Labour relations quality and productivity: An empirical analysis on French firms

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Abstract:

This analysis characterizes empirically how good labour relations can alleviate the negative impact on productivity of regulatory constraints or workforce opposition. Our evidence of good labour relations lies in the existence of binding collective agreements, at the firm or at the industry level. The estimations are based on a unique dataset collected by the Banque de France about the obstacles French firms may face in increasing their utilisation of production factors. Data are an unbalanced sample of 9,185 observations, corresponding to 2,134 companies, over the period 1991-2008.

Our main results may be summarised as follows: i) 'workforce or union opposition' interacted with 'regulatory constraints' has a negative significant impact on total factor productivity (TFP). Regulatory constraints would become really binding when workers or unions use them as a tool to oppose management's decisions; ii) 'workforce or union opposition' interacted with 'firm agreement' has a positive significant impact on TFP. Firm agreements, which reflect good-quality local labour relations, would be used by firms to offset the negative impact of local opposition from workers or unions; iii) 'regulatory constraints' interacted with 'branch agreement' has a positive significant impact on TFP. Branch agreements, which can only be obtained if labour relations at the industry level are supportive, would be used by branches to offset the negative impact of regulatory constraints.

These results give a strong confirmation that labour relations quality, at the branch or the firm levels, is an important factor of productive performance.

Keywords: Labour relation, collective bargaining, trade unions, productivity
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1. Introduction

A large amount of literature has been analysing the impact of worker voices, and more generally of the quality of work relations, on firm performances. An important part of this literature characterizes work relations by representative institutions, such as unions or works councils, and investigates their impact on firm performances. These performances are themselves characterized by labour productivity, total factor productivity or profitability. As a matter of fact, these studies do not really provide a unified and simple message.

Concerning the effect of unionization, the literature surveys from Hirsch (2007) and Morikawa (2010) show that while a majority of analyses find a positive impact on productivity, some do find a non-significant impact or even a negative one. For example, both on US individual firm data, Brown and Medoff (1978) find a positive impact and Clark (1984) a negative one. On the same type of data, Cooke (1994) or Black and Lynch (2001) give an interesting explanation of this contrast: they find a positive impact of unionization on productivity only in firms where the employer adopts some human resource practices that promote joint decision with incentive-based compensation, and a negative impact in firms that maintain more traditional labour management relations. The impact of unionization on average wage is found to be usually positive, but the impact on firm profitability is ambiguous, positive or negative depending on the study. The survey from Addison (2005) also highlights contrasted conclusions in the literature regarding the impact of works councils on productivity. Addison *et al.* (2000) on German and British firms and Addison *et al.* (2001) on German firms obtain a positive impact in large firms only. Fairris and Askenazy (2010) find, on French firms, no evidence of a positive impact of works councils on firm productivity and even some limited evidence of a negative effect. Hübler and Jirjahn (2003) provide an empirical explanation of these different results. Based on German firms, their study shows a positive impact of works councils on productivity only within firms covered by collective agreements. This empirical result is actually in line with the theoretical seminal paper from Freeman and Lazear (1994) which shows that works councils can improve firm productivity under certain conditions: "*There are potential net social gains from works councils. But to work best and gain these potential benefits, the rules governing councils must be carefully written to bound the power of labor and management and 'fit' the broader labor system in which councils must function*". It appears that works councils can improve firm productivity only in situations where the quality of labour relations is good enough to prevent some risks of inefficiency. The positive impact on productivity results in fact from the interaction between works councils and these good labour relations, works councils being however a negative productivity factor if taken individually.

The aim of our analysis is to characterize the impact on productivity of good labour relations. In particular, we investigate how the negative effects on productivity of legal or regulatory constraints and workforce or union opposition, taken individually, would be alleviated by interactions with firm or branch agreements. As in Hübler and Jirjahn (2003), our evidence of good labour relations lies in the existence of binding collective agreements, at the firm or at the industry level.

Our empirical analysis is based on a unique survey of French firms about the obstacles firm may face in increasing utilisation of their production factors, the survey on factor utilisation degrees (FUD hereafter). We merge this survey with another individual company dataset collected by the Banque de France, the FiBEn database. FiBEn is a very large individual company database that includes balance sheets and profit and loss accounts from annual tax statements, and can be used to compute total factor productivity (TFP) and changes in output. The FUD survey has been carried out every year since 1989 by the Banque de France at the plant level. It not only provides rich insights about firm-level factor utilisation, but also a unique appraisal of rigidities faced by firms in increasing their capital workweek. Firms are directly asked to declare the presence of such rigidities, and to characterize their legal, social or technical nature. More precisely, entrepreneurs answered the following question: « *If you had to increase your capital operating time, and if your sales potential could justify it, would you meet obstacles or brakes such as…* ? ». The considered obstacles are: worker opposition, union opposition,

absence of qualified workforce, bottleneck on commodities or supply, technical obstacles, legal or regulatory constraint, branch agreement, firm agreement, and other. The merger of these two databases results in an unbalanced sample of 9,185 observations, corresponding to 2,134 companies, over the period 1991-2008. To our knowledge, this individual company database is unique for allowing an empirical analysis concerning the impact of these rigidities on TFP. Even if it is declared as an obstacle to increase the capital operating time, we will consider the existence of a collective agreement (at the branch or the firm level) as a proxy for good labour relations. The ability to conclude a collective agreement implies such good labour relations, between employers and at least some unions.

The empirical strategy consists in estimating a relation where firm-level TFP is explained by output changes, sector, year, sector-year and size fixed effects along with different obstacles declared by firms, these obstacles being considered individually or interacted for some of them. These estimates may face a reverse causality bias: firms benefitting from high TFP may be able to provide higher wages. Employers could therefore overcome worker or union opposition, better secure supply, attract talents and negotiate more favourable firm agreements by being able to provide more generous compensations for increased flexibility. This bias may be both cyclical and permanent and is not easy to address. A first difficulty arises from obstacles being reported in a binary way, which makes them uneasy to instrument. Moreover, since a lot of obstacles appear to be correlated, finding a specific and exogenous instrument for any of these obstacles turned out to be a serious difficulty. We therefore chose not to make matters worse by implementing a sloppy instrumentation, and rather used an empirical strategy based on the appraisal of *structural rigidities*, computed from averaging observations over more than 5 years, and a series of robustness checks.

The main results obtained from the estimates may be summarised as follows: i) 'workforce or union opposition' interacted with 'regulatory constraints' has a negative significant impact on TFP. Regulatory constraints would become really binding when workers or unions use them as a tool to oppose management's decisions; ii) 'workforce or union opposition' interacted with 'firm agreement' has a positive significant impact on TFP. Firm agreements, which reflect good-quality local labour relations, would be used by firms to offset the negative impact of local opposition from workers or unions; iii) 'regulatory constraints' interacted with 'branch agreement' has a positive significant impact on TFP. Branch agreements, which can only be obtained if labour relations at the industry level are supportive, would be used by branches to offset the negative impact of regulatory constraints.

These results strongly support the importance of labour relations quality, at the branch or the firm levels, as a powerful factor of productive performance. They provide an original confirmation to early insights in the literature (e.g. Freeman and Lazear, 1994).

Section 2 presents the data we used. Section 3 details the empirical strategy and section 4 comments the results. Section 5 displays the outcome of several robustness checks and section 6 concludes.

2. Data and obstacles to increase capital operating time

2.1. An original dataset

Our empirical analysis merges two firm-level annual datasets constructed by the Banque de France: FiBEn and a survey on factor utilisation degrees (FUD).

FiBEn is a large database built on fiscal documents, including balance sheets and profit-and-loss statements. It features all French firms with sales exceeding €750,000 per year, or with a credit outstanding higher than €380,000. Every year, these accounting data are available for about 200,000 firms. In 2004, FiBEn was covering 80 % of the firms with 20 to 500 employees, and 98 % of those employing more than 500 employees. This database allows calculating firm-level value added (Q), the capital stock (K), the volume of employment (L) and computing total factor productivity (TFP):

- The value added volume (*Q*) is calculated by dividing value added in value (production in value minus intermediate consumptions) by a national accounting index of value added price at the industry level (two digit decomposition level).

- The volume of capital (*K*) sums gross capital volumes for buildings and equipment. Gross capital at historical price (as reported in tax statements) is divided by a national index for investment price, lagged with the mean age of gross capital (itself calculated from the share of depreciated capital in gross capital, at historical price). This measure corresponds to the volume of capital, usually by the end of a fiscal year. For this reason, we introduce a one-year lag for capital to calculate share-weighted factor growth.

- The average employment level (*L*) is directly available in FiBEn.

- Total factor productivity for firm *i* in sector *j* at date *t* (TFP_{ijt}) is obtained by dividing total value added Q_{ijt} by the volume of production inputs V_{ijt}, where:

$$V_{ijt} = {K_{ijt-1}}^{1-\alpha_j} {L_{ijt}}^{\alpha_j}$$

with α_j the labour share in revenue for sector *j*, calculated from the median over firms in this industry, on the dataset period.

The FUD survey has been carried out each September since 1989[1]. 1,500 to 2,500 plants[2] are covered by this survey, depending on the year. This dataset directly provides for each plant the annual growth rate of capital workweek (*WK*) and the level of labour workweek (*WL*).

While the FUD survey is carried out at the plant level, FiBEn gives information at the firm level. A difficulty in the data merge lies in the fact that some firms are multi plants. When several plants of a single firm were covered by the FUD survey, we aggregated for each year all plants of this firm, weighting them by their share in the firm's total employment. We considered the FUD survey answers to be representative enough when the employment level corresponding to this aggregation was higher than 50 % of the one reported in FiBEn (otherwise, the firm was dropped from the final dataset[3]). Each time one observation was missing for a given firm, we interpolated its value taking the average of its one-period past and one-period next observations.

The sample used in this paper is an unbalanced firm panel of 9,185 observations, corresponding to 2,134 companies, over the period 1991-2008. The criteria underlying this sample selection are detailed below.

2.2. Obstacles to shifts in capital operating time

Our dataset not only provides rich insights about firm-level factor utilisation, but also a unique appraisal of rigidities faced by firms in increasing their capital workweek. Firms were directly asked to declare the presence of such rigidities, and to characterize their legal, social or technical nature. More precisely, entrepreneurs answered the following question: « *If you had to increase your capital operating time, and if your sales potential could justify it, would you meet obstacles or brakes such as*…? »:

1- Worker opposition (*WOPP*)

[1] 2002 is unfortunately not present in the dataset since accidentally, paper questionnaires for the 2002 survey are no longer available at Banque de France.

[2] These plants are the ones usually covered by Banque de France monthly survey on business climate.

[3] In the final dataset, only 55 observations correspond to multi-plants firms.

2- Union opposition (*UOPP*)
3- Absence of qualified workforce (*ABS*)
4- Bottleneck on commodities or supply (*BOTT*)
5- Technical obstacles (*TOBS*)
6- Legal or regulatory constraint (*REG*)
7- Branch agreement (*BRA*)
8- Firm agreement (*FIR*)
9- Other

Beyond reporting obstacles, firms were also asked to rank them. Given the heterogeneity - and sometimes irrelevance - of these suggestive rankings, we preferred to particularly focus on the *presence* of an obstacle, and made some methodological choices. On the one hand, considering that an obstacle is present as soon as it is reported may imply uneasy interpretations, as some firms report all of them. On the other hand, considering only obstacles ranked in first position may rule out any possibility to analyse firms facing many rigidities. We therefore chose to consider an obstacle as *present* if it is declared and ranked either in first, second or third position.

A possible confusion between different obstacles close in their label led us to adopt an aggregation procedure, so as to reduce some potential interpretation biases. We first decided, in an arbitrary way, to aggregate *ABS*, *BOTT* and *TOBS* in a single variable named « Skills, supply or technical constraints (*TEC*) », since the difference in perception of these obstacles may not be easy to detect. Then, we undertook a hierarchical clustering procedure, represented in Figure 1, to further aggregate obstacles while keeping a strong explanatory power.

Figure 1: **Hierarchical clustering procedure result**

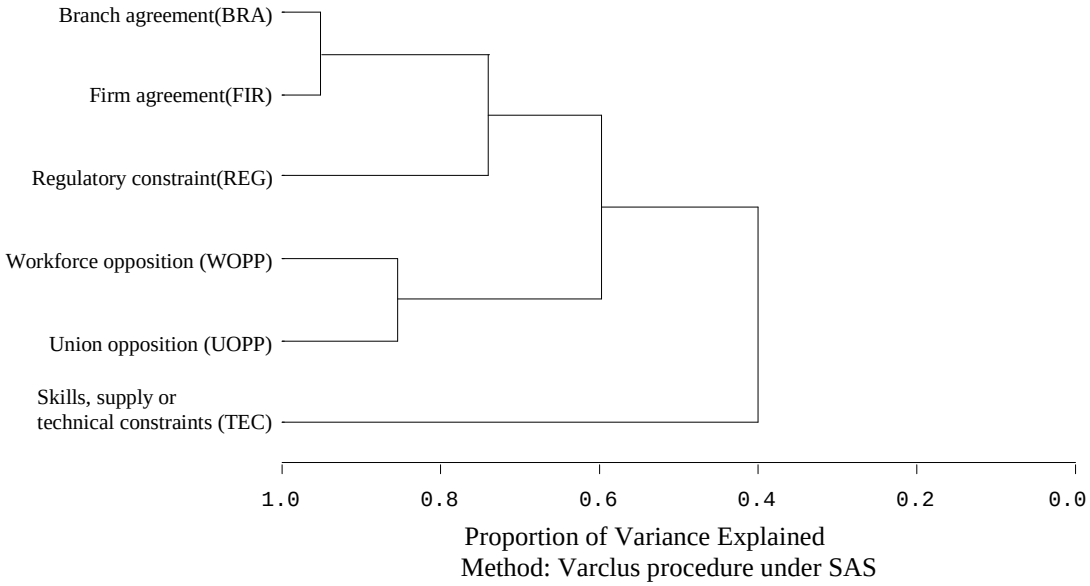


Figure 1 displays the way obstacles are aggregated through the clustering procedure. The horizontal axis represents the share of variance still explained after aggregating variables (taking as a benchmark the non-aggregated model). The first obstacles to be aggregated were branch and firm agreements, then workforce and union opposition. Not only these two aggregations seemed intuitively relevant, they also allow explaining more than 80 % of the variance associated with the non-aggregated model. We therefore decided to stop aggregating variables at this threshold, to avoid losing too much

explanatory power with respect to the non-aggregated model. Table 1 summarizes the aggregation procedure outcome.

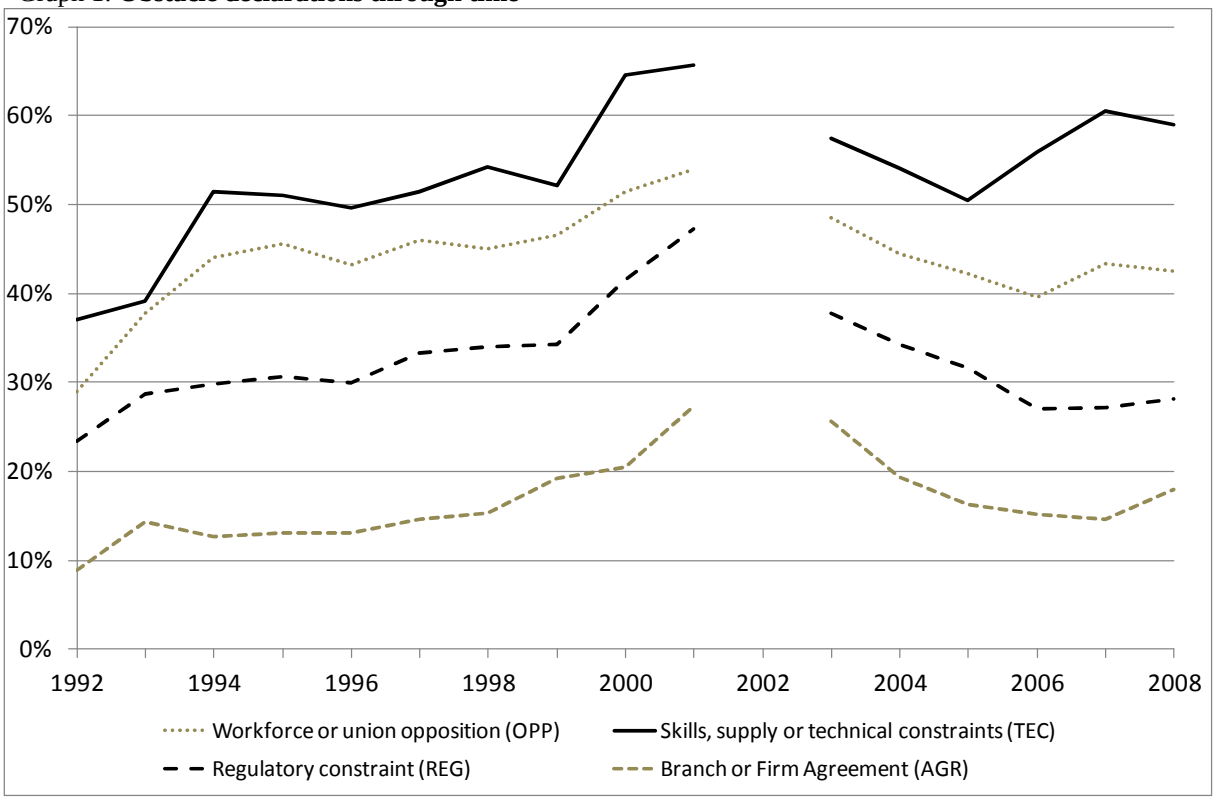
Table 1: **Aggregation procedure**

Aggregated obstacles[4] **…**	**… from originally declared obstacles**
Workforce or union opposition (*OPP*)	- Workforce opposition (*WOPP*) - Union opposition (*UOPP*)
Skills, supply or technical constraints (*TEC*)	- Absence of qualified workforce (*ABS*) - Bottleneck on commodities or supply (*BOTT*) - Technical obstacles (*TOBS*)
Regulatory constraint (*REG*)	- Legal or regulatory constraint (*REG*)
Branch or Firm Agreement (*AGR*)	- Branch agreement (*BRA*) - Firm agreement (*FIR*)

2.3. Conjunctural and structural rigidities

Looking at the evolution of obstacle declarations through time yields interesting insights (Graph 1).

Graph 1: **Obstacle declarations through time**



The 9,185 observations panel is unbalanced, which may imply sample effects. 2002 is unfortunately not present in the dataset since accidentally, paper questionnaires for the 2002 survey are no longer available at the Banque de France.

First, it appears that the different obstacles can easily be ranked in terms of reporting frequency, this hierarchy being quite stable through time. Each year, between 35% and 70% of firms signalled the

[4] For instance, the *OPP* variable takes value 1 if workforce opposition (*WOPP*) and / or union opposition (*UOPP*) are / is declared, 0 otherwise. Other aggregates were built the same way, from their corresponding components.

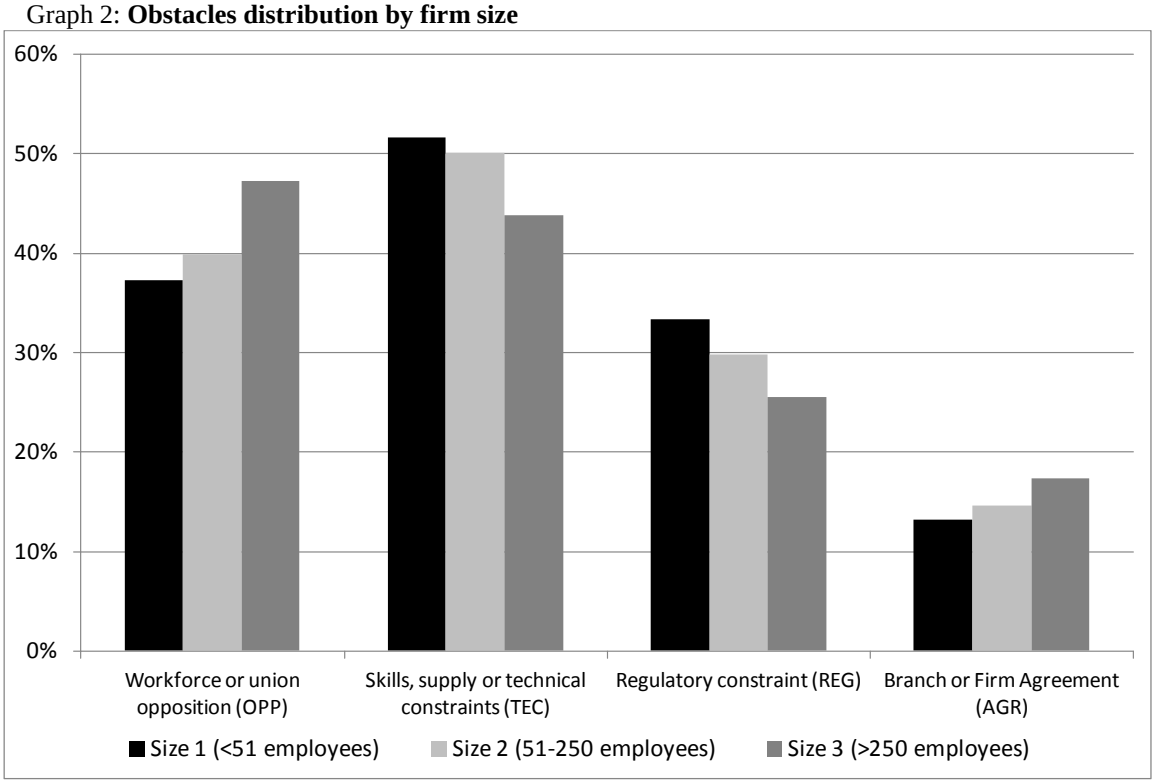
presence of skills, supply or technical constraints (*TEC*), which makes them the most frequently reported obstacles. Workforce or union oppositions (*OPP*) were signalled by nearly 45% of firms every year, while regulatory obstacles were declared by a third of firms on average (with a peak at 50% in 2001). Obstacles linked to collective agreements at the branch or firm level (*AGR*) would be the least reported rigidities, but would nevertheless be faced by around 15% of firms every year.

Second, aside from these hierarchical considerations, we observe a kind of common trend between obstacle reporting, stemming probably from the business cycle and its perception by firms. A global increase in obstacle declarations can be highlighted between 1998 and 2001. It is easily understandable that during expansions, firms perceive constraints in a stronger way, precisely because they feel the need to increase their production and, therefore, their capital operating time. This is why we will refer to these annual assessments of obstacles as *conjunctural*. As a matter of fact, the *TEC* obstacle showed the strongest conjunctural component over 1991-2008.

Since conjunctural obstacles are presumably affected by the cycle and quite volatile, we also constructed *structural* obstacles indicators. More precisely, these structural rigidities were built from averaging obstacle dummy variables over the whole period of presence in the sample. In order to have truly *structural* averages, we kept firms which stayed at least 5 years in the sample. The value of each structural obstacle is constant for a given firm, between 0 and 1. It takes value 0 if the firm never declared this obstacle, and would take 1 if the rigidity was signalled each year of presence in the sample (although this second case never appears).

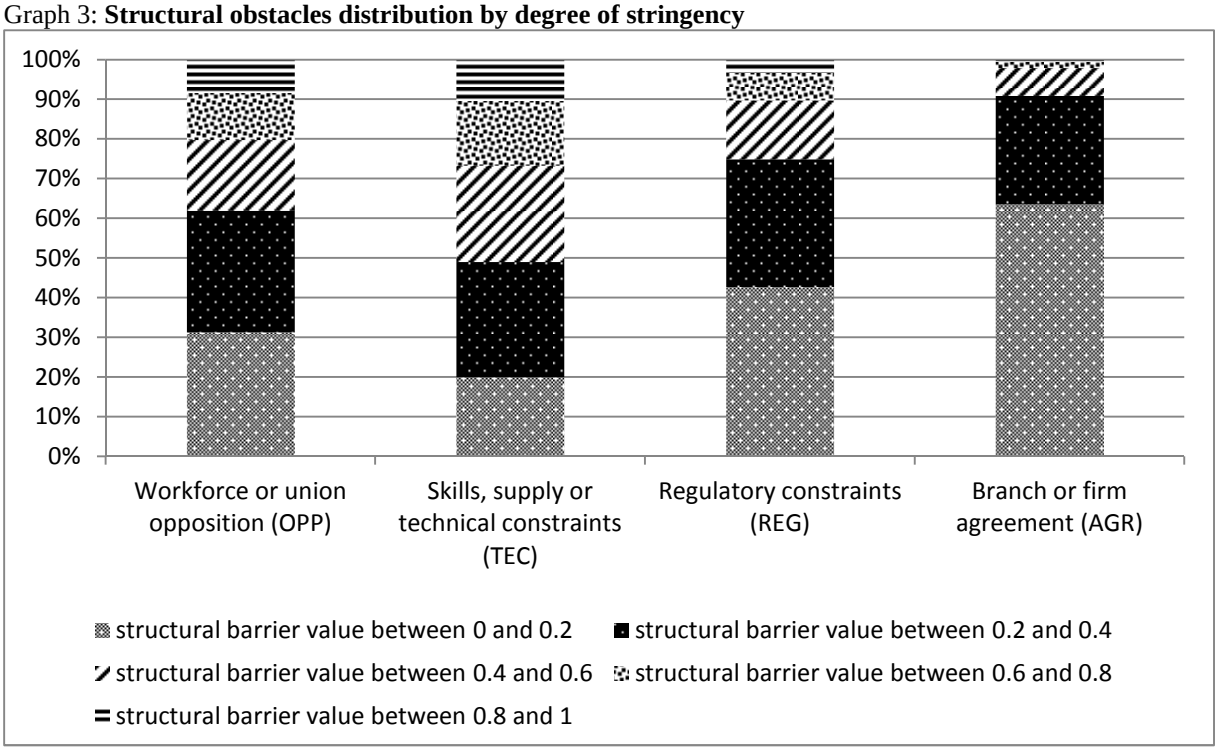
Interestingly, the larger the firm, the more frequently obstacles are declared as regards workforce or union opposition (*OPP*) and branch or firm agreements (*AGR*) (see Graph 2). In contrast, the smaller the firm, the more frequently entrepreneurs report obstacles linked to skills, supply or technical constraints (*TEC*) and regulatory constraints (*REG*). This tends to show that large firms have developed means to adapt technical shortages and regulatory obstacles, but would suffer more than smaller firms from workers' oppositions. Small firms in France are generally operating in a less unionized environment than big firms. This may explain why their reporting of obstacles linked to workforce or union opposition, and branch or firm agreements, is lower with respect to larger firms.

Graph 2: **Obstacles distribution by firm size**



We can see from Graph 3 that structural obstacles linked to workforce or union opposition and those associated with skills, supply or technical constraints frequently have a high value. As a matter of fact, 25% of skills, supply or technical structural obstacles and 20% of workforce or union opposition structural rigidities would be considered as very severe (value > 0.6). In contrast, nearly 2/3 of branch or firm agreement structural obstacles would be considered as mild (value < 0.2). Regulatory structural obstacles would display an intermediate profile, being considered as weakly severe (< 0.2) in 45% of cases, and as strongly severe (> 0.6) in 10% of cases.

Graph 3: **Structural obstacles distribution by degree of stringency**



We now explain and detail in the following section our empirical strategy.

3. Empirical methodology

In the FUD survey, obstacles to increase capital operating time provide rich information on constraints that may prevent improvements in total factor productivity (*TFP*). These obstacles will therefore be used as determinants of *TFP* in our estimations. Hence, we use for our *TFP* regressions the sub-sample of observations for which firms report obstacles to increase capital operating time[5].

Workforce or union opposition (*OPP*) bears directly on *TFP* through lower worker effort or indirectly through resistance to reorganisation of the production process. Skills, supply or technical constraints (*TEC*) bear on human capital and on capital utilisation in the upper phase of the cycle, which will impact our measure of *TFP*. These shortages may constrain firms to adopt non-optimal production organization or process, which would have a negative impact on the *TFP*. Regulatory constraints (*REG*) or branch/firm agreements (*AGR*) may hinder *TFP*-improving reorganisations. On the other

[5] There may be a bias in using this sub-sample as firms reporting obstacles need to increase capital operating time and hence may be in a tense production phase. To take into account this bias, we control for the firm production cycle and restrict the sample to firms staying at least 5 years in the database. The whole sample cannot be used as firms not reporting obstacles to increase capital operating time may be doing so because they do not need to increase capital operating time and not because they do not face similar obstacles.

hand, *AGR* or *OPP* testify of a significant worker involvement, alleviating information asymmetries between employees and management and reducing economic inefficiencies (Freeman and Lazear, 1995). Indeed, unionization (Brown and Medoff, 1978) or worker voice (Fairris and Askenazy, 2010) have been shown to have a positive impact on firm productivity.

Some interactions between obstacles may be relevant. Indeed, workforce or union opposition may be more detrimental to *TFP* if this opposition can use regulatory constraints to prevent reorganisations of the production process (*OPP*REG*). On the contrary, firm or branch agreement may alleviate workforce or union opposition (*OPP*AGR*) or help overcome rigidities stemming from regulation (*REG*AGR*).

We may face a reverse causality bias: firms benefitting from high *TFP* may be able to provide higher wages, overcoming worker or union opposition, to better secure supply, attract talents and negotiate more favourable firm agreements by being able to provide more generous compensations for increased flexibility. This bias may be both cyclical and permanent: social climate may improve in the upper phase of the cycle when *TFP* is high; firms with efficient management leading to high *TFP* may permanently benefit from more favourable social climate. It is not possible to fully address this problem. Instrumentation strategy could not be used partly because obstacles are expressed in a binary way. All potential instruments of obstacles[6] we had access to turned out to be too weak and it is difficult to instrument specifically one obstacle as obstacles tend to be correlated.

Hence, we use several ways to address this potential bias, although we recognise that correlations more than causal links are highlighted in our regressions. First, obstacles are either lagged one year or averaged over a period of 5 years at least. Then, we use controls for sector, year, sector*year, firm size in order to control both for the industry cycle and for the most relevant observable characteristics of firms. Changes in value added are introduced as determinants of *TFP* in order to control for the firm-specific cycle or for a trend in activity, which may reveal low/high performers due to unobserved firm characteristics (management...). In the robustness part, we also use firm-specific fixed effects, which control for time-invariant firm unobserved heterogeneity such as management quality and hence may alleviate this reverse causality problem. In this part, we also split the sample between high and low productivity firms.

The estimated equations are the following:

$$\text{Lagged: } tfp_{it} = \alpha_0 + \alpha_1 \Delta q_{it} + \sum_{k=1}^{k=4} \beta_k OBS_{k,i,t-1} + \gamma X_{ijt} + \varepsilon_{it} \qquad (1)$$

$$\text{Structural: } tfp_{it} = \alpha_0 + \alpha_1 \Delta q_{it} + \sum_{k=1}^{k=4} \beta_k \overline{OBS}_{k,i} + \gamma X_{ijt} + \varepsilon_{it} \qquad (2)$$

With variables:

- *tfp*: total factor productivity (in log)
- *q*: value added (in log)
- OBS_k: obstacles to increasing capital operating time
- $\overline{OBS_k}$: firm average of OBS_k over the period of presence in the database (5-year minimum)
- *X:* a vector of controls including sector, year, sector-year, size dummies[7]
- ε: error term

[6] Instrumentations with various balance sheet or Profit and Loss account variables, sector averages of obstacles or lagged differenced obstacles were unsuccessfully attempted.

[7] We distinguish 3 classes of size by number of employees, 0-50 employees, 51-250 employees and over 250 employees, so as to match the main regulatory thresholds (among others, the creation of a work council or the compulsory designation of a legal auditor occur above 50 employees, while strengthened accounting rules and apprenticeship tax characterize firms having more than 250 employees…).

We expect β_k in the structural specification (2) to be higher than β_k in the lagged specification (1) as they represent the cumulated impact of obstacles over the whole period firms are present in the database and not only a one-year effect.

Our main estimates do not include firm-specific fixed effects since they are not relevant with our structural specification (relation 2).

Moreover, structural features captured by firm fixed effects may encompass the role of social dialogue, which interacts with management quality to improve firm performance. Indeed, the implementation of innovative management practises -such as joint decision making and incentive-based compensation - has to interact with the presence of union to yield higher productivity (cf. Black and Lynch, 2001). Hence, fixed effects, which may capture both management practises and union presence, would prevent us to emphasise the role of social dialogue. That is why we only present as a robustness check the firm fixed-effects regressions, for relation 1 (lagged specification).

Along with some controls for the industry cycle (through sector-year dummies), changes in value added are included as well in order to account for the potential mismeasurements of factor utilisation in *TFP* (cf. Cette *and al.*, 2011) and limit the risk of reverse causality.

As we may face heteroscedasticity in this kind of panel, robust standard errors are chosen.

4. Results

Estimation results are presented in Table 2 for the whole dataset and in Table 3 for each of the three firm sizes.

Value added growth has a positive significant impact on the *TFP* level, with a very stable coefficient between 0.60 and 0.65. This result, standard and consistent with the literature, will not be further commented.

The 'skills, supply or technological constraints' (*TEC*) have a negative significant impact on the *TFP* level, confirming intuitions. These shortages may constrain firms to adopt a non-optimal production organization or process, which would decrease the *TFP* level compared to a situation without such shortages. The existence of such constraints one year decreases TFP by 2% to 3 % a year later, and the permanent existence of such constraints decreases the TFP by around 9 %. But this impact is mainly observed in medium-size firms and does not appear so significant for smaller or larger ones.

'Workforce or union opposition' (*OPP*) and 'regulatory constraints' (*REG*) do not have a significant impact on productivity, apart for medium size firms: 'Workforce or union opposition' can be overcome by the management's hierarchical power and 'regulatory constraints' may not be implemented due to insufficient external enforcement and control. But the interaction between the two has a negative significant impact on *TFP*, as well as the sum of the three coefficients (OPP+REG+OPP*REG). This relation is mainly observed for large firms and, to a lower extent, for small ones, but not for medium-size firms. It means that regulatory constraints would become really binding, mainly in large firms, only when workers or unions use them as a tool to oppose management's decisions.

Similarly, 'regulatory constraints', which do not have a significant impact on TFP by themselves, have a positive and significant impact on *TFP* when interacted with 'branch or firm agreement'. This impact benefits all sizes of firms. Everything else equal, firms with a 'branch or firm agreement' but without 'regulatory constraints' would have a lower productivity level than other firms without such

agreement[8]. But at the same time, firms with a 'branch or firm agreement' and with 'regulatory constraints' would benefit from a higher productivity level than other firms without agreement and regulatory constraints. The existence of such simultaneous constraints and signs of good labour relations one year increases TFP by 6% to 7 % a year later, and the permanent existence of such simultaneous constraints increases the TFP by around 40 %. It suggests that collective agreement could be a way often used by firms to alleviate and even turn into a bonus the constraints from regulation, as the total impact of REG+AGR+REG*AGR is significantly positive.

One interesting feature of the results is that medium-size firms are sensitive to all types of obstacles (cf. Column 4, Table 3), while it is not the case for small or large firms. Indeed, small firms are less constrained by regulation and labour relations institutions, which may apply to firms above a certain number of employees. Large firms may have the internal flexibility to manage these constraints, while medium size firms would fully bear the brunt of regulation and labour relations institutions. It may be one reason why it appears difficult for French firms to develop beyond a certain threshold as evidenced by the larger proportion of small firms in France than in other OECD countries (OECD, 2009).

To get a clearer view on the impact of collective agreements, we decompose this variable in its two elementary components 'branch agreement' and 'firm agreement'. The results of these estimates are presented in the Table 4.

It appears for the structural estimates that 'workforce or union opposition' (*OPP*) interacted with 'firm agreement' has a positive significant impact on *TFP*. Local firm agreements, (*FIR*) which can be obtained only if local labour relations are supportive, would be used by firms to offset (or even turn into a bonus, as shown by the total impact of OPP+FIR+OPP*FIR) the negative impact of local opposition from workers or unions. When branch agreements' are used as a tool by workers to oppose the management's policy, they weigh on *TFP* the same way as the interaction of 'regulatory constraints' and 'workforce or union opposition': the overall impact of OPP+BRA+OPP*BRA is indeed significantly negative. At the same time, 'regulatory constraints' interacted with 'branch agreement' has a positive significant impact on *TFP*, which more than offsets the impact of the two standing by themselves. Branch agreements, which are a sign of good labour relations at the industry level, may be used by branches to offset the negative impact of constraints from regulation. An eloquent example of this feature is the implementation of the 35-hours week regulation, which led branches to negotiate agreements increasing intra-annual working-time flexibility and boosted productivity per hour worked. Hence, branch agreements have a specific role between regulation and firm agreements: it worsens the impact of firm-specific deteriorated labour relations but alleviates the impact of regulation.

These results strongly support the importance of labour relations quality, at the branch or the firm levels, as a powerful factor of productive performance. They provide an original confirmation to early insights in the literature (e.g. Freeman and Lazear, 1994).

5. Robustness checks

First, we provide in Table 5 estimates of different specifications, which are relevant although not our preferred one:

- Firm fixed effects capture the time-invariant unobserved heterogeneity between firms such as differences in the quality of management. It is not our preferred specification as argued in part

[8] 'Branch or firm agreement' without an interaction term (column 2 of Table 2) has a positive impact on TFP which may encompass the negative impact of 'branch or firm agreement' alone and the positive effect from the interaction between 'branch or firm agreement' and 'regulatory constraints'.

3 because the role of social dialogue, which we try to highlight, is too closely intertwined with this unobserved heterogeneity. As firm fixed effects are not compatible with the structural specification[9], we use the lagged specification of column 3 in Table 1 as reference equation. As firm fixed effects tend to take away a large part of the variance, we use a higher significance threshold (10% instead of 5%) for the coefficients. The main results are not notably altered: the interaction between regulatory constraints and branch or firm agreement (*REG*AGR*) is positive and significant at the 1% threshold; employee or union opposition and regulatory constraints (*OPP*REG*) is negative and significant at the 10% threshold. Branch of firm agreements by themselves are negative, confirming the result of the structural specification. Skills, supply or technical constraints (*TEC*) are not significant any more, which is the main difference with the reference equation: this obstacle, which is cited by more than 70% firms every year, especially by the smallest ones, tends to be time-invariant and hence redundant with firm fixed effects.

- We test the robustness of the structural specification to removing the dummy variables size and Industry * Year, which may capture some structural features. Our main results are not altered: *REG*AGR* is still positive, significant and of a similar magnitude; *AGR* and *TEC* are still negative, significant and of a similar magnitude. The main difference is that *OPP*REG*, although still negative, is not significant anymore when removing the control for the industry cycle.
- We remove the control for the firm production cycle, ΔVA. Indeed, this control may encompass a lot of relationships beyond the firm production cycle (in particular supply shocks due to our variables of interests) and be a source of endogeneity. However, the coefficients in the reference equation are not altered in signs, significance or even magnitude when removing this control.
- We then test our results for firms which *TFP* level is above or below the Industry*Year median. That way, we can test for reverse causality due to high *TFP* allowing to buy social peace or making it easier to attract skills. The sign and significance of most coefficients are unaltered but they tend to be lower in absolute value and the coefficient of *OPP*REG*, although negative, is not significant for firms below the median *TFP*. The coefficient of *REG*AGR* is lower for low-productivity firm, highlighting the reverse causality problem: high-productivity firms can reach agreement allowing to soften the impact of regulation more easily than low-productivity firm because they can offer greater compensation for increasing flexibility in negotiation with employees or unions.

Our flagship result is the structural regression in column 4 of Table 1, which emphasises the role of interactions between regulatory constraints, branch or firm agreements, and employee or union opposition. In Table 6, we present several robustness checks for this regression, on different sub-samples:

- First we exclude firms which *TFP* level lies in the first or last *TFP* decile. That way we are sure to exclude all reporting mistakes or legal oddities (e.g. production located in a firm but not the corresponding employees) and see whether our results are driven by a small number of extreme observations. Coefficients sign and significance are not altered although their magnitude tends to be lower.
- Then we exclude one by one all sectors, to evaluate the sensitivity of our results to specific activities (although we already have industry dummies in the reference equation). These sectors can represent from 1.5 to 20% of the sample. Sign, significance and even magnitude of the coefficients are barely altered, especially for *REG*AGR*. The main difference is that the result for *OPP*REG* seems to be driven by the metal product industry (representing 18% of the sample), although the sign of the coefficient is not altered. *OPP*AGR* is actually

[9] Firm averages of obstacles are time-invariant and firm-specific and would be collinear with the firm fixed effects.

significant at the 10% level in the reference equation but it is significant at the 5 or 1% level without the wood or metal products industries.

Hence, most of our results appear to stand all tests successfully. Our main result, showing that the negative effect of regulatory constraints on productivity can be alleviated by branch or firm agreements, appears to be fairly robust. Moreover, the fact that regulatory constraints may be more stringent when employees or unions use them to prevent *TFP*-improving changes is also quite robust.

6. Conclusion

Our aim was to analyse the impact on productivity of good labour relations. We have used an original database containing 9,185 observations, corresponding to 2,134 French companies, over the period 1991-2008. To our knowledge, this company-level database is unique to carry out such analysis. We have made the assumption that the existence of a collective agreement (at the branch or the firm level) is a proxy for good labour relations.

The main results obtained from our estimates are the following: i) 'workforce or union opposition' interacted with 'regulatory constraints' has a negative significant impact on TFP. Regulatory constraints would become really binding when workers or unions use them as a tool to oppose management's decisions; ii) 'workforce or union opposition' interacted with 'firm agreement' has a positive significant impact on TFP. Firm agreements, which reflect good-quality local labour relations, would be used by firms to offset the negative impact of local opposition from workers or unions; iii) 'regulatory constraints' interacted with 'branch agreement' has a positive significant impact on TFP. Branch agreements, which can only be obtained if labour relations at the industry level are supportive, would be used by branches to offset the negative impact of regulatory constraints. These results strongly support the importance of labour relations quality and provide an original confirmation to early insights in the literature.

Nevertheless, we must remain cautious in generalising these results, since France is a particular country concerning working relations. Among OECD countries, France has the lowest union membership rate. Related with that, France is probably the country (or at least one of the countries) where labour market regulation is the most stringent and where collective bargaining processes are the poorest and the weakest. Labour relations get conflictual more quickly, leading more easily to strikes for example, in France than in other countries. In such circumstances, the ability to conclude a collective agreement is probably a stronger indication for good labour relations in France than elsewhere. We cannot exclude that the impact of collective agreement, taken as a proxy of good labour relations, could have a positive but lower impact on productivity in other countries. Our result would need to be confirmed on a database covering other countries, for it to be generalised.

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Appendix

Descriptive Statistics

FiBEn & FUD (Factor Utilisation Degrees) survey

Variable	Description	Source	p10	Q1	Median	Q3	P90	Mean	Standard Error
$\overline{OPP}$	Structural worker or union opposition	FUD survey	0.091	0.200	0.385	0.615	0.800	0.415	0.003
$\overline{TEC}$	Structural skills, supply or technical constraints	FUD survey	0.167	0.300	0.500	0.667	0.833	0.493	0.003
$\overline{REG}$	Structural regulatory constraints	FUD survey	0.000	0.125	0.250	0.438	0.667	0.308	0.002
$\overline{AGR}$	Structural branch or firm agreement	FUD survey	0.000	0.056	0.125	0.231	0.400	0.168	0.002
$\overline{OPP * REG}$		FUD survey	0.000	0.028	0.082	0.184	0.347	0.136	0.002
$\overline{OPP * AGR}$		FUD survey	0.000	0.000	0.040	0.099	0.188	0.076	0.001
$\overline{REG * AGR}$		FUD survey	0.000	0.000	0.030	0.080	0.156	0.059	0.001
Tfp	Total factor productivity in log	FiBEn	2.430	2.620	2.837	3.089	3.368	2.870	0.004
Δq	Value added growth rate	FiBEn	-0.164	-0.060	0.026	0.112	0.206	0.021	0.002

Firm's size	Firm's size. based on the workforce	**3 classes**:	**Frequency**	**Percentage**
$\mathbf{1}_{size\ 1}$		1- workforce ≤ 50	2486	27.1
$\mathbf{1}_{size\ 2}$		2- 50 < workforce≤ 250	4308	46.9
$\mathbf{1}_{size\ 3}$		workforce > 250	2391	26.0

Industry (control variables)		Frequency	Percentage
B0	Agriculture and food industry (AFI)	929	10.1
C1	Clothing, leather and footwear	510	5.6
C2	Paper, printing and publishing	635	6.9
C3	Chemical, rubber, plastics and fuel	158	1.7
C4	Household equipment industries	499	5.4
D0	Industry	206	2.3
E1	Shipbuilding, aeronautic and railway industries	133	1.5
E2	Mechanical equipment industries	1361	14.8
E3	Electric and electronic equipment industries	305	3.3
F1	Mineral products industry	346	3.8
F2	Textile industry	336	3.7
F3	Wood and paper industry	912	9.9
F4	Chemicals and plastics industry	727	7.9
F5	Metallurgy and metal transformation	1831	19.9
F6	Electric and electronic components industry	297	3.2

Industry (Robustness)	Frequency	Percentage
AFI and others	1044	11.37
Intermediary goods industry	4374	47.62
Equipment and automobile industry	1983	21.59
Consumption goods industry	1784	19.42

Table 2: **Main results**

Dependent variable: TFP (in log)	(1) **Lagged (conjunctural)**	(2) **Structural**	(3) **Lagged (conjunctural)**	(4) **Structural**
Δ.Value added (log)	0.642***	0.642***	0.642***	0.640***
	(0.031)	(0.032)	(0.031)	(0.032)
Workforce or union opposition (OPP)	-0.005	-0.023	0.016	0.007
	(0.008)	(0.013)	(0.009)	(0.023)
Skills, supply or technical constraints (TEC)	-0.026***	-0.089***	-0.031***	-0.092***
	(0.007)	(0.014)	(0.008)	(0.014)
Regulatory constraints (REG)	0.011	0.022	0.022	0.028
	(0.008)	(0.015)	(0.012)	(0.030)
Branch or firm agreement (AGR)	0.004	0.074**	-0.007	-0.156**
	(0.011)	(0.023)	(0.027)	(0.059)
Workforce or union opposition and regulatory constraints (OPP * REG)			-0.042*	-0.153**
			(0.017)	(0.050)
Workforce or union opposition and branch or firm agreement (OPP * AGR)			-0.037	0.139
			(0.025)	(0.081)
Regulatory constraints and branch or firm agreement (REG * AGR)			0.065**	0.414***
			(0.022)	(0.089)
OPP+REG+OPP*REG			-0.004	-0.117***
			(0.011)	(0.025)
OPP+AGR+OPP*AGR			-0.028	-0.010
			(0.017)	(0.049)
REG+AGR+REG*AGR			0.080***	0.286***
			(0.022)	(0.067)
N	9185	9185	9185	9185
Adj. R^2	0.361	0.364	0.362	0.367

Standard errors in parentheses

OLS estimates over 1991-2008. "Lagged" means that obstacles are lagged one year; "structural" means that obstacles are averaged over the whole period. Sector, Year, Sector*Year, Size dummies and constant included but not reported. Standard errors are robust to heteroscedasticity. F-tests reject the nullity of the coefficients of REG+AGR+ REG*AGR in column 3 and 4.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 3: **Results by firm size**

Dependent Variable: TFP (log)	(1)	(2)	(3)	(4)	(5)	(6)
	≤50 employees		**51-250 employees**		**>250 employees**	
	Lagged (conjunctural)	**Structural**	**Lagged (conjunctural)**	**Structural**	**Lagged (conjunctural)**	**Structural**
Δ.Value added (log)	0.600***	0.592***	0.650***	0.646***	0.670***	0.668***
	(0.075)	(0.078)	(0.040)	(0.039)	(0.054)	(0.054)
Workforce or union opposition (OPP)	-0.023	0.030	0.007	-0.072*	0.038	0.034
	(0.020)	(0.047)	(0.013)	(0.035)	(0.020)	(0.047)
Skills, supply or technical constraints (TEC)	-0.010	-0.048	-0.033**	-0.106***	-0.022	-0.078*
	(0.017)	(0.031)	(0.010)	(0.020)	(0.016)	(0.034)
Regulatory constraints (REG)	0.009	0.086	0.001	-0.111**	0.045	0.111
	(0.023)	(0.064)	(0.017)	(0.040)	(0.030)	(0.076)
Branch or firm agreement (AGR)	0.172**	0.059	-0.060	-0.330**	-0.051	-0.183
	(0.059)	(0.117)	(0.043)	(0.106)	(0.046)	(0.096)
Workforce or union opposition and regulatory constraints (OPP*REG)	0.016	-0.222*	0.004	0.097	-0.119**	-0.258*
	(0.033)	(0.101)	(0.024)	(0.076)	(0.038)	(0.111)
Workforce or union opposition and branch or firm agreement (OPP*AGR)	-0.201***	-0.192	0.018	0.230	-0.007	0.353*
	(0.050)	(0.174)	(0.038)	(0.130)	(0.050)	(0.152)
Regulatory constraints and branch or firm agreement (REG*AGR)	0.019	0.578**	0.039	0.532***	0.133**	0.158
	(0.048)	(0.176)	(0.033)	(0.157)	(0.046)	(0.153)
N	2486	2486	4308	4308	2391	2391
Adj. R^2	0.302	0.311	0.377	0.384	0.398	0.400

Standard errors in parentheses

OLS estimates over 1991-2008. "Lagged" means that obstacles are lagged one year; "structural" means that obstacles are averaged over the whole period. Sector, Year, Sector*Year, Size dummies and constant included but not reported. Standard errors are robust to heteroscedasticity. F-tests reject the nullity of the coefficients of REG+AGR+REG*AGR in column 1, 2 and 5, of OPP+AGR+OPP*AGR in column 6.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4: **Separating Branch and firm agreements**

Dependent variable: TFP (in log)	(1) Lagged (conjunctural)	(2) Structural	(3) Lagged (conjunctural)	(4) Structural
Δ.Value added (log)	0.642***	0.642***	0.642***	0.640***
	(0.031)	(0.032)	(0.031)	(0.032)
Workforce or union opposition (OPP)	-0.005	-0.020	0.014	-0.010
	(0.008)	(0.013)	(0.009)	(0.024)
Skills, supply or technical constraints (TEC)	-0.026***	-0.089***	-0.030***	-0.095***
	(0.007)	(0.014)	(0.008)	(0.014)
Regulatory constraints (REG)	0.011	0.021	0.021	0.012
	(0.008)	(0.015)	(0.012)	(0.030)
Branch agreement (BRA)	0.004	0.066	0.023	-0.089
	(0.015)	(0.034)	(0.039)	(0.085)
Firm agreement (FIR)	0.002	0.028	-0.021	-0.187*
	(0.015)	(0.031)	(0.037)	(0.083)
Workforce or union opposition and regulatory constraints (OPP*REG)			-0.037*	-0.114*
			(0.017)	(0.051)
Workforce or union opposition and branch agreement (OPP*BRA)			-0.087*	-0.112
			(0.034)	(0.117)
Workforce or union opposition and firm agreement (OPP*FIR)			0.017	0.337**
			(0.036)	(0.107)
Regulatory constraints and branch agreement (REG*BRA)			0.042	0.437***
			(0.034)	(0.117)
Regulatory constraints and firm agreement (REG*FIR)			0.044	0.176
			(0.031)	(0.132)
OPP+REG+OPP*REG			-0.002	-0.112***
			(0.011)	(0.025)
OPP+BRA+OPP*BRA			-0.050*	-0.211*
			(0.025)	(0.086)
OPP+FIR+OPP*FIR			0.010	0.140*
			(0.021)	(0.064)
REG+BRA+REG*BRA			0.086**	0.360***
			(0.027)	(0.086)
REG+FIR+REG*FIR			0.044	0.001
			(0.034)	(0.106)
N	9185	9185	9185	9185
Adj. R^2	0.361	0.364	0.362	0.367

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ - Standard errors in parentheses

OLS estimates over 1991-2008. "Lagged" means that obstacles are lagged one year; "structural" means that obstacles are averaged over the whole period. Sector, Year, Sector*Year, Size dummies and constant included but not reported. Standard errors are robust to heteroscedasticity.

Table 5: **Robustness to different specifications**

Dependent variable: TFP (in log)	(1) **Reference equation Lagged (conjunctural)**	(2) **Fixed effects Lagged (conjunctural)**	(3) **Reference equation Structural**	(4) **Without size dummies Structural**	(5) **Without Industry * Year dummies Structural**	(6) **Without** ΔValue added **Structural**	(7) **TFP> Year-Industry Median Structural**	(8) **TFP< Year-Industry Median Structural**
Δ.Value added (log)	0.642***	0.561***	0.640***	0.639***	0.671***		0.736***	0.677***
	(0.031)	(0.024)	(0.032)	(0.032)	(0.032)		(0.033)	(0.050)
Workforce or union opposition (OPP)	0.016	0.004	0.007	0.016	-0.008	0.008	0.004	0.004
	(0.009)	(0.006)	(0.023)	(0.023)	(0.027)	(0.025)	(0.029)	(0.019)
Skills, supply or technical constraints (TEC)	-0.031***	0.004	-0.092***	-0.100***	-0.105***	-0.089***	-0.050**	-0.034**
	(0.008)	(0.005)	(0.014)	(0.014)	(0.017)	(0.015)	(0.017)	(0.012)
Regulatory constraints (REG)	0.022	0.005	0.028	0.018	0.023	0.028	0.018	0.020
	(0.012)	(0.008)	(0.030)	(0.030)	(0.036)	(0.032)	(0.035)	(0.026)
Branch or firm agreement (AGR)	-0.007	-0.027°	-0.156**	-0.145*	-0.138*	-0.175**	-0.114°	-0.134**
	(0.027)	(0.015)	(0.059)	(0.059)	(0.068)	(0.065)	(0.068)	(0.049)
OPP*REG	-0.042*	-0.017°	-0.153**	-0.144**	-0.064	-0.166**	-0.123°	-0.039
	(0.017)	(0.010)	(0.050)	(0.050)	(0.060)	(0.054)	(0.063)	(0.041)
OPP*AGR	-0.037	-0.012	0.139°	0.129	0.158°	0.152°	0.077	0.155*
	(0.025)	(0.014)	(0.081)	(0.081)	(0.092)	(0.087)	(0.091)	(0.063)
REG*AGR	0.065**	0.036**	0.414***	0.412***	0.344***	0.445***	0.379***	0.138*
	(0.022)	(0.013)	(0.089)	(0.089)	(0.100)	(0.096)	(0.105)	(0.067)
N	9185	9185	9185	9185	9185	9185	4462	4723
Adj. R^2	0.367	0.456	0.367	0.364	0.127	0.264	0.532	0.602

Standard errors in parentheses

Estimates over 1991-2008. Lagged obstacle for column 1-2; structural obstacles for column 3-8. Sector, Year, Sector*Year, Size dummies and constant included but not reported in columns 1 and 3-8 unless otherwise specified. Year and Sector*Year dummies are included and GMM estimates in column 2. Standard errors are robust to heteroscedasticity.

$^{\circ}$ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 6: **Structural obstacles (averages) - Robustness to exclusion of specific observations**

Dependent variable: Log TFP Excluding:	(1) **Reference equation**	(2) **1st and last decile of TFP**	(3) **agriculture & food industry**	(4) **consumer goods**	(5) **motor vehicles**	(6) **equipment goods**	(7) **mineral products**	(8) **textile**	(9) **wood**	(10) **chemicals**	(11) **metal products**
Δ.Value added (log)	0.640***	0.345***	0.666***	0.619***	0.640***	0.639***	0.635***	0.643***	0.636***	0.633***	0.652***
	(0.032)	(0.019)	(0.034)	(0.035)	(0.032)	(0.038)	(0.032)	(0.033)	(0.033)	(0.033)	(0.033)
Workforce or union opposition (OPP)	0.007	0.004	0.001	-0.020	0.009	0.034	0.013	0.010	0.012	0.013	-0.025
	(0.023)	(0.017)	(0.023)	(0.026)	(0.024)	(0.026)	(0.024)	(0.024)	(0.025)	(0.025)	(0.026)
Skills, supply or technical constraints (TEC)	-0.092***	-0.072***	-0.079***	-0.076***	-0.097***	-0.107***	-0.093***	-0.084***	-0.084***	-0.100***	-0.102***
	(0.014)	(0.011)	(0.015)	(0.016)	(0.015)	(0.016)	(0.014)	(0.015)	(0.015)	(0.015)	(0.016)
Regulatory constraints (REG)	0.028	0.006	0.034	-0.006	0.036	0.002	0.018	0.030	0.046	0.048	0.027
	(0.030)	(0.022)	(0.031)	(0.034)	(0.030)	(0.034)	(0.030)	(0.031)	(0.031)	(0.031)	(0.034)
Branch or firm agreement (AGR)	-0.156**	-0.112**	-0.153*	-0.155*	-0.136*	-0.170*	-0.144*	-0.134*	-0.172**	-0.161**	-0.189**
	(0.059)	(0.039)	(0.060)	(0.066)	(0.060)	(0.068)	(0.060)	(0.062)	(0.064)	(0.062)	(0.065)
OPP*REG	-0.153**	-0.081*	-0.148**	-0.141*	-0.161**	-0.139*	-0.141**	-0.154**	-0.197***	-0.186***	-0.072
	(0.050)	(0.038)	(0.051)	(0.056)	(0.051)	(0.059)	(0.051)	(0.052)	(0.052)	(0.052)	(0.057)
OPP*AGR	0.139	0.040	0.095	0.170	0.102	0.103	0.098	0.115	0.226*	0.159	0.246**
	(0.081)	(0.056)	(0.085)	(0.090)	(0.084)	(0.088)	(0.081)	(0.084)	(0.088)	(0.084)	(0.089)
REG*AGR	0.414***	0.218***	0.462***	0.481***	0.428***	0.482***	0.421***	0.387***	0.414***	0.365***	0.224*
	(0.089)	(0.060)	(0.093)	(0.097)	(0.093)	(0.099)	(0.090)	(0.093)	(0.094)	(0.092)	(0.094)
N	9185	7535	8265	7401	8985	7402	8857	8844	8320	8493	7493
Adj. R^2	0.367	0.269	0.384	0.370	0.367	0.302	0.374	0.354	0.378	0.377	0.374

Standard errors in parentheses ; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

OLS estimates over 1991-2008. Sector, Year, Sector*Year, Size dummies and constant included but not reported. Standard errors are robust to heteroscedasticity.