final database, we have access to the annual growth rate in wages, in the associated Chinese Penetration Index. There are also a set of instruments. The instruments are constructed following the same method. However, the relevant Chinese Penetration Index is now for the same industry but in a another country.

Table 3.7 summarizes statistics on the wage-floor-level dataset obtained. The final data include 4332 observations at the wage floor time industry agreement time year level, and comprises 457 distinct industry-level agreements. On average there are 6 wage floors per industry agreement, and each agreement cover on average 62108 employee. The evolution of wage floors, the index of penetration of Chines imports (given by equation 3.22) and the instruments display enough variation to be used.

### 3.4.3 Descriptive Evidence

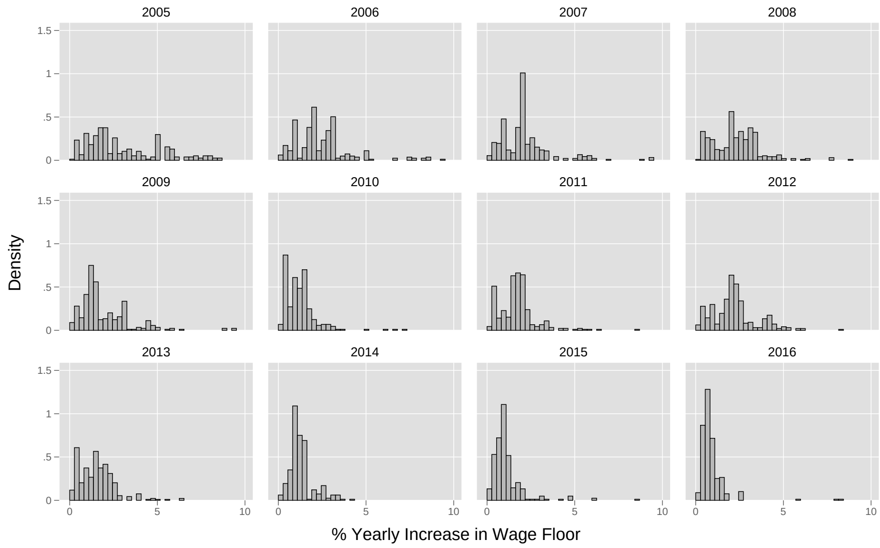
First, wage floor growths are correlated among each other. This can be seen in the following graph 3.7 depicting the 2015 growth rate in wage floor by broad occupation. There is almost a perfect line between manual and non-manual workers and strong relationship between middle management and upper management. The correlation between blue collars and white collars is clear despite the absence of a perfect relationship. This suggests that our model based on using a single representative agent is pertinent.

FIGURE 3.7 : Yearly Wage Floor Growth by Occupation (2015)



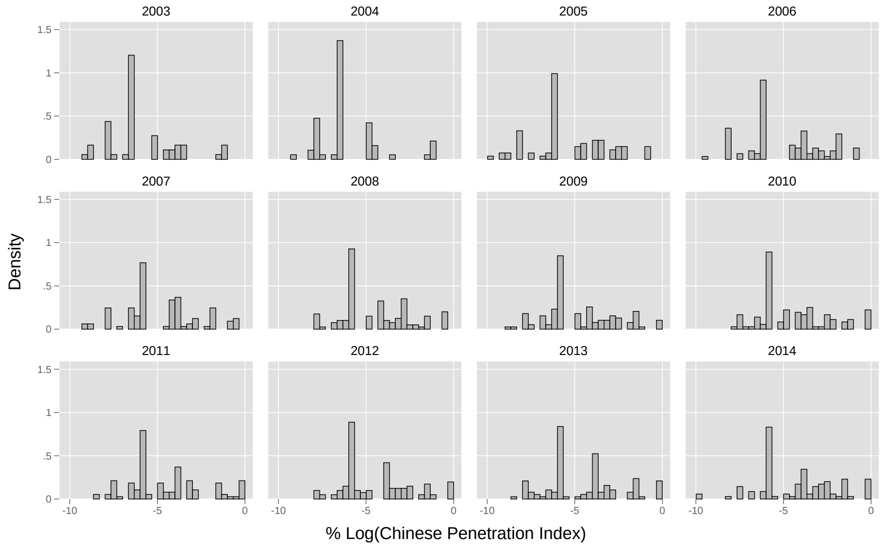

Second, the variance in wage floor growth has fallen over time. This is apparent in 3.8 which depicts the distribution in wage floor growth across the past decade. Initially, wage floor growth rates were much more spread out. As time as gone, the variance in wage floor increases has fallen. Almost all growth rates are now concentrated around 2%, almost in line with inflation. This suggests that the statistical power of our estimates mainly stem from the large amount of variation observed during the early years of the new century. Those years correspond to the rise of China exports. Consequently, this is not an issue.

FIGURE 3.8 : Yearly Wage Floor Growth



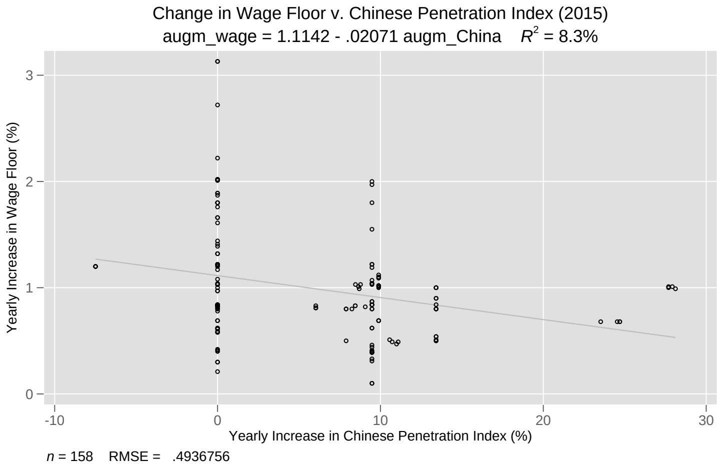

Third, at the same time, the share of Chinese goods in French trade has continued to rise. This is reflected by the histograms 3.9 below for the log-mean Chinese penetration index per occupation and industry. It is apparent that the (log) mean Chinese penetration index for each occupation per industry has risen over time. The large dispersion in these histograms suggests that some industries have been spared. As long at this phenomena is explained by virtue of the non-tradeable nature of the products (and not some endogenous and unobservable feature of the industry), it provides us with a large source of variation through which we can identify the impact of foreign competition on wages and revenue.

FIGURE 3.9 : Yearly Log (Mean Chinese Penetration Index)




Finally, it is then not surprising to find a relationship between wage floor growth rates and growth in Chinese imports. This can be seen in graph 3.10 which depicts changes the yearly increase in wage floor against the yearly increase in Chinese penetration index across occupations. The negative slope suggests that this relationship holds. However, other observable factors might be at play. These factors could include heterogeneous TFP growth rates, for example. The use of regression analysis will allow us to deal with these issues.

FIGURE 3.10 : Yearly Wage Floor Growth against Chinese Penetration Yearly Growth (2015)

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### 3.4.4 The impact of international competition on sector-level wage negotiation

We first run the following regression

$$\Delta w_{i,j,t} = \alpha_0 + \beta \Delta I_{i,j,t} + \alpha_{j,t} + \epsilon_{i,j,t} \tag{3.23}$$

Where $\Delta w_{i,j,t}$ is the increase in the wage floor $i$, in industry agreement $j$, during year $t$. $\Delta I_{i,j,t}$ is the percentage of variation, between year $t$ and $t-1$, of the index given by equation 3.22. $\alpha_{j,t}$ are fixed effects. Described in the table below, they include year, industry by occupation and per wage floor type (annual, monthly, or unclassified). Because it is highly likely that industries diverge in their wage floors due to some unobserved industry-level factors, such as productivity or unions history, we conduct the analysis *within* industry. We indeed use the fact that within a single industry agreement, several skill-dependent wage floors coexist to compare wage floors within a given industry. This enables us to alleviate several of the most obvious endogeneity concerns by removing any unobserved industry-level heterogeneity. Indeed, we use fixed effects which capture the effect that are specific to an industry, during a year (productivity shock, legal changes...). Results are given in table 3.1.

TABLE 3.1 : Ordinary Least Squares : All Sectors

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | % Yearly Increase in Wage Floor | % Yearly Increase in Wage Floor | % Yearly Increase in Wage Floor | % Yearly Increase in Wage Floor |
| % Yearly Increase in Chinese Penetration Index | 0.0180*** | 0.0115*** | -0.0311*** | -0.0325*** |
| | (4.08) | (2.50) | (-5.92) | (-6.17) |
| Year Fixed Effects | No | No | Yes | Yes |
| Industry by Occupation Fixed Effects | No | Yes | Yes | Yes |
| Type of Wage Floor Fixed Effect | No | No | No | Yes |
| Observations | 4311 | 4304 | 4304 | 4304 |

Note : The table presents results of the OLS estimates of the effect of the annual change of the exposure to Chinese imports, measured at the industry-level by the index given in equation 3.21 on the Wage Floors of french firms. The dependent variable is measured as the yearly rate of change in a wage floor for a given occupation and industry. Types of Wage Floor are annual and monthly based. Industry identifiers are based on the code IDCC. There are four groups of occupation (manual, non manual, middle management, and upper management). T-statistics are given in brackets.*, **, and *** denote statistical significance at 10%, 5% and 1% levels.

Table 3.1 suggests that wage floors grow slower in presence of increasing competition from China. Although the two first columns report positive coefficients, this only reflects that wage floors grow over time, even in presence of Chinese competition. This does not change when we control for industry fixed effects as long-run TFP growth does fully account for increases in wages. However, once year fixed effects are introduced in column (3) and (4), the cross-temporal elasticity is around -3% and statistically significant. This is robust to controlling for the type of wage floor. Nevertheless, there might be a unobservable French demand shocks driving this effect.

To allow for this possibility, we use an instrumental variable identification strategy. The arguments goes as follows. If there is a supply shock, the Chinese penetration index in other countries but France should also be growing. Thus, the growth rate of the Chinese penetration index in other countries can identify the impact of Chinese penetration in the domestic markets. Results for this exercise are are given in table 3.2

TABLE 3.2 : Two Stage Least Squares : All Sectors

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | % Yearly Increase in Wage Floor | % Yearly Increase in Wage Floor | % Yearly Increase in Wage Floor | % Yearly Increase in Wage Floor |
| % Yearly Increase in Chinese Penetration Index | -0.0114** | 0.000533 | -0.0485*** | -0.0521*** |
| | (-2.25) | (0.09) | (-6.18) | (-6.59) |
| Year Fixed Effects | No | No | Yes | Yes |
| Industry by Occupation Fixed Effects | No | Yes | Yes | Yes |
| Type of Wage Floor Fixed Effect | No | No | No | Yes |
| Observations | 4311 | 4304 | 4304 | 4304 |

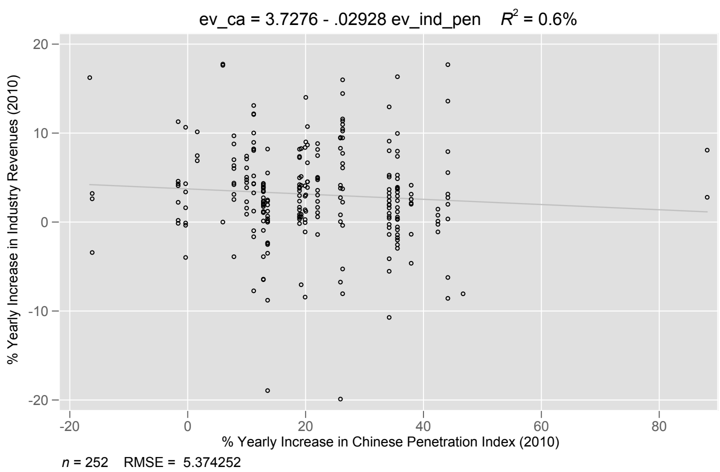
Note : The table presents results of the IV estimates of the effect of the annual change of the exposure to Chinese imports, measured at the industry-level by the index given in equation 3.21 on the Wage Floors of french firms. The dependent variable is measured as the yearly rate of change in a wage floor for a given occupation and industry. It is instrumented using the Chinese Penetration Index of the same industry in a set of other countries. Types of Wage Floor are annual and monthly based. Industry identifiers are based on the code IDCC. There are four groups of occupation (manual, non manual, middle management, and upper management). T-statistics are given in brackets.*, **, and *** denote statistical significance at 10%, 5% and 1% levels.

Table 3.2 suggests the OLS results understated the elasticity. This is consistent with the expected attenuation bias discussed above. Again, once we control for time fixed effects, the last two columns suggests an elasticity of -5%. This provides compelling evidence that wage floors have fallen in response to the rise of Chinese competition.

### 3.4.5 The impact of international competition on revenue of firms

In this section, we consider the impact of Chinese competition on the revenues of firms. This allows us to consider how an increase of international competition modifies the rent to be shared between employers and employees. Graphically speaking, this appears to be a negative relationship between both, as seen in the following picture 3.11. In it, the growth rate of individual firms are scattered across the penetration index of Chinese goods in their respective industry. This way of proceeding gives as much importance to small firms (few workers and revenues) as to large firms (many workers and revenues). To avoid a misleading analysis, we weight future analyses by the number of employees in the firm in order to estimate an effect which quantitatively reflects the importance of Chinese competition on French workers.

FIGURE 3.11 : Yearly Revenue Growth against Chinese Penetration Yearly Growth (2010)




.

Moreover, we have found that the slope of this relationship can change from year to year. Both of these issues suggests that there could be potential confounds. As a first step, we run the following ordinary least squares regression :

$$\Delta R_{i,j,t} = \alpha_0 + \beta \Delta I_{j,t} + \alpha_{j,t} + S_{i,t} + L_{i,t} + \epsilon_{i,j,t} \quad (3.24)$$

Where $\Delta R_{i,j,t}$ is the yearly percentage increase in the revenue of firm $i$, operating in industry agreement $j$, during year $t$. $\Delta I_{j,t}$ is the percentage of variation, between year $t$ and $t-1$, of the index given by equation 3.21 for industry $j$. $\alpha_{j,t}$ are fixed effects. There is one for each pair industry-level agreement, year, where the industry is defined at the two digit of the NACE classification. They capture the effect that are specific to an industry, during a year (productivity shock, legal changes...). $S_{i,t}$ is a fixed effect of the size of the firm, there is one form firms with an average size over the year between 1 and 10 employee, one for an average size between 10 and 50, one between 50 and 100, one between 100 and 500 and on for firms with more than 500 employee. $L_{i,t}$ is a fixed effect for the location of the firm. There is one fixed effect for each 26 french region. Results are given in table 3.3

TABLE 3.3 : Weighted Regression (by Number of Employees)

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| | % Δ Revenues | % Δ Revenues | % Δ Revenues | % Δ Revenues | % Δ Revenues |
| % Δ Chinese Penetration Index | 0.0118*** | -0.00342*** | -0.0189*** | -0.0189*** | -0.0182*** |
| | (16.51) | (-3.83) | (-19.80) | (-19.77) | (-18.40) |
| Constant | Yes | Yes | Yes | Yes | Yes |
| Year Fixed Effects | No | No | Yes | Yes | Yes |
| Industry Fixed Effects | No | Yes | Yes | Yes | Yes |
| Firm Size Fixed Effect | No | No | No | Yes | Yes |
| Region Fixed Effect | No | No | No | No | Yes |
| Firm Fixed Effect | No | No | No | No | Yes |
| Observations | 470357 | 470357 | 470357 | 470357 | 470357 |

Note : The table presents results of the OLS estimates of the effect of the annual change of the exposure to Chinese imports, measured at the industry-level by the index given in equation 3.21 on the revenue of french firms. The dependent variable is the yearly rate of change in firm revenues (identified by the code SIREN). Extreme Values (above 20% and below -20% ) were dropped. Firms with fewer than 2 employees or negative amounts of revenues were dropped. Firm Size Fixed Effects were estimated by grouping firms into groups (below 50, 50-100,100-500, above 500) and estimating a dummy for each of these groups. Analytic weights were used based on the number of employees in each firm. This was done to provide adequate representation of large firms in the regression. Industry identifiers are based on the code APE. Firm location is used to identify the region fixed effects. Firm fixed effects are identified by the code SIREN of the company. T-statistics are given in brackets.*, **, and *** denote statistical significance at 10%, 5% and 1% levels.

The preceding table suggests a negative impact of Chinese trade on firm revenues. Through the effect of inflation and productivity growth, the raw correlation in the data is positive. However, after correcting for long-run productivity growth rates through industry fixed effects, a negative and statistically significant coefficient can be found in column (2). Further controlling for time fixed effects, a more substantial effect can be detected : an elasticity of firm revenues to the Chinese penetration index nearing 2%. This effect is robust to firm and region fixed effects, as displayed in column (4) and (5). Surprisingly, the estimated coefficient does not change much across those specifications and is highly statistically significant. The following table considers the specification using instrumental variables in order to detect and improve upon any potential attenuation bias.

TABLE 3.4 : Instrumental Variable Weighted Regression (by Number of Employees)

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | % Δ Revenues | % Δ Revenues | % Δ Revenues | % Δ Revenues | % Δ Revenues | % Δ Revenues |
| % Δ Chinese Penetration Index | -0.00457*** | -0.0258*** | -0.0449*** | -0.0449*** | -0.0413*** | -0.0426*** |
| | (-4.25) | (-17.15) | (-30.48) | (-30.45) | (-28.17) | (-28.37) |
| Constant | Yes | Yes | Yes | Yes | Yes | Yes |
| Year Fixed Effects | No | No | Yes | Yes | Yes | Yes |
| Industry Fixed Effects | No | Yes | Yes | Yes | Yes | Yes |
| Firm Size Fixed Effect | No | No | No | Yes | Yes | Yes |
| Region Fixed Effect | No | No | No | No | Yes | Yes |
| Firm Fixed Effect | No | No | No | No | No | Yes |
| Observations | 470357 | 470347 | 470347 | 470347 | 469305 | 435902 |

Note : The table presents results of the IV estimates of the effect of the annual change of the exposure to Chinese imports, measured at the industry-level by the index given in equation 3.21 on the revenue of french firms. It is instrumented using the Chinese Penetration Index of the same industry in a set of other countries. The dependent variable is the yearly rate of change in firm revenues (identified by the code SIREN). Extreme Values (above 20% and below -20% ) were dropped. Firms with fewer than 2 employees or negative amounts of revenues were dropped. Firm Size Fixed Effects were estimated by grouping firms into groups (below 50, 50-100,100-500, above 500) and estimating a dummy for each of these groups. Analytic weights were used based on the number of employees in each firm. This was done to provide adequate representation of large firms in the regression.Industry identifiers are based on the code APE. Firm location is used to identify the region fixed effects. Firm fixed effects are identified by the code SIREN of the company. T-statistics are given in brackets.*, **, and *** denote statistical significance at 10%, 5% and 1% levels.

Coefficient estimates from table 3.4 suggest a negative effect of Chinese competition on firm revenues and an attenuation bias. Indeed, all coefficients are now negative and statistically significant. The magnitude of these coefficients appear on the rise. This can be seen by comparing column (2) to the one found in table 3.3. The coefficient is here, in absolute size, ten times larger. Once we take into account time fixed effects in column (3), the estimated elasticity stabilizes at -4%. In comparison to the ordinary least squares results, this compels us to think that there are French demand shocks which lead our ordinary least squares estimates to be upwards bias. Moreover, this estimate appears unaffected by the inclusion of further control variables. In particular, firm size (column 4) and region (column 5) fixed effects barely dent the estimate. Firm fixed effects do not even impact the level of statistical significance of the estimated coefficient.

# Appendix

## 3.A Method used for figure 3.1

Here, we use the same method as in Le Moigne and Ragot (2015). We use publicly available data on national accounts for France[14] and Germany[15]. For each country, and for each year, we compute the average wage per industry. Then we use classifications given in table 3.5 for France and table 3.6 for Germany. Finally, for both tradable sectors and non-tradable sectors we compute, for each country and for each year, the average value of the wages.

TABLE 3.5 : Classification of Industries for France

| Tradable Sectors | Non-tradable sectors |
|---|---|
| Agriculture, forestry and fishing | Construction |
| Manufacture of food products, beverages and tobacco products | Trade |
| Manufacture of coke and refined petroleum products | Transportation and storage |
| Manufacture of electrical, computer and electronic equipment ; manufacture of machinery | Accommodation and food service activities |
| Manufacture of transport equipment | Real estate activities |
| Other manufacturing | Non market services |
| Information and communication | Household services |
| Financial and insurance activities | |
| energy, water supply, sewerage, waste management and remediation activities | |

TABLE 3.6 : Classification of Industries for Germany

| Tradable Sectors | Non-tradable sectors |
|---|---|
| Agriculture, Forestry, Fishing | Construction |
| Industry excluding construction | Trade, transport, accomodation and food services |
| Manufacturing | Public services, education, health |
| Information-communication | Other services |
| Financial and insurance services | Real estate activities |

## 3.B Descriptive statistics

## 3.C Firm-level bargaining

### Proof of Proposition 1

14. https ://www.insee.fr/fr/statistiques/2383648 ?sommaire=2383694
15. https ://www-genesis.destatis.de/genesis/online/data ;jsessionid=1A67458D0DE3A191755F3588EAB7AE65.tomcat$_G O_{23}?operation = statistikAbruftabellenlevelindex = 0levelid = 1530794283356index = 2$

TABLE 3.7 : Summary statistics, data set on the revenue of firms

| Variable | # Obs. | Mean | Std | Min | Max | Percentiles | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | $25^{th}$ | $50^{th}$ | $75^{th}$ |
| Revenue annual evolution(%) | 435902 | 0.416 | 8.995 | -18.947 | 19.125 | -5.366 | 0 | 6.476 |
| Size of firms | 435902 | 32.746 | 361.145 | 2 | 86587 | 3 | 6.25 | 16 |
| Index of Penetration of Chinese imports (%) | 435902 | 16.516 | 16.573 | -79.296 | 101.654 | 7.448 | 12.838 | 22.913 |
| Index of Penetration of Chinese imports in Germany (%) | 435902 | 15.800 | 21.129 | -53.983 | 74.857 | 3.492 | 15.814 | 22.089 |
| Index of Penetration of Chinese imports in Denmark(%) | 435902 | 21.515 | 55.510 | -87.809 | 151.053 | 4.875 | 17.561 | 27.623 |
| Index of Penetration of Chinese imports in UK(%) | 435902 | 18.343 | 39.756 | -75.816 | 89.2113 | 5.855 | 14.968 | 24.490 |
| Index of Penetration of Chinese imports in Japan (%) | 435902 | 8.769 | 15.489 | -67.375 | 114.599 | 1.962 | 10.497 | 16.566 |
| Index of Penetration of Chinese imports in Finland (%) | 435902 | 29.729 | 28.024 | -99.839 | 142.581 | 1.657 | 17.258 | 31.840 |
| Index of Penetration of Chinese imports in Spain (%) | 435902 | 18.057 | 27.982 | -63.887 | 206.679 | 2.650 | 17.332 | 28.256 |
| Index of Penetration of Chinese imports in USA (%) | 435902 | 12.504 | 15.416 | -82.038 | 147.840 | 5.808 | 10.573 | 18.463 |
| Index of Penetration of Chinese imports in Sweden (%) | 435902 | 22.737 | 32.619 | -96.396 | 161.238 | 2.986 | 16.147 | 34.525 |
| Index of Penetration of Chinese imports in Norway (%) | 435902 | 22.200 | 57.993 | -95.527 | 171.236 | 6.260 | 16.958 | 29.198 |
| Index of Penetration of Chinese imports in Netherlands (%) | 435902 | 16.266 | 27.510 | -76.509 | 11.492 | 4.651 | 16.958 | 29.198 |

Notes : The revenue annual change is the percentage evolution of the revenue of a firm. The index of penetration is computed at the 2 digit level of the NACE classification of a firm. Its the ration of the import from China on the production in a country, minus its exports, plus its imports. Its given by equation 3.21

Using equations 3.7 and 3.2 it is straightforward to derive that

$$\frac{\partial q_c(\phi, w)}{\partial w} = -\frac{\sigma}{w} q_c(\phi, w)$$

Therefore, we directly obtain

$$\frac{1}{q_c(\phi, w)} \frac{\partial q_c(\phi, w)}{\partial w} = \frac{-\sigma}{w}$$

Furthermore, using the same method, we derive

$$\frac{1}{r_c(\phi, w) - (w)\frac{q_c(\phi,w)}{\phi}} \frac{\partial \left[ r_c(\phi, w) - w \right] \frac{q_c(\phi,w)}{\phi}}{\partial w} = \frac{1-\sigma}{w}$$

Therefore the wage equation is given by

$$\beta \left[ \frac{-\sigma}{w} + \frac{1}{w - \tilde{w}} \right] + (1-\beta) \left[ \frac{1-\sigma}{w} \right] = 0$$

# 3.D Industry level bargaining

## Proof of Proposition 2.A

First,

$$L_c = \frac{M_c}{1 - G(\phi^*_{d,c})} \left[ Q_c \int_{\phi^*_{d,c}}^{\infty} \left[ \frac{w}{\rho \phi P_c} \right]^{-\sigma} g(\phi) d\phi + Q_{(-c)} \int_{\phi^*_{x,c}}^{\infty} \left[ \frac{\tau w}{\rho \phi P_{(-c)}} \right]^{-\sigma} g(\phi) d\phi \right]$$

Therefore, it can derived that

$$\frac{\partial L_c}{\partial w} = \frac{M_c}{1 - G(\phi^*_{d,c})} \left[ Q_c \int_{\phi^*_{d,c}}^{\infty} \left[ \frac{w}{\rho \phi P_c} \right]^{-\sigma} g(\phi) d\phi + Q_{(-c)} \int_{\phi^*_{x,c}}^{\infty} \left[ \frac{\tau w}{\rho \phi P_{(-c)}} \right]^{-\sigma} g(\phi) d\phi \right] \frac{-\sigma}{w}$$
$$+ \frac{M_c}{1 - G(\phi^*_{d,c})} \left[ \int_{\phi^*_{d,c}}^{\infty} \left[ \frac{w}{\rho \phi} \right]^{-\sigma} g(\phi) d\phi \frac{\partial \left(P_c\right)^{\sigma - \xi}}{\partial w} + \int_{\phi^*_{x,c}}^{\infty} \left[ \frac{\tau w}{\rho \phi} \right]^{-\sigma} g(\phi) d\phi \frac{\partial \left(P_{(-c)}\right)^{\sigma - \xi}}{\partial w} \right]$$

Using the definition of the aggregate price we obtain

$$\frac{\partial P_c}{\partial w} = \frac{P_c^{\sigma}}{w} \left[ \frac{M_c}{1 - G(\phi^*_{d,c})} \int_{\phi^*_{d,c}}^{\infty} \left[ \frac{w}{\rho \phi} \right]^{1-\sigma} g(\phi) d\phi \right]$$

$$\frac{\partial P_{(-c)}}{\partial w} = \frac{P_{(-c)}^{\sigma}}{w} \left[ \frac{M_c}{1 - G(\phi^*_{d,c})} \int_{\phi^*_{x,c}}^{\infty} \left[ \frac{\tau w}{\rho \phi} \right]^{1-\sigma} g(\phi) d\phi \right]$$

TABLE 3.8 : Summary statistics, data set on wage floors

| Variable | # Obs. | Mean | Std | Min | Max | Percentiles | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | $25^{th}$ | $50^{th}$ | $75^{th}$ |
| Wage floor evolution(%) | 4332 | 2.288 | 2.586 | 0 | 10.48 | 1 | 1.8 | 2.6 |
| Number of wage floor per sector-level agreement | 457 | 6.632 | 3.979 | 2 | 31 | 5 | 6 | 7 |
| Number of employee covered by a sector-level agreement | 457 | 62108 | 1130 | 1200 | 677290 | 13610 | 33000 | 60800 |
| Index of Penetration of Chinese imports (%) | 4332 | 6.828 | 11.403 | -23.806 | 68.804 | 0 | 3.985 | 12.226 |
| Index of Penetration of Chinese imports in Germany (%) | 4332 | 5.378 | 17.249 | -13.598 | 79.210 | -1.23 | 2.987 | 17.894 |
| Index of Penetration of Chinese imports in Denmark(%) | 4332 | 8.354 | 8.996 | -32.025 | 72.145 | 1.234 | 3.215 | 11.298 |
| Index of Penetration of Chinese imports in UK(%) | 4332 | 7.896 | 20.548 | -36.254 | 61.028 | 1.236 | 5.468 | 10.847 |
| Index of Penetration of Chinese imports in Japan (%) | 4332 | 7.999 | 17.203 | -48.658 | 89.358 | -1.258 | 4 .554 | 11.764 |
| Index of Penetration of Chinese imports in Finland (%) | 4332 | 8.889 | 9.367 | -15.624 | 55.478 | 1.354 | 3.247 | 17.498 |
| Index of Penetration of Chinese imports in Spain (%) | 4332 | 7.777 | 18.945 | -31.457 | 78.947 | -2.147 | 4.876 | 18.478 |
| Index of Penetration of Chinese imports in USA (%) | 4332 | 6.547 | 11.259 | -27.589 | 64.729 | -0.247 | 3.213 | 11.896 |
| Index of Penetration of Chinese imports in Sweden (%) | 4332 | 8.976 | 10.278 | -19.864 | 62.108 | 0.284 | 4.235 | 11.875 |
| Index of Penetration of Chinese imports in Norway (%) | 4332 | 6.357 | 14.865 | -22.789 | 74.358 | -1.231 | 4.573 | 8.972 |
| Index of Penetration of Chinese imports in Netherlands (%) | 4332 | 9.992 | 10.002 | -20.478 | 54.887 | 1.548 | 5.556 | 12.875 |

Notes : The revenue annual change is the percentage evolution of the revenue of a firm. The index of penetration is computed at the position level, and embodiedd the penetration of Chinese imports. Its given by equation 3.22

Therefore, we derive

$$\frac{1}{L_c}\frac{\partial L_c}{\partial w} = \frac{-\sigma}{w} + \frac{\sigma-\xi}{w}\left[\frac{L_c^H \frac{\tilde{R}_c^H}{R_c} + L_c^F \frac{\tilde{R}_c^F}{R_{(-c)}}}{L_c}\right]$$

moreover, as all firms pay the same wage, we directly obtain that for both country

$$\tilde{R}_c = \frac{w_c}{\rho} L_c \tag{3.25}$$

Using equation 3.25, we obtain

$$\frac{1}{L_c}\frac{\partial L_c}{\partial w} = \frac{-\sigma}{w} + \frac{\sigma-\xi}{w}\left[\frac{\tilde{R}_c^H \frac{\tilde{R}_c^H}{R_c} + \tilde{R}_c^F \frac{\tilde{R}_c^F}{R_{(-c)}}}{\tilde{R}_c}\right]$$

Using the same method, we derive

$$\frac{1}{R_c}\frac{\partial R_c}{\partial w} = \frac{1-\sigma}{w} + \frac{\sigma-\xi}{w}\left[\frac{\tilde{R}_c^H \frac{\tilde{R}_c^H}{R_c} + \tilde{R}_c^F \frac{\tilde{R}_c^F}{R_{(-c)}}}{\tilde{R}_c}\right]$$

# 3.E The impact of the wage floor on the trade equilibrium

## Proof of Proposition 3.A

First equation (3.9) and Proposition 2 imply that

$$\frac{\phi^*_{d,a}}{\phi^*_{x,b}} \geq \frac{\phi^*_{d,b}}{\phi^*_{x,a}}$$

Furthermore, the free entry condition (3.10) implies that in both countries the productivity cutoff for domestic sales and the one for exporting sales respect the same downward-sloping relation. Therefore, building on previous insights, it's straightforward to derive Proposition 3.A.

## Proof of Proposition 3.B

The free entry condition (3.10) implies that for $c \in \{a, b\}$

$$f_e = \left[1 - G(\phi^*_{d,c})\right] \overline{\pi}_c$$

Using Proposition 3.A, the previous equation implies that $\overline{\pi}_a < \overline{\pi}_b$. Furthermore, for $c \in \{a, b\}$

$$\overline{\pi}_c = \frac{\overline{r}_c}{\sigma} - f - \frac{1 - G(\phi^*_{x,c})}{1 - G(\phi^*_{d,c})} f_x$$

Proposition 3.A and the previous result on the average profit imply that $\overline{r}_a < \overline{r}_b$.

# Proof of Proposition 3.C

Equation (3.8) implies that

$$R_a \left[\frac{w}{\rho \phi^*_{d,a} P_a}\right]^{1-\sigma} = R_b \left[\frac{w_b}{\rho \phi^*_{d,b} P_b}\right]^{1-\sigma}$$

Equation (3.1) implies that

$$\left[\frac{R_a}{R_b}\right]^{\frac{\sigma-\xi}{(1-\sigma)(1-\xi)}} = \frac{w_b}{w_a} \frac{\phi^*_{d,a}}{\phi^*_{d,b}}$$

This equation and Proposition 3.A imply Proposition 3.C.

# Proof of Proposition 3.D

First we prove that

$$\overline{r}_{d,a} > \overline{r}_{d,b} > \overline{r}_{x,b} > \overline{r}_{x,a} \tag{3.26}$$

First, Proposition 3.A implies that $\overline{r}^H_a \geq \overline{r}^H_b$ and $\overline{r}^F_b \geq \overline{r}^F_a$. Then we compare $\overline{r}^H_b$ and $\overline{r}^F_b$. The share of the aggregate revenues from the market of country $b$ earned by firms of country $b$ (*ie* $\frac{\tilde{R}^H_b}{R_b}$) is equal to

$$\frac{\frac{M_b}{1-G(\phi^*_{d,b})} \int_{\phi^*_{d,b}}^{\infty} \left[\frac{w_b}{\phi}\right]^{1-\sigma} g(\phi) d\phi}{\frac{M_b}{1-G(\phi^*_{d,b})} \int_{\phi^*_{d,b}}^{\infty} \left[\frac{w_b}{\phi}\right]^{1-\sigma} g(\phi) d\phi + \frac{M_a}{1-G(\phi^*_{a,b})} \int_{\phi^*_{a,x}}^{\infty} \left[\tau \frac{w_a}{\phi}\right]^{1-\sigma} g(\phi) d\phi}$$

Proposition 3.A implies that this is superior to the share of the aggregate revenues from the market of country $a$ earned by firms of country $b$ (*ie* $\frac{\tilde{R}^H_b}{R_b}$) which is equal to

$$\frac{\frac{M_b}{1-G(\phi^*_{d,b})} \int_{\phi^*_{x,b}}^{\infty} \left[\tau \frac{w_b}{\phi}\right]^{1-\sigma} g(\phi) d\phi}{\frac{M_b}{1-G(\phi^*_{d,b})} \int_{\phi^*_{x,b}}^{\infty} \left[\tau \frac{w_b}{\phi}\right]^{1-\sigma} g(\phi) d\phi + \frac{M_a}{1-G(\phi^*_{a,b})} \int_{\phi^*_{a,d}}^{\infty} \left[\frac{w_a}{\phi}\right]^{1-\sigma} g(\phi) d\phi}$$

Therefore, Proposition 3.C directly imply that $\overline{r}^H_b \geq \overline{r}^F_b$.

Furthermore, the definition of aggregate revenue, the value of the average revenue and equation (3.12) imply that

$$R_a = M_a \overline{r}_{d,a} + M_b \overline{r}_{x,b}$$

$$R_b = M_b \overline{r}_{d,b} + M_a \overline{r}_{x,a}$$

This implies that

$$\left[M_a - M_b\right] \left[\overline{r}_{d,a} \overline{r}_{d,b} - \overline{r}_{x,a} \overline{r}_{x,b}\right] = R_a \left[\overline{r}_{d,b} + \overline{r}_{x,a}\right] - R_b \left[\overline{r}_{x,b} + \overline{r}_{d,a}\right]$$

Therefore, Proposition 3.C and equation 3.26 imply Proposition 3.D

# Proof of Proposition 3.E

This can be derived from Proposition 3.B and Proposition 3.D.

# Proof of Proposition 3.F

This can be derived from Proposition 3.E and equation 3.25.

# 3.F Impact of trade frictions on the wage floor

## Proof of Proposition 4

### *Proof of Proposition 4.A*

We suppose that $\tau$ is decreasing and $\frac{w_a}{w_b}$ is constant. The Pareto distribution implies that

$$\bar{r}_c = \frac{a\sigma}{a-(\sigma-1)}\left[f + f_x\left(\frac{\phi^*_{c,d}}{\phi^*_{c,x}}\right)^a\right] \tag{3.27}$$

$$\frac{1}{\bar{r}_c}d\bar{r}_c = a\frac{f_x\left[\frac{\phi^*_{d,c}}{\phi^*_{x,c}}\right]^a}{f+f_x\left[\frac{\phi^*_{d,c}}{\phi^*_{x,c}}\right]^a}\left[\frac{1}{\phi^*_{d,c}}d\phi^*_{d,c} - \frac{1}{\phi^*_{x,c}}d\phi^*_{x,c}\right] \tag{3.28}$$

$$\bar{r}_{c,d} = \frac{a\sigma f}{a-(\sigma-1)}$$

$$\bar{r}_{c,x} = \frac{a\sigma f_x}{a-(\sigma-1)}\left[\frac{\phi^*_{d,c}}{\phi^*_{x,c}}\right]^a$$

Therefore, using equation 3.19, this directly implies that $\frac{\bar{r}_a}{\bar{r}_b}$ is decreasing.
Furthermore, it can be derived that

$$\frac{M_a}{M_b} = \frac{\frac{R_a}{R_b}\bar{r}_{d,b} - \bar{r}_{x,b}}{\bar{r}_{d,a} - \bar{r}_{x,a}\frac{R_a}{R_b}}$$

Using the same method, it's straightforward to obtain that $\frac{\bar{r}_{d,b}-\bar{r}_{x,b}}{\bar{r}_{d,a}-\bar{r}_{x,a}}$ is decreasing.

Finally, using equations 3.19 and 3.8 it can be derived that

$$\frac{\sigma-\xi}{(1-\sigma)(1-\xi)}\left[\frac{1}{R_a}\frac{\partial R_a}{\partial\tau} - \frac{1}{R_b}\frac{\partial R_b}{\partial\tau}\right] = \frac{1}{\phi^*_{d,a}}\frac{\partial\phi^*_{d,a}}{\partial\tau} - \frac{1}{\phi^*_{d,b}}\frac{\partial\phi^*_{d,b}}{\partial\tau} < 0$$

Therefore, $\frac{M_a}{M_b}$ decreases which, using the result on relative average profit, directly implies that the original assumptions would imply that $\frac{\tilde{R}_a}{\tilde{R}_b}$ decreases.

### *Proof of Proposition 4.B*

We suppose that $\frac{\tilde{R}_a}{\tilde{R}_b}$ is decreasing and that $\tau$ is constant. Furthermore, I define $x = \frac{\tilde{R}_{d,a}}{R_a}$ and $y = \frac{\tilde{R}_{x,a}}{R_b}$. We obtain that

$$d\left[\frac{x\tilde{R}_{d,a}+y\tilde{R}_{x,a}}{\tilde{R}_{d,a}+\tilde{R}_{x,a}}\right] = \frac{(\tilde{R}_{x,a})^2[x-y]\,d\left[\frac{\tilde{R}_{d,a}}{\tilde{R}_{x,a}}\right] + \left[\tilde{R}_{d,a}+\tilde{R}_{x,a}\right]\left[\tilde{R}_{d,a}dx + \tilde{R}_{x,a}dy\right]}{\left[\tilde{R}_{d,a}+\tilde{R}_{x,a}\right]^2}$$

We focus on the the study of the evolution of $x\frac{\tilde{R}_{d,a}}{\tilde{R}_{x,a}}$. This is equal to

$$\frac{\tilde{R}_{d,a}}{R_a}\frac{\bar{r}_{d,a}}{\bar{r}_{x,a}}$$

As the distribution is Pareto, the average revenue is given by

$$\bar{r}_{d,c} = \frac{a\sigma f}{a-(\sigma-1)}$$

$$\bar{r}_{x,c} = \frac{a\sigma f_x}{a-(\sigma-1)}\left[\frac{\phi^*_{d,c}}{\phi^*_{x,c}}\right]^a$$

Therefore, using the logarithmic derivative, we have

$$\frac{1}{\frac{\tilde{R}_{d,a}}{R_a}\frac{\bar{r}_{d,a}}{\bar{r}_{x,a}}}d\left[\frac{\tilde{R}_{d,a}}{R_a}\frac{\bar{r}_{d,a}}{\bar{r}_{x,a}}\right] = \frac{1}{M_a}dM_a - \frac{1}{R_a}dR_a - \frac{1}{\bar{r}_{x,a}}d\bar{r}_{x,a}$$

Furthermore, using equations 3.20, 3.19 and the Pareto distribution, we have

$$-\frac{d\bar{r}_{x,a}}{\bar{r}_{x,a}} \leq -\frac{d\bar{r}_{x,b}}{\bar{r}_{x,b}}$$

It is straightforward to derive that $\frac{\bar{r}_{x,b}}{\bar{r}_{d,a}+\frac{M_b}{M_a}\bar{r}_{x,b}}$ is decreasing, directly implying that

$$\frac{1}{M_a}dM_a - \frac{1}{R_a}dR_a - \frac{1}{\bar{r}_{x,a}}d\bar{r}_{x,a} < 0$$

Therefore, $x\frac{\tilde{R}_{d,a}}{\tilde{R}_{x,a}}$ is decreasing. Furthermore, it is straightforward to derive that both $x$ and $y$ are decreasing, consequently

$$d\left[\frac{x\tilde{R}_{d,a} + y\tilde{R}_{x,a}}{\tilde{R}_{d,a} + \tilde{R}_{x,a}}\right] < \left[\frac{\tilde{R}_{x,a}}{\tilde{R}_{x,a} + \tilde{R}_{d,a}}\right]^2 d\left[x\frac{\tilde{R}_{d,a}}{\tilde{R}_{x,a}}\right] < 0$$

This implies that when $\tau$ is constant and $\frac{\tilde{R}_a}{\tilde{R}_b}$ is decreasing, therefore $\mu$ is decreasing.

# Proof of Proposition 5

## *Proof of Proposition 5.A*

The Pareto distribution, equations 3.20, 3.19 and results of Proposition 3 imply that $0 < \frac{1}{\bar{r}_a}\frac{\partial \bar{r}_a}{\partial \tau} < \frac{1}{\bar{r}_b}\frac{\partial \bar{r}_b}{\partial \tau}$. Furthermore, the ratio of mass of firms is equal to

$$\frac{M_a}{M_b} = \frac{\frac{R_a}{R_b}\bar{r}_{d,b} - \bar{r}_{x,b}}{\bar{r}_{d,a} - \bar{r}_{x,a}\frac{R_a}{R_b}}$$

First, using equation 3.19 and results of Proposition 4, it is straightforward to obtain that $\frac{1}{\phi^*_{d,a}}\frac{\partial \phi^*_{d,a}}{\partial \tau} < \frac{1}{\phi^*_{d,b}}\frac{\partial \phi^*_{d,b}}{\partial \tau}$. Consequently, using equation 3.8 we obtain that $\frac{R_b}{R_a}$ is increasing.

Furthermore, using the Pareto distribution and equations 3.20, 3.19 we directly obtain that $0 < \frac{1}{\bar{r}_{x,a}}\frac{\partial \bar{r}_{x,a}}{\partial \tau} < \frac{1}{\bar{r}_{x,b}}\frac{\partial \bar{r}_{x,b}}{\partial \tau}$. Therefore, using Proposition 3.D, we derive that $\frac{\partial \bar{r}_{x,a}}{\partial \tau} < \frac{\partial \bar{r}_{x,b}}{\partial \tau}$. Consequently, it is straightforward to obtain that the following function decreases when $\tau$ decreases.

$$\frac{\bar{r}_{x,b} - \bar{r}_{d,b}}{\bar{r}_{x,a} - \bar{r}_{d,a}}$$

Using previous results, we can conclude that when $\tau$ decreases, $\frac{M_a}{M_b}$ decreases, so, using the result on average profit, that $\frac{\tilde{R}_a}{\tilde{R}_b}$ decreases if $\tau$ decreases and relative labor cost don't change.

## *Proof of Proposition 5.B*

We suppose that $\frac{\tilde{R}_a}{\tilde{R}_b}$ is constant and that $\tau$ is decreasing. Then, using the same methods as just above, it is straightforward to obtain that $\frac{1}{\phi^*_{d,a}}\frac{\partial \phi^*_{d,a}}{\partial \tau} > \frac{1}{\phi^*_{d,b}}\frac{\partial \phi^*_{d,b}}{\partial \tau}$. Therefore, this implies that $\frac{\tilde{R}_{x,a}}{\tilde{R}_{d,a}}$ is increasing. Furthermore, using equation 3.8, this implies that $\frac{R_b}{R_a}$ is decreasing. Consequently, we derive that

$$d\left[\frac{x\tilde{R}_{d,a} + y\tilde{R}_{x,a}}{\tilde{R}_{d,a} + \tilde{R}_{x,a}}\right] = \frac{(\tilde{R}_{x,a})^2\left[x-y\right]d\left[\frac{\tilde{R}_{d,a}}{\tilde{R}_{x,a}}\right] + \left[\tilde{R}_{d,a} + \tilde{R}_{x,a}\right]\left[\tilde{R}_{d,a}dx + \tilde{R}_{x,a}dy\right]}{\left[\tilde{R}_{d,a} + \tilde{R}_{x,a}\right]^2}$$

Using previous results, we derive that

$$d\left[\frac{x\tilde{R}_{d,a} + y\tilde{R}_{x,a}}{\tilde{R}_{d,a} + \tilde{R}_{x,a}}\right] < 0 \iff \left[\frac{\tilde{R}_{d,a}}{\tilde{R}_{x,a}}dx + dy\right] < 0$$

Using the hypothesis, we derive that

$$d\left[\frac{\tilde{R}_a}{\tilde{R}_a + \tilde{R}_b}\right] = d\left[\frac{xR_a + yR_b}{R_a + R_b}\right] = \frac{R_b^2\left[x-y\right]d\left[\frac{R_a}{R_b}\right] + \left[R_a + R_b\right]\left[R_a dx + R_b dy\right]}{\left[R_a + R_b\right]^2} = 0$$

As $d\left[\frac{R_a}{R_b}\right]$ and $x > y$ therefore $\frac{R_a}{R_b}dx + dy < 0$. Using that[16] $dx < dy$, which implies that $dx < 0$. Furthermore $\frac{R_a}{R_b} = \frac{\tilde{R}_{d,a} + \tilde{R}_{x,b}}{\tilde{R}_{x,b} + \tilde{R}_{x,a}} > \frac{R_a}{R_b}$. Therefore, we have

$$-\frac{R_a}{R_b}dx > dy \Rightarrow -\frac{\tilde{R}_{d,a}}{\tilde{R}_{x,a}}dx > dy$$

Which implies that, if $\tau$ decreases and $\frac{\tilde{R}_a}{\tilde{R}_b}$ is constant therefore $\left[\frac{x\tilde{R}_{d,a} + y\tilde{R}_{x,a}}{\tilde{R}_{d,a} + \tilde{R}_{x,a}}\right] = \mu$ decreases.

# Proof of Proposition 6

## *Proof of Proposition 6.B*

The reduction of the trade frictions generates a wage reduction in country $a$. Furthermore, goods produced abroad are less expensive, due to a reduction of $\tau$. Using equation 3.8, the proof of the raise of the utility of consumers of country $a$ is obvious. Furthermore, equation 3.20 implies that

16. The proof of the following results is not given, it can easily be derived using previous results

$$\frac{d\left[\frac{\tau w_a}{\phi^*_{x,a}}\right]}{\left[\frac{\tau w_a}{\phi^*_{x,a}}\right]} = \frac{dw_a}{w_a}\left[1 - \frac{\bar{r}_{d,a}\bar{r}_{d,b} - \bar{r}_{d,a}\bar{r}_{x,b}}{\bar{r}_{d,a}\bar{r}_{d,b} - \bar{r}_{x,a}\bar{r}_{x,b}}\right] + \frac{d\tau}{\tau}\left[1 - \frac{\bar{r}_{d,a}\bar{r}_{d,b} - \bar{r}_{d,a}\bar{r}_{x,a}}{\bar{r}_{d,a}\bar{r}_{d,b} - \bar{r}_{x,a}\bar{r}_{x,b}}\right]$$

When $\tau$ decreases, $w_a$ decreases, therefore the previous quantity is negative. Using equation 3.8, this implies that $R_b$ is increasing.

Finally, as $\frac{w_a}{w_b}$ decreases when $\tau$ decreases, the fact that $\frac{R_a}{R_b}$ decreases is straightforward.

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ÉCOLE DOCTORALE
Sciences de l'homme et de la société (SHS)

**Titre :** Essais sur la négociation sectorielle

**Mots clés :** marché du travail/négociation salariales/conventions collectives

**Résumé :** Dans le premier chapitre, après une présentation des institutions responsables des négociations salariales en France, je me penche sur l'utilisation, par les grandes entreprises, des salaires planchers pour évincer la concurrence. En effet, les salaires négociés au niveau de l'industrie s'appliquent à l'ensemble des entreprises, qu'elles soient présentent lors des négociations ou non. Ce chapitre possède une partie théorique où il est montré que les plus grosses entreprises ont un intérêt à augmenter les salaires planchers, pour réduire le profit des plus petites entreprises, et ainsi récupérer leurs parts de marché. Par conséquent, plus les syndicats patronaux représentent les intérêts des grandes entreprises, plus le salaire négocié au niveau sectoriel est important. Cette prédiction est testée en utilisant des données françaises. L'utilisation d'une stratégie instrumentale permet de montrer que plus les entreprises négociant les salaires planchers sont grosses par rapport à la moyenne de l'industrie concernée, plus le salaire négocié est important.
Dans le second chapitre, je regarde l'effet des négociations sectorielles sur l'innovation. J'utilise un modèle avec compétition monopolistique. Je trouve que, dans le cas d'une négociation salariale au niveau de l'industrie, les parties à la négociation prennent en compte le fait que l'augmentation du coût du travail va diminuer les investissements, de leurs concurrents. En effet, avec la négociation sectorielle, l'augmentation du salaire plancher implique que les revenus tirés d'une innovation diminuent. Cette baisse des investissements permet aux entreprises dominantes de sécuriser leur place, ce qui possède un effet négatif sur l'innovation et la croissance.
Dans le dernier chapitre, je trouve que la compétition internationale réduit l'importance des effets mis en avant précédemment. En effet, les négociations sectorielles permettent aux entreprises dominantes de former des accords collusifs. Cependant, les entreprises étrangères du même secteur ne sont pas sujettes à ces accords salariaux. Cela vient donc empêcher la mise en place de ces effets de cartel. Ce chapitre est basé sur un modèle de type Melitz. De plus, des donnés sur les salaires négociés en France sont utilisées. L'augmentation des échanges avec la Chine est utilisée comme un choc exogène. Il est prouvé que cela réduit la rente extraite lors des accords de branche.

**Title :** Essays on sectoral-level wage bargaining

**Keywords :** labor market/wage bargaining/collective bargaining

**Abstract :** In the first chapter, after a presentation of institutional settings, I will focus on the use of sector-level agreements by large firms to reduce competition. Indeed, wage floors are binding for all firms of the industry, whether they sit at the negotiating table or not. This chapter provides a theoretical framework showing that such agreements can be used by dominant firms to reduce competition. In this framework, the higher the over-representation of large firms in employers' federations, the larger the bargained wage floors. This leads to the eviction of small firms. This prediction is tested on French administrative data. I document the domination of large firms within federations and devise an instrumental strategy to show that when the bargaining firms are relatively large compared to the industry standard - ie the lower the federation's representativeness, the higher are wage floors.
In the second chapter, I look at the effect of sector-level agreements on innovation. It is based on a model with monopolistic competition between products of an industry on the one hand, and between industries on the other hand. First, I find that when the bargaining process occurs at the industry level, negotiating parties take into account that a wage increase will deter investments of competitors. Indeed, when the wage negotiated at the industry-level increases, the labor cost increase implies that the reward for innovations decrease. As this will reduce the probability to be outperformed, this will generate a wage surplus when the bargaining takes place at the industry-level, reducing both production and employment. Furthermore, it will decrease the research effort of the industry reducing the productivity growth.
In the final chapter, I find that international competition mitigates the previous effects. Indeed, collective wage bargaining allows firms of a given industry to coordinate. However, international competition makes this collusive equilibrium unsustainable. Indeed, domestic firms face competition from foreign competitors which are not bound by those agreements. To support this argument, a Melitz-type model is developed and its implications tested on French data using the China Shock as a source of exogenous variation. The rent extracted during sector-level agreements no longer exist when domestic firms face Chinese competition.

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