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**An Attempt to Evaluate the Impact of Reorganization
on the Way Working Time Reduction Has Been Implemented
by French Firms since 1996**

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04 – 19

An attempt to evaluate the impact of reorganization on the way Working Time Reduction has been implemented by French firms since 1996

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Abstract

In this paper, we assess how the fact French firms are reorganized could influence the date she chooses to implement working time reduction (WTR), as well as other variables included in the WTR administrative surveys'agreements, like the WTR type of device ("offensive"/"defensive") companies adopt, the number of workers she commits on to hire, if she benefits or not from incentives. We first consider as a reorganized firm, a firm who makes use of at least two organizational production devices (among other Just In Time, Total Quality and People Involvment devices). We merge two surveys, one dealing with organizational characteristics within the firm (COI - "Changements Organisationnels et l'Informatisation", 1997) and the other containing information on WTR agreements (Robien, Aubry I or II). After having presented some stylized facts about WTR variables and modeled the probability for a firm to be reorganized, we implement various matching estimators (simple nearest match, kernel and reweighting ones) to evaluate the causal effect of reorganization on the considered WTR variables. We find that WTR (Robien as Aubry I or II) may favour reorganized firms, since the latter would: i) implement earlier a WTR; ii) be more numerous to adopt an "offensive" device; iii) commit on more job creations; iv) they do not necessarily benefit more often from incentives.

1   Introduction

Many studies were led to analyse the potential links between production reorganization and Working Time Reduction (WTR) since the implementation of the Robien, Aubry I and II laws to reduce the mandatory weekly hours of work. Most tried to evaluate the impact of an effective WTR on organizational changes; fewer the impact of organizational changes before the WTR is beeing implemented on the adoption of a WTR device.

In fact, it may exist a rather reciprocal relation between WTR and organizational changes. Indeed, and on the one hand, according to Aubry I and II laws in particular, firms were allowed to bargain a WTR together with possible labour reorganizations (like the modulation and in particular the annualization of the hours of work) in order to make easier the WTR implementation, since firms could accept reducing working time with full wage compensation in exchange of more flexibility, from an organizational point of view. Moreover, they could benefit from incentives (reduction in employer social contributions) as they implement earlier WTR. On the other hand, the organization of the work in the firm before turning to WTR could influence the way the firm implements it: through a general equilibrium model including a negociation on both the intensity of the work and weekly hours of work, P. Askenazy [2001] conclude that i) firms who would be the first to implement a WTR are those for which the *cost of reducing the working time* is the lowest; ii) those firms would appear to be companies that make use of the so-called "*innovative work practices*" (or "high performance" devices such as Just In Time (JIT), Total Quality Management (TQM) and People Involvment (PI) around the classification proposed by R. Hall [1987]) before implementing a WTR; iii) consequently, firms benefiting from incentives would be those ones using such practices. M. Bunel [2001] investigated the determinants of implementing the "modulation/annualization" device following a WTR, through a profit maximization framework together with flexibility choice behaviour and wage bargaining. In his empirical analysis, using both REPONSE98 and Robien and Aubry I administrative surveys' agreements, he found that firms who went into that direction were those who already made use of such devices before turning to reducing the effective weekly hours of work. Moreover, the volatility of the demand, reorganization cost and organizational choice of her competitors are the main explanatory factors for the probability of adopting the "annualization" device while implementing WTR. Some times after, P. Askenazy [2002] tried to put evidence on his previous theoretical results. He therefore considered the use of so-called high performance devices, as well as (New) Information and Communication Technology practices. Through the use of the REPONSE98 database, and considering single "innovative work practices", His results, on the basis of the use of RESPONSE98 survey, were the following: firstly, the impact of WTR on the adoption of new pratices is rather significant, WTR increasing the massive use of Just In Time devices and accelerating the increase in responsabilities of all categories of workers. Secondly, the author shows that (Tables 3 to 5 of his paper) there seems to be an effect of having adopted some practices on the fact the firm decided to implement 35-hour work week: a positive one for Just In Time

(Table 3 of his paper) and a negative one for Total Quality Management (Table 5), confirming thus the results and predictions obtained by earlier studies such that of A.-L. Aucouturier et alii. [1999], who share and try to check the same idea. Nevertheless, in the two papers, results are often found to be non significant (particularly as to innovative devices other than JIT ones), either because they rely on preliminary data bases, or because often single "innovative devices" were used, although there seems to exist high correlations between these practices (see N. Greenan and J. Mairesse [1999, 2001, 2002]).

Contrary to P. Askenazy [2002], we do not focus on organizational devices individually but on the number of pratices in use by a firm, so as to attempt to "characterize" firms who are reorganized from those who are not before having implemented a shorter work week. Indeed, following a definition of reorganization near to that kept by P. Osterman [1994] and M. Gittleman et al. [1998], the study led by V. Janod and A. Saint-Martin [2003] tried to make such a distinction and showed that reorganizations have a positive impact on some companies'economic performance indicators like Total Factor Productivity (TFP), but none on workers and capital growth rates. Our intuition is that the reorganization may influence firms in her decision to implement a WTR as well as other indicators provided by Robien, Aubry I and II WTR administrative surveys' agreements. On the basis of the paper of V. Janod and A. Saint-Martin [2003], we model the probability for a company to be reorganized before having implemented working time. Then, we apply the propensity score matching methods for non-experimental studies (B. Crépon and N. Iung [1999], R. Dehejia and S. Wahba [2002], J. Heckman et al. [1998a, 1998b]) to evaluate the consequence for a firm to be reorganized or not on its WTR date of implementation (distinguishing the date it signs a WTR agreement from the date it chooses to implement it), as well as on the fact it benefits from incentives, commits on job creations (or not) and on how many jobs.

Firstly, our descriptive statistics show us that reorganized firms should be more numerous to implement earlier working time reduction (considering the day chosen by the firm and not necessarily the WTR device), to wait fewer time between the agreement signing and WTR implementation, to commit more often on job creations (and on more employment creations) and to benefit fewer from incentives. However, such results may be linked to the fact individual characteristics or organizational constraints the firm has to face may influence both the reorganization of the work before the WTR implementation and the considered working time reduction variable. Secondly, consistently with our descriptive statistics, the probability for a firm, coming from both COI survey and WTR administrative surveys' agreements, to be reorganized depends on the one hand positively on its size, on the fact it competes more on quality of goods, variety and services, it faces a more "volatile"/ random demand (but negatively on the fact it adjusts production to demand) and greater competition or client constraints. Moreover, such companies work more often by night or on saturday. On the other hand, reorganized firms tend to be fewer coming from the consumption good sector, being opened on sunday. Also, ways used to adjust production to demand should have its importance for a firm in becoming reor-

ganized: temporary labour force, part time work or "modulation" impacts positively on it. Thirdly, while performing the kernel / Nadaraya Watson matching estimator to control for all of these factors, we see that reorganized firms tend to commit more often on job creations, to implement earlier a WTR, but do not necessarily benefit more often from incentives (because a lot of them are Aubry II precursor companies). The range of the results are rather sensitive to whether or not the 1997 within the firm employment level is included in the propensity score specification, because this variable may be highly correlated to the number of devices in use and may be caused by this one. Hence, we implement the Nadaraya-Watson matching estimator only considering firms with fewer than 500 employees: the former results remain unchanged, either matching on the propensity score or on the log odd ratio. The results are often unsignificant, when considering the re-weighting or the nearest neighbour estimator (except for the job creation commitment). Moreover, our first reorganization indicator may appear to be too simple (two organizational devices or more versus fewer than two). Consequently, and fourthly, we compare firms using (m) devices to $(m-k)$ devices. Our previous results hold (particularly as to the date of implementation/ to commiting on job creations or not), go in the same direction, but to a lesser extent and the more important the "device gap" is between the two types of firms.

On the basis of these last results, we may infer that reorganized companies – who employ workers with greater wages and who are not necessarily the more flexible units – tend to commit more often and on more job creations, as well as to implement earlier a WTR, without benefiting more often from incentives. Since WTR were very often negotiated together with reorganization (like for instance annualization of the hours of work), reorganized firms were also the first to reorganize further when implementing the WTR.

The remaining of the paper stands as follows: Section two gives a definition for the firm reorganization of the work, presents some descriptive statistics about WTR features of reorganized and non reorganized firms, and lists potential determinants for both reorganization and WTR variables (in particular the WTR date of implementation); Section three introduces the evaluation problem applied to our framework and discuss the results. Section four concludes.

2 Reorganization and WTR features

2.1 A definition for reorganized companies

According to V. Janod and A. Saint-Martin [2002], there are at least two possible approaches to define a reorganization process indicator at the firm level. One way consists in considering several organization devices, around firm strategies classified by R. Hall [1987] around three goals: Just In Time, Total Quality Management and People Involvment – see N. Greenan and J. Mairesse [1999] and Appendix 2 for details on different devices present classification) and testing which one has an impact on the firm on the decision to implement WTR. This is what P. Askenazy [2002] did,

arguing that it is common knowledge that employers do have a better perception of the firm organization and of managerial tools. That's why he only takes account for the employer questionnaire of the REPONSE98 survey.

An other way is to do as V. Janod and A. Saint-Martin [2003] did and consider that the reorganization level of firms can be measured by the number of organizational devices the firm makes use of. In fact, N. Greenan and J. Mairesse [1999] worked on the French COI ("Changements Organisationnels et Informatisation", dealing with the Organizational Changes and Computerization) survey and they focused on both workers and firms questionnaires to build up variables dealing with organizational changes. Arguing that both employees and employer firm do not see the same way organizational changes, they showed that employees' perception of organizational change would not be influenced by the nature of the practice but by the fact there exists a wider number of organizational devices within the firm. This result remains unchanged as they looked at evolutions in the use organizational practices between 1994 and 1997. Moreover, using the same survey and for French manufacturing, V. Janod and A. Saint-Martin [2003] found similar results when considering the number of organizational devices used by the firm.

Consequently, we keep the same indicator as they do: a company is said to be reorganized as soon as it uses at least two organizational devices. This definition is near to the idea M. Gittleman et al. [1998] have of organizational change and is near to the definition given in P. Osterman [1994], but does not take account for the fact the two or more practices in use should involve 50% of employees[1]. However, such a criterion can be seen as being too simplistic, because two reorganized companies may use a different set of organizational devices and the number of devices in use can be very different between two reorganized units. Nevertheless, it allows us to compare firms of the two groups. It will be further useful to consider a more general indicator for reorganization (like the exact number of devices in use within the company, like in V. Janod and A. Saint-Martin [2003])[2].

2.2 Working Time characterics of such firms

We work on the same COI survey, distinguishing first among industries only, but on a wider field including agricultural and food industries[3]. We merge this survey to

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[1] However, it should not really be a limit of the analysis in the sense that, as the author underlined it, a firm can be taken as "non reorganized" if it uses 2 devices, but with at most one of the two devices occupying fewer than 50% (say 49%) of salaried employees; on the contrary, a two devices firm may involving 51% of people for both tasks may be considered as "reorganized".

[2] Like these authors, we consider the same group of 13 devices, around three goals: a) Just In Time (delivery and production); b) Quality of the goods (ISO norms and EAQF certification; other certification or total quality management; value analysis - functional analysis or "AMDEC", total productive maintenance; problems solving groups); c) Increasing management autonomy (autonomous groups, project teams, organization in profit center, formal in-house customer /supplier contracts; the reduction of the number of hierarchical layers and the evolution number of tasks done by one production worker). See N. Greenan and J. Mairesse [1999, 2001, 2002] for a detailed presentation.

[3] There are actually two different questionnaires for industrial firms, the so-called "entreprises industrielles" , and for food industries, the so-called "industries agro-alimentaires". However, they

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administrative WTR Robien and Aubry I and II (2003 version for the last quoted) agreements files. Some points have to be enlightened. Firstly, the COI survey was built at a firm level, whereas Robien, Aubry I and Aubry II surveys'agreements include establishments. However, to avoid restricting us to too few firms, we use the variable which points to the reference establishment within every firms of the WTR administrative surveys'agreements[4].

Table 1: **Percentage of companies using a given number of organizational devices following that she has implemented Robien, Aubry I, Aubry II precursor, Aubry II or not implemented any WTR yet.**

N. of devices	No WTR yet	Robien	AubryI	AubryII P^c	AubryII
Zero device	19.05^b	6.45	14.84	5.99	13.55
One device	17.44	12.26	13.63	6.89	12.84
Two devices	13.84	4.52	15.52	10.18	12.06
Three devices	12.77	14.19	14.57	9.28	11.48
Four devices	10.30	11.61	9.91	14.37	12.00
Five devices	8.15	9.03	8.50	9.88	9.23
Six devices	5.26	9.68	6.34	10.18	7.29
Seven devices	4.94	7.10	4.59	10.18	5.68
Eight devices	2.95	12.26	4.86	7.19	5.10
Nine devices	2.47	7.10	3.51	5.99	4.52
Ten devices	1.56	3.87	2.70	4.79	3.16
Eleven devices	1.02	1.29	0.94	2.10	1.87
Twelve devices	0.21	0.65	0.67	2.69	0.84
Thirteen devices	0.05	0.00	0.00	0.30	0.39
Number of devices	3.07	4.86	3.54	5.13	3.97

Notes : ^{a} Industrial enterprises and agricultural and food industries.
^{b} In percentage of the type of companies having implemented a WTR device or not.^{c} "P" for precursor.

Sources : Author's results based on Manufacturing part of COI survey, administrative survey of Robien and Aubry agreements.

Then, hoping to capture the impact of being reorganized on the decision of implementing working time, we removed from sample those Robien establishments (whose law was enforced in June, 11th1996) whose agreements were signed before 1998 and who changed of status between 1994 and 1997 (i.e. after we verify that those ones using two or more devices in 1997 were making use of less than two devices in 1994 and vice-versa (see Appendix 2)). Such an operation does lead to a small reduction

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are very similar and only differ across question Q23, which we do not use (see N. Greenan and S. Hamon-Cholet [2001]). Otherwise, taking account for other activity sectors will be hard because of significant differences between questionnaires.

[4]Something that should not disturb us in that study because we use only variables provided in the COI survey as derterminants of reorganization (see further and Appendix 2).

of our sample because initially there were not many firms which implemented Robien and which are in the COI survey too. Moreover, we have to assume like E. Debauche [2001] that a firm status doesn't change to fast (a "non reorganized" firm in 1997 is not reorganized some months before agreements is being signed).

Table 2: **Reorganization and Working Time Reduction implementation.**

Firms / Device	No WTR yet	Robien	Aubry I	Aubry II P^d	Aubry II
Reorg.	36.19^a	6.03^c	25.38	13.94	54.65
Non Reorg.	49.48^b	4.19^c	30.49	6.21	59.10

Note : ^{a,b}In percentage of reorganized (respectively of the non reorganized) firms coming from full COI survey. ^{c}In percentage of firms that already have implemented a WTR. ^{d}"P" for precursor. The two rows sum to one only for the four last columns.

Sources :   Author's results based on Manufacturing part of COI survey, administrative survey of Robien and Aubry agreements.

Therefore, if we look at Table 1, we will see that companies having already implemented a working time reduction (i.e. beween the Robien law enforcement, in June, 11th1996 and May, 30th2003) use in average more a greater number of organizational devices than those that haven't done it yet: 4.86 for Robien, 3.54 for Aubry I, 5.13 for Aubry II precursors – i.e. firms which anticipated the mandatory WTR but actually do not benefit from incentives because they forgot to ask for or they didn't want to fill in the required conditions (see M. Bunel [2002] and Appendix 1 as to details concerning WTR incentive devices)[5] – and 3.97 for Aubry II, against 3.07 for other. With regard to each level of device number within a firm, 19.05% (respectively 17.44%) of the companies that do not have implemented a WTR yet use none (respectively one) of these devices, whereas other types of companies are far fewer to be in these cases[6]. More generally, WTR companies are more numerous to use more devices, departing from the three devices level[7]. As we consider companies that are reorganized following the "two devices or more" definition, we see that they seem to be more numerous to have (already) implemented a Working Time Reduction (Robien, Aubry I or II). Given the implementation of a WTR, reorganized firms have more often chosen to adopt a Robien, but less often an Aubry I device. However, they are also more numerous to have anticipate the mandatory WTR[8] without benefiting

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[5]Both Aubry I and Aubry II precursor companies use on average 3.86 organizational devices.

[6]Note that only 15.2% of all firms do not make use of any of these devices, contrary to 19.4% in V. Janod and A. Saint-Martin [2003] study. This comes from the fact we do a different merge and include food sector in our analysis. Moreover, all these statistics do not make use of COI weights, since we work on a merged and cleaned database (see N. Greenan and S. Hamon-Cholet [2001] and Appendix 2).

[7]Considering Aubry I and Aubry II precursors firms as a single group (since both anticipate the mandatory WTR, either benefiting from incentives or not).

[8]Before January, 1th2000 for firms with more than 20 employees; January, 1th2002 for firms with

from incentives. Finally, Aubry II firms are more often found among non reorganized firms (59.10% against 54.65%, see Table 2).

Given that benefiting from Robien or more particularly Aubry I incentives does not appear to be sufficient to distinguish firms following to their WTR of implementation, we create some continuous variables (expressed in years) to measure the WTR date of implementation of all firms: i) the date at which the WTR agreement was signed and ii) the WTR has been implemented within the company, both relatively to Robien law enforcement date; iii) the delay between these two distances as a measure of the time the firm waits after signing the agreement before implementing the WTR. As we look further at the "date at which the agreement was signed" and at the "date the WTR has been implemented" within the two types of firms, it seems that reorganized firms implement a WTR earlier than others, whether we consider the percentage of firms after a certain period (13.31% versus 8.07% fewer than 3 years after June 11^{th}1996; 50.10% versus 45.52% between 3 and 4 years later and 36.69% versus 42.63% more than four years later), or the difference beween the mean date within the two groups: more than 2 months $((3.97 - 3.79) \times 12$ - see Table 3). It is less clear in the case of the date the agreements were signed, partly because this is a proxy of the WTR date of implementation that is measured with error (the company may enforce the WTR before, after or at the same time as it chooses to implement WTR, as it is underlined in M. Leclair [2002]).

Looking further at some other WTR characteristics (Table 3), our "delay" variable shows that reorganized companies tend to enforce WTR faster after signing an agreement. Else, it appears that reorganized firms are less numerous to commit on a smaller WTR (31.90% versus 35.40%). Otherwise, reorganized firms tend to commit less on job preservations but more on job creations or on both: overall, 68.92% of them signed what we may call "offensive agreement" against 60.69% of the non reorganized plants. Moreover, they commit on more job creations[9].

Finally, all is as if the date of implementation represents a cost for firms to implement WTR: should more reorganized enterprises – that are better performing, in particular in terms of their Total Factor Productivity growth rate (V. Janod and A. Saint-Martin [2003]) but are not necessarily the more flexible firms – implement a WTR earlier and commit more often and on more job creations? This is what we want to look at. Nevertheless, a lot of organizational constraints as well as strategy elements and other individual characteristics of firms may influence both the fact they became reorganized and the fact they commit on more job creations or the fact they implement earlier a WTR. Therefore, we aim at studying to what the extent determinants of reorganization allow us to explain differences in WTR features[10] as we distinguish between the two types of companies.

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20 or fewer than 20 employees.

[9]Note that these facts hold whatever the threshold ("one device or more", "two devices or more",...,"ten devices or more") we set as we define reorganization.

[10]Contrary to the previous version of administrative surveys on Working Time Reduction agreements, the present one does not provide any element on post WTR reorganizations, wage compensations and union representations within the firm. So, by now, we are not able to provide any result for causal effect of WTR on ex-post reorganization.

Table 3: **Information about working time following the company is ex-ante reorganized or not.**

WTR Variable / Type of companies	Reorganized	Non Reorganized
Recalling :		
WTR adoption before May 2003	63.41^a	50.44
Date of implementation[b] :		
Between 0 and 3 years	13.31^a	11.85
Between 3 and 4 years	50.10	45.52
More than 4 years	36.69	42.63
Mean delay	3.79^d	3.97
Agreement's date[c] :		
Between 0 and 3 years	21.07^a	23.99
Between 3 and 4 years	48.18	43.50
More than 4 years	30.75	32.51
Mean delay	3.58^d	3.64
Delay between agreement and implementation :	0.21^d	0.32
Taxe reductions :		
Robien incentives	6.03^a	4.19
Aubry I incentives (before 2000)	24.90	28.47
Incentives (after 2000)	0.48	2.02
No incentives (only structural help)	68.58	65.32
Commitment on WTR Size :		
10%	31.90^a	35.40
15%	0.96	0.43
Kind of agreement :		
Job creations	62.45^a	55.78
Job creations and preservations	6.47	4.91
Job preservations	20.50	27.02
No commitment	10.58	12.28
Summary and correction :		
Offensive[e]	68.92^a	60.69
Other (preservation only or no promise))	31.08	39.31
Mean forecasted job creations :	9.67^e	3.57

Note :   [a]Percentage of reorganized (resp. non reorganized) companies.
[b],[c]Day of WTR implementation (resp. agreement) relative to the day law Robien was enforced (june 11th 1996).
[d]In years after the agreements were signed (resp. after WTR is being implemented). [e]Number of forecasted job creations.

Sources :   Author's results based on Manufacturing part of COI survey and on administrative surveys of Robien and Aubry I and II agreements.

2.3   Potential determinants for firm reorganization

In fact, several studies aimed at determining the origins of firms reorganizations. Through the indicator we choose to model reorganization, P. Osterman [1994] and M. Gittleman et al. [1998] among others suggest a lot of variables that may influence / may be influenced by reorganization. We present them further in Tables 4 and 5[11].

The first group of variables we study are those dealing with the *competitive strategy and the market environment* of the firm. Indeed, as to *strategy*, some companies compete more on the quality of goods, variety and services: those firms are said to follow the "high road"; other go rather competing on the basis of cost reduction and follow the "low road" (see for example M. Piore and C. Sabel [1984]). The assumption that is made concerning these strategy aspects is that the former favours the labour factor allowing workers to have more responsibilities within the firm (via encouraging team initiatives (self-directed teams, problem solving groups)) and to be more involved into the establishment management (weekly or monthly employee meetings where Chef Executive Officer and Human Resource Manager meet their employees) for instance. This implies in general more generous employment conditions (higher wages, profit sharing schemes, individual incentives bonus on the firm profitability), at least to promote job retention / reduce turnover. Moreover, employees of those firms gravitating to a "high road" tend to be more concerned with skill than those of other establishments (inducing practices such as cross-training – see D. Jones et al. [2002] for an attempt to describe firms as such). The COI survey may allow us to make such a distinction through the question asked to the firms concerning the importance of several factors in her strategy: cost reduction appears to be a major goal for both of the company types; so does the quality improvment of goods. However, reorganized firms are more different from other ones since their strategy relies far more on new products and new production process (82.47% of reorganized WTR firms versus 69.65% of non reorganized ones as to new products; 82.37% versus 68.93% as to new production process)[12]. Concerning *markets constraints*, two theories go in opposite ways. The first one stipulates that a competitive pressure may encourage firms adopting more productive / flexible work systems in order to better control for market instability and to improve the production process. The second one tells us that adopting such organizational practices while instability grows may represent a too considerable investment on the short run, thus reducing the firm margins and discouraging companies to undertake such practices, all the more than such devices may become profitable only in the long run. Turning to data, we see, on the one hand, that so-called reorganized firms face more often a random demand for goods (83.52% of such units versus 73.12% of other ones), higher market competition (79.89% versus 72.54%) and suffer more from client constraints (79.36% versus 73.99%), these

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[11]Always on the basis of firms coming from both the COI survey and WTR administrative surveys'agreements.

[12]However, such indicators help us to take account for the firm strategy only partly. It would be interesting to study the information given by employees, which would allow us to take account for meetings, cross training, firm and employee locations,... . This may partly explain our weak conclusions on this point and is actually further analysed in another part of the author research on the subject.

elements tending to advocate for the first part of the theory. On the other hand, non reorganized companies face more often provider and administrative contraints. Otherwise, ways firms used to adjust production to demand have their importance in determining firms to being reorganized: in particular, temporary labour force, part time work and "modulation" are much more in use in reorganized firms than in other ones (76.58% versus 55.78% as to temporary labour force for instance – see Table 4).

The second group of variables refers to *more individual characteristics*. Relatively to *time constraints*, companies with a more flexible organization tend to work/ be opened more often by night (61.97% versus 37.43%) or on saturday (63.41% versus 41.91%) and less on sunday than other firms. The size of the firm may also have an impact on the decision of the firm to reorganize: according to the theory, smaller establishments should have fewer resources to devote to human resource innovations, whereas they should be "more agile to adopt new production techniques than other" since they are not "weighted down by the heavy hand of corporate bureaucracy" (see P. Osterman [1994]). Table 4 and 5 show us there is a positive relation between our definition of reorganization and the employment level within the company, which confirms the first part of the theory. Highly related to the firm size, the fact she is part of a wider organization should provide her greater information and financial ressources to implement reorganization: according to our sample, 63% of non reorganized firms are basically independant units.

The last variable deals more with firm characteristics and should more accompany reorganization than simply cause it, particularly in the case of Human Resource Management practices (such as cross training, compensation, pay for skill) which should presumably be jointly determined with reorganizations (M. Gittleman et alii. [1998]). Even if our purpose is to look for variables that cause (rather than are correlated with) reorganizations, we present some figures dealing with the wage level within the firm: reorganized companies would be characterized by higher or medium wages (about 63% of the concerned units versus 51% of other units) confirming the fact firms pay her employees a wage premium to compensate more commitment, effort and avoid turnover (see the efficient wage theory).

2.4 Potential determinants for WTR date of implementation and other WTR variables[13]

Several of the quoted determinants of firm reorganization may also affect WTR variables such as the WTR date of implementation, benefiting or not from incentives and commiting on job creations. Particularly if implementing a WTR occurs within the framework of law Robien, Aubry I and II, where WTR was often negotiated together with reorganization (adoption of modulation devices,...).

Firstly, as to firm strategy, and on the one hand, a company which competes on cost reduction to lower the prices of good relatively to that proposed by its competitors will be expected to wait further: indeed, the WTR often leads to an hourly wage increase and a decrease in the individual productivity. On the contrary, a WTR may

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[13]This sub-section is mainly due to A.-L. Aucouturier et al. [1999].

Table 4: **Organizational features within companies that have implemented working time reduction before May 2003. Part 1.**

Features / Type of companies	Reorganized	Non Reorganized
Number of employed people in 1997[a] :	503	132
Rather important fators in the firm startegy :		
New products	82.47^b	69.65
Product differenciation	73.08	59.39
Quality improvement	97.27	91.33
New production processes	82.37	68.93
Cost reduction	97.56^a	93.35
Organizational constraints :		
Higher market competition	79.89^b	72.54
Market uncertainty	60.82	60.40
Client constraints	79.36	73.99
Provider constraints	20.16	22.98
Administrative constraints	40.80	41.76
Shareholding	28.11	14.45
Other (merge...)	24.62	14.45
WTR in 1997 :	12.88^b	7.08
Equipment Use also :		
By night	61.97^b	37.43
On Saturday	63.65	41.91
On Sunday	75.43	84.39
Production ajustment to demand:	95.69	90.61
Random ajustment	83.52^b	73.12
Expected ajustment	55.70	53.32
Ways used to ajust production :		
Overtime	70.93^b	60.26
Temporary labour force	76.58	55.78
Finite term contracts	70.35	61.99
Part time work	26.87	13.58
Part time unemployment	15.80	15.61
Annualization	14.85	11.56
Modulation	35.82	27.89
Subcontracting	50.14	38.29
Production storage	52.44	45.38

Note :   [a]Number of workers.[b]Percentage of the (reorganized or not) firm group.
Sources :   Descriptive statistics based on manufacturing part of COI survey
          and on administrative surveys of Robien and Aubry I and II agreements.

Table 5: **Organizational features on reorganized or non reorganized firms. Part 2.**

Features / Type of companies	Reorganized	Non Reorganized
Sectors :		
Food industries	19.54^a	14.74
Consumption goods	14.13	30.92
Car industries	4.17	2.31
Equipment goods	19.01	12.57
Intermediary goods	40.23	36.56
Energy	1.68	1.88
Other (including services, trade)	1.01^d	1.2
Number of employed people by class in 1997 :		
Less than 28 people	6.61^a	14.74
Between 29 and 49 people	13.41	30.06
Between 50 and 99 people	18.10	26.30
Between 100 and 249 people	19.64	16.47
Between 250 and 499 people	15.71	7.08
More than 500 people	26.53	5.35
Firm ownership[b] :		
French group	37.61^a	25.48
Foreign group	30.89	11.27
Independant firm	31.50	63.26
Wages[b] :		
High wages	14.73^a	7.11
Medium wages	49.76	44.02
Low wages	35.51	48.87

Notes :   [a]Pourcentage of reorganized (resp. non reorganized) companies.
   [b]Not available for food industries.

Sources :   Descriptive statistics based on Manufacturing part of COI survey
   and on administrative survey of Robien, Aubry I and II agreements.

help firms competing on the quality of goods, introducing new production processes or differentiating products, to increase people involvment in the production process and hire workers with new skills. In this way, a client constraint may also be seen as a determinant of the WTR implementation. On the other hand, firms competing on international markets may suffer from stronger competition, from more market uncertainty, which may make them reluctant to implement WTR.

Secondly, other factors deal with a more or less random demand for good. For instance, a firm – facing a more random demand and being forced to adjust its production to it – may appreciate to increase the flexibility of its organization. Since Robien, Aubry I and II laws allow firms to adopt modulation of the hours of work, it may be a good occasion for such companies to implement a WTR within that framework.

Thirdly, the existence of a modulation device within plants before the implementation of a WTR may favour such units, since it will allow them to generalize the use of such a practice in exchange of WTR given to her employees. Other ways used to adjust demand to the production may also encourage or not the firm in implementing a WTR: i) overtime becomes rather costly following the mandatory reduction of weekly hours of work and consequently negotiated modulation of the hours of the work may prevent firms from suffering from too big cost increases; ii) a WTR will not necessarily be advantageous for the firm if this one already makes use of part time work, because part time work allows the company to use complementary hours without any additional cost.

Fourthly, firms may be reluctant to render its organization more flexible through the implemention of a WTR and a modulation device if she is already opened all the day long, as well as on saturday and on sunday.

Finally, individual characteristics, such as the size of firms should influence the way she implements a WTR, in terms of the WTR date of implementation and in terms of the number of job creations / preservations she commits on, this at least through one channel, the mandatory one: to benefit from incentives, larger firms had to reduce their weekly hours of work earlier than other ones (see Appendix 1) and to commit on creating/ preserving a particular number of jobs (in the case of Robien and Aubry I devices).

Other potential determinants of both reorganization of the work before the WTR implementation and the reorganization aren't considered by now since we do not have any information about[14].

Now we've reviewed factors that may determine reorganizations, as well as the firm WTR date of implementation or other WTR variables, we would like to know in what extent those variables help us in understanding observed differences in WTR features. To do this, we choose to implement experimental methods based on the propensity score matching. In the next section, we present our results as soon as we have developped the econometric framework.

---

[14]This is particularly the case of the presence of unions within firms. However, it would be interesting to look at this later since, as it was underlined by P. Osterman [1994], unions seem to have been rather reluctant to reorganizations. Nonetheless, the author give some example where unions were also cooperative (see also P. Askenazy [2002]).

3 The evaluation problem: theory and results

3.1 The econometric model

The model we use to estimate the impact of reorganization on several WTR characteristics refers to the evaluation problem. Initially developped to analyse randomized experiments (R. Fisher [1935], J. Neyman [1923]), it has been enforced by D. Rubin [1974] in *non-experimental studies*.

In this model, we consider N units (firms in our case) all facing two exhaustive and exclusive *states of nature*[15], corresponding to the two possible values taken by the variable T_i we name further *treatment*. Hence, each unit i is either assigned to $T_i = 1$ (here: firm i is reorganized) or to 0 (here: firm i is not reorganized)[16]. Moreover, we denote by (Y_{1i}, Y_{0i}) the *potential outcomes* (here: a WTR variable, like the WTR date of implementation, job creations,...) associated with participation of i to treatment 1 or 0 and Y_{Ti} represents what would be realized if i were assigned to treatment T_i. Ex-post, only one of these two potential outcomes is observed:

$$Y_i = T_i Y_{1i} + (1 - T_i) Y_{0i}$$

considering N_1 individuals who are assigned to treatment 1 and whose observed outcome is $Y_i = Y_{1i}$ and $N - N_1$ others (the non treated/ non reorganized) whose observed outcome is $Y_i = Y_{0i}$. For the two types of individuals, the remaining potential outcome is called a *counterfactual*[17]. Our interest is therefore in estimating either the whole average treatment effect:

$$ATE \equiv E(Y_{1i} - Y_{0i}) \tag{1}$$

or the average treatment on the treated:

$$ATET \equiv E(Y_{1i} - Y_{0i}|T_i = 1) \tag{2}$$

Since we have:

$$E(Y_{1i} - Y_{0i}) = E(Y_{1i} - Y_{0i}|T_i = 1) P(T_i = 1) + E(Y_{1i} - Y_{0i}|T_i = 0) P(T_i = 0)$$

the problem is that neither (2) nor (1) are identified, unless we suppose that $E(Y_{0i}|T_i = 1) = E(Y_{0i}|T_i = 0)$ and $E(Y_{1i}|T_i = 1) = E(Y_{1i}|T_i = 0)$, i.e. that we are in presence of a

---

[15]For our interest, we restrict by now to the case of only two treatments. As to multi-treatment analysis, see G. Imbens [1999], M. Lechner [1999, 2002] or M. Frölich [2002].

[16]As we consider at the moment only the two treatments case, the 0 treatment may sometimes be named as being the no-treatment case.

[17]Note that the notion of potential outcome implicitly suppose 'no interference between different units'. Indeed, it assumes that the pair of potential (Y_{1i}, Y_{0i}) for individual i is not affected by the allocation of other individuals to the treatment, i.e. that :

$$Y_i(T) = Y_i\left(T'\right) \text{ if } T = T'$$

This refers to the Stable Unit Treatment Value Assumption (SUTVA – D. Rubin [1980]).

randomized experiment where individuals are randomly assigned to treatment (see R. Fisher [1935]) or – equivalently – that potential outcome in each of the two states would be the same had the individual been or not been treated. Indeed, it is not our case: the "reorganization" or "non reorganization" treatments may be compared to a more natural experiment. Consequently, estimating for instance (2) through the estimator $c = E(Y_{1i}|T_i = 1) - E(Y_{0i}|T_i = 0)$ will lead to a biased estimator (B. Crépon and N. Iung [1999] for instance):

$$c = E(Y_{1i} - Y_{0i}|T_i = 1) + [E(Y_{0i}|T_i = 1) - E(Y_{0i}|T_i = 0)] \tag{3}$$

where $E(Y_{0i}|T_i = 1) - E(Y_{0i}|T_i = 0)$ is the *selection bias,* which is linked to the fact that individuals between sub populations of type 1 or 0 differ in their characteristics and that some of these affect *both* the treatment *and* the outcome variable (the so-called *confounding variables*). One way to overcome this trouble is to use "*a quasi-experimental strategy*", which consists in reproducing randomized experiments thanks to available information. The intuition is that comparing two very similar individuals i and j coming from each of the two groups should lead to identical potential outcomes Y_{0i} and Y_{0j}, or Y_{1i} and Y_{1j}. So, considering we have information on individual characteristics that include *all* confounding variables (X_i), we have to suppose the *ignorable treatment assumption* (P. Rosenbaum and D. Rubin [1983]) or *conditional independance assumption* (M. Lechner [1999]) to be checked[18]:

$$(Y_{1i}, Y_{0i}) \amalg T_i | X_i \tag{4}$$

where "$\amalg$" refers to independance. (4) implies:

$$E(Y_{0i}|X_i, T_i = 1) = E(Y_{0i}|X_i, T_i = 0) \text{ and } E(Y_{1i}|X_i, T_i = 1) = E(Y_{1i}|X_i, T_i = 0)$$

and identifies the two presented effects:

$$E(Y_{1i} - Y_{0i}|T_i = 1) = E(Y_{1i}|T_i = 1) - E_X(E(Y_{0i}|X_i, T_i = 0)|T_i = 1)$$

and:

$$\begin{aligned}
&E(Y_{1i} - Y_{0i}|T_i = 1)\\
=\ &\{E(Y_{1i}|T_i = 1) - E_X(E(Y_{0i}|X_i, T_i = 0)|T_i = 1)\} P(T_i = 1|X_i)\\
&+ \{E_X(E(Y_{1i}|X_i, T_i = 1)|T_i = 0) - E(Y_{0i}|X_i, T_i = 0)\}(1 - P(T_i = 1|X_i))
\end{aligned}$$

However, as the dimension of X_i is great, it becomes tedious constructing comparable individuals. P. Rosenbaum and D. Rubin [1983] show that conditioning on the propensity score (i.e. on the probability for an individual of being assigned to the treatment conditional on observables) denoted by $(P(X_i) \equiv P(T_i = 1|X_i) = E(T_i|X_i))$ rather than directly on covariates would allow for reduction in dimensionality and

---

[18]Note that however it is impossible to test for conditional independence, unless we have some information on counterfactuals as it was the case of J. Heckman et al. [1998a, 1998b] for example. If it is not the case and if we have controlled for all confounding variables, the remaining bias is due to differences in unobservables.

has the favourable theoretical property to be a consequence of (4)(see for example R. Dehejia and S. Wahba [1998] for a proof)[19]:

$$(Y_{1i}, Y_{0i}) \amalg T_i | X_i \Rightarrow (Y_{1i}, Y_{0i}) \amalg T_i | E(T_i | X_i) \tag{5}$$

However, estimators of $E(Y_{0i}|P(X_i), T_i = 1)$ and of $E(Y_{1i}|P(X_i), T_i = 0)$ could be computed only if there is sufficient overlapping between the propensity score density in both sub-populations; else, we may compare individuals that are not comparable[20]. So we may also have to check for the *common support assumption* or *overlapping assumption*:

$$0 < E(T_i | X_i) < 1 \tag{6}$$

Under these two conditions (5) and (6), we have :

$$
\begin{aligned}
E(Y_{0i}|P(X_i), T_i = 1) &= E(Y_{0i}|P(X_i), T_i = 0) \\
\text{and } E(Y_{1i}|P(X_i), T_i = 1) &= E(Y_{1i}|P(X_i), T_i = 0)
\end{aligned}
$$

which identifies (1) nor (2). Since $E(Y_{ji}|T_i = j)_{j=0,1}$ may be easily estimated through sample means, it remains to choose estimators for counterfactuals.

3.2 Some words about considered propensity score estimators

Several estimators for $E(Y_{0i}|P(X_i), T_i = 1)$ (and for $E(Y_{1i}|P(X_i), T_i = 0)$ equivalently) have already been put under consideration in the evaluation litterature. Two major categories may be distinguished: one based on regressions and another on re-weighting outcomes. By now, we consider three of them: two regression ones (the simple nearest neighbour and the kernel (i.e. local constant or Nadaraya Watson) estimators) and the re-weighting estimator.

3.2.1 Regressions

The simple nearest neighbour estimator is based on D. Rubin [1974] idea to compare two comparable individuals: one want to find, for each i from the $T = 1$ sample, one individual from the $T = 0$ sample such that $|P(X_i) - P(X_j)|$ is the smallest. An extension of this method is to consider k nearest neighbours:

$$\hat{E}(Y_{0i}|P(X_i), T_i = 1) = \frac{1}{J} \sum_{\substack{j=1 \\ \{T_j \in A_x\}}}^{J} Y_{0j} \tag{7}$$

---

[19]Indeed, an alternative should be to match on the Mahalanobis distance (see P. Rosenbaum and D. Rubin [1985]) which is rather ad-hoc. Besides, it is not garanteed the estimates to be consistent. However, it has the property to reduce differences in the covariates within matched pairs in all directions (see D. Rubin and N. Thomas [1992]).

[20]However, restricting on the common support may not solve entirely the lack of overlapping, since a parameter – that may be of reduced interest – is estimated. M. Lechner [2001] presents this problem and proposed as a solution to bound the Average Treatment Effect on the basis of the Maximum and the Minimum value taken by the outcome variable. Nevertheless, in further study, this method appears to know difficulties in excluding 0 from the ATE or $ATET$ confidence interval. Moreover, Maximum and Minimum of continuous variables are not known in general and hence have to be estimated.

where A_x index the set of x observations with the k lowest value of $|P(X_i) - P(X_j)|$. Such estimators may be highly biased, particularly if they are implemented without replacement. Considering matching with replacement allows partly to solve this problem, but it may lead to variance inflation (see R. Dehejia and S. Wahba [1998]). Recently, A. Abadie and G. Imbens [2003] have been studying large sample properties of these estimators and show they include a conditional bias that may not vanish and so may be not $N^{\frac{1}{2}}$ consistent as more than one continuous variable is included in the covariates. Moreover, when correcting for conditional bias and considering a fixed number k of nearest neighbours, the estimator still does not reach the efficiency bounds derived by J. Hahn [1998] for average treatment effect. However, when there is at most one continuous variable, the efficiency loss can be made arbitrarily small, the estimator may be consistent under some limited smoothness requirements and asymptotically normal after bias is removed.

Another limit of such estimator is that it gives the same weight to all observations that are used to build the counterfactual, whatever the distance $|P(X_i) - P(X_j)|$ is. The Kernel /Nadaraya Watson estimator helps in solving such a problem:

$$\hat{E}(Y_{0i}|P(X_i), T_i = 1) = \sum_{j:T_j=0} \frac{K\left(\frac{P(X_i)-P(X_j)}{h_{n_0}}\right)}{\sum\limits_{j:T_j=0} K\left(\frac{P(X_i)-P(X_j)}{h_{n_0}}\right)} Y_{0j}$$

where the weighting is achieved through a kernel function $K(.)$ that is chosen such to sum to one and to be an odd function[21]. Moreover, this estimator has been proved to be consistent and asymptotically normally distributed (even with estimated propensity score – see J. Heckman et al. $[1998a, 1998b]$ [22]). Besides, it suggests a trade-off – that is not proposed by the kth nearest neighbour estimator – between the bias and the variance of the estimator and is related to the choice of a bandwidth parameter h_{n_0}[23].

3.2.2 Re-weighting

Rather than imputing a value for counterfactuals through local polynomial and other regressions, another way to estimate $E(Y_{0i}|P(X_i), T_i = 1)$ is re-weighting outcomes Y_{0i}. Indeed, as to Average Treatment Effect on the Treated, we may re-write $E_X(E(Y_{0i}|X_i, T_i = 0)|T_i = 1)$ as (see for instance T. Brodaty et al. [2002]):

$$
\begin{aligned}
E_X(E(Y_{0i}|X_i, T_i = 0)|T_i = 1) &= E\left(Y_{0i}\frac{f(X_i|T_i=1)}{f(X_i|T_i=0)}|T=0\right) \\
&= E\left(Y_{0i}\frac{P(X_i)}{1-P(X_i)}\frac{P(T_i=0)}{P(T_i=1)}|T=0\right)
\end{aligned}
$$

---

[21] With a Uniform Kernel, we find an estimator which looks like the kth nearest neighbour one.

[22] The authors established this result not only for the local constant estimator, but also for all other local polynomial estimators.

[23] Which will be discuss later. Note that we won't look further at other regression estimators that uses all observations, like the least squares one. However, consistent estimation of each counterfactual requires that the local neighbourhood – around the unit to be matched – shrinks with increasing sample size. Consequently, those estimators are in general not consistent (M. Frölich [2002]).

where $f(X_i|T_i = j)$, $j = 1, 0$ represents covariates density given assignment to treatment j. This expression suggests therefore an alternative estimator for the counterfactual:

$$E(\widehat{Y_{0i}|T_i} = 1) = \frac{1}{N_1} \frac{P(T_i = 0)}{P(T_i = 1)} \sum_{j=1}^{N_1} Y_{0i} \frac{P(X_i)}{1 - P(X_i)}$$

and hence for $ATET$:

$$\widehat{ATET} = \frac{1}{N_1} \sum_{i:T_i=1} Y_i - \sum_{i:T_i=0} \frac{\frac{\hat{P}(X_i)}{1-\hat{P}(X_i)}}{\sum_{i=1}^{N} \frac{\hat{P}(X_i)}{1-\hat{P}(X_i)}} Y_i \qquad (8)$$

for estimated propensity score $\hat{P}(X_i)$.

For ATE, the whole estimand rewrites (see G. Imbens [2003]):

$$
\begin{aligned}
ATE & \equiv E(Y_{1i} - Y_{0i}) \\
& = E\left(\frac{T_i Y_i}{P(X_i)} - \frac{(1 - T_i)Y_i}{1 - P(X_i)}\right)
\end{aligned}
$$

which leads to the following estimator $\frac{1}{N} \sum_{i=1}^{N} \left(\frac{T_i Y_i}{P(X_i)} - \frac{(1-T_i)Y_i}{1-P(X_i)}\right)$. However, its weights sum to one only in expectation. Normalizing them, we find the estimator proposed by K. Hirano et al. [2002]:

$$\widehat{ATE} = \sum_{i=1}^{N} \frac{\frac{T_i}{P(X_i)}}{\sum_{i=1}^{N} \frac{T_i}{P(X_i)}} Y_i - \sum_{i=1}^{N} \frac{\frac{(1-T_i)}{1-P(X_i)}}{\sum_{i=1}^{N} \frac{(1-T_i)}{1-P(X_i)}} Y_i \qquad (9)$$

where propensity score might be known or not. These authors show that these estimators are consistent and asymptotically normally distributed, but are in general not efficient if propensity score is known or parametrically estimated.

3.2.3 Which one to choose?

Using different theoretical densities for covariates or for the propensity score, and in the case of the Average Treatment Effect on the Treated, M. Frölich [2000, 2003] recently attempted to study performances – in terms of mean squared error reduction – of kernel/ local constant, local linear and re-weighting estimators relatively to that of the simple nearest neighbour estimator. He found that in almost all cases, kernel regression outperforms the simple nearest neighbour estimator (except in some cases, when there are fewer control units than treated[24]), the re-weighting very often, whereas it is less clear as to the local linear estimator. Hence, we will put our attention

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[24]This should represent 1 case over 6 in his study. Note further that, since the author works only on Average Treatment Effect on the Treated, this could have been expected: Kernel matching use all the sample observations and so performs better when there are more control units, contrary to the nearest neighbour.

on the Nadaraya-Watson estimator, without forgetting to have a look at other two estimators[25].

Nevertheless, there are no precise ways to choose $h_{n_l l=0,1}$. P. Todd [1999] advises to set it equal to the distance to the kth nearest neighbour as a good way to take account for heterogeneity, allowing it thus to vary from point to point with smaller $h_{n_l l=0,1}$ for points evaluation where there are more observations in the local neighbourhood. Another method suggested for instance by T. Brodaty et al. [1999], in the case of using a duration model, was to consider a Silverman rule of thumb. More recently, M. Frölich [2000, 2003] has been studying finite sample properties of different matching estimators and by now recommends minimizing the leave-one-out cross-validation criterion (which works quite well but does not offer an asymptotically optimal way to set h_{n_0}):

$$h_{n_0} = \arg\min CV(h) = \sum_{j|T=0} (Y_{0i} - \hat{m}_{-i}(P(X_j), h)) \tag{10}$$

where $\hat{m}_{-i}(P(X_j), h)$ represents the leave-one-out estimator, i.e. a non parametric regression of Y_{0i} on all $P(X_j), j \neq i$ coming from the $T = 0$ sample[26]. This criterion appears also to perform better than that of the Akaike (or of other penalizations – see W. Härdle et al. [1999]) penalized cross-validation criterion minimization.

3.2.4   Choice-based sampling

The last point concerning (whole or on the treated) Average Treatment Effects deals with the fact we may work on a choice-based sample. In fact, except in the case where we want to study the impact of reorganization on the implementation or not of a WTR (which is measured on the whole COI survey), we have to restrict us to the intersection of both COI and WTR surveys to study the causal effect of reorganizations on WTR dates of implementation and jobs commitment or on the fact the firm gets incentives.

Since our descriptive statistics showed us that reorganized firms tend to be more numerous to have already implemented a WTR, we are sure that reorganized firms are over-sampled in the final sample. It may not have happened at random, because larger firms were often led to lower earlier their effective weekly hours of work: before January, 1st 2000 for firms with more than 20 employees and January 1st 2002 for others, if they want to benefit from incentives (see Appendix 1). So we should have to weight our observations as is recommended in T. Amemiya [1985]. However, from the original weights that were present in the COI survey to take account for firm size and for sectors, it will be difficult to compute such weights. Indeed, the initial survey contained 5675 firms coming from overall industries. After cleaning, only 4644 of them were kept. Only 60% of the latter (about 2780 units) already implemented a WTR and may be usefull to us. Consequently, we will adopt the other solution

---

[25]Note that M. Frölich [2000, 2003] results depend on the relative size of the treated sample relatively to that of the non treated sample, on the form of propensity score / of covariates density.

[26]Because it is $E(Y_0|T = 1)$ is to be estimated using non parametric regression and because the smoothness for the $E(Y_1)$ and $E(Y_0)$ curves may not be the same.

proposed by J. Heckman and P. Todd [1999], i.e. matching on the estimated odd ratio, since this ratio is monotonically related to the true odd ratio:

$$\frac{\tilde{P}\left(T=1|X\right)}{\tilde{P}\left(T=0|X\right)} = \frac{P\left(T=1|X\right)}{P\left(T=0|X\right)} \times \left(\frac{P^*}{1-P^*}\right) \times \left(\frac{1-P}{P}\right)$$

where $P \equiv P\left(T=1\right)$ and $P\left(T=1|X\right)$ (respectively $P^* \equiv P^*\left(T=1\right)$ and $\tilde{P}\left(T=1|X\right)$) represent true probabilities (respectively probabilities we estimate through our final choice-based sample)[27].

3.3   Results[28]

We estimate two binary logit models, one on the full COI sample, the other on observations that are only common to both the COI survey and the administrative WTR surveys'agreements. Our specification confirms our previous descriptive statistics, whether restricting to only 10% significant determinants or not (see Table 8 in appendix)[29].

Turning to Table 6, we see that mean differences before matching – what we called the naive estimator (see (3)) – are highly significant: reorganized firms are more numerous to have adopted earlier a WTR (considering the whole COI sample or the intersection of the two COI and WTR samples); moreover, she commits more often on job creations and on more job creations. However, such results may be related to difference in firms individual characteristics and organizational constraints and strategy that may affect both the treatment (i.e. reorganization) and the outcome variables as we saw it in previous section. Our Nadaraya Watson propensity score matching estimates lead to following results (Table 6, first column): reorganized firms tend to have i) implemented a WTR one month earlier (-0.092×12) than other types of firms, ii) commited more often (4.7% considering ATET, 4.2% considering ATE)

---

[27]In our case, a simple logistic model is used to estimate the probability for a firm to be reorganized and we choose to match on the log-odd ratio, so on $\ln \frac{\tilde{P}(T=1|X)}{\tilde{P}(T=0|X)} = X\tilde{\beta}$, where the intercept $\tilde{\beta}_0 = \beta_0 + \ln\left(\frac{P^*}{1-P^*}\right) + \ln\left(\frac{P}{1-P}\right)$. In our results, we will present kernel estimates both based on propensity score matching or on log - odd ratio matching so to compare with. By construction, results provided by the simple nearest neighbour estimator won't be affected.

[28]All our computations were led under the SAS IML module (as to matching estimators) and under the LOGISTIC procedure (as to the estimation of the probability model). Since our interest relies on Population Average Treatment Effects (see G. Imbens [2003] for further discussion on that matter), we compute boostraped standard errors (on 200 replications) for all estimators, i) re-estimating the logit model and ii) choosing the bandwidth parameter through the leave-one-out cross validation minimization criterion (in the case of the Nadaraya Watson estimator) at each simulation. Otherwise, we restrict us to the common support the simplest way, i.e. removing from sample all propensity score values that are smaller than the maximum of the smallest PS values (among the reorganized and the non reorganized sub-sample groups) and bigger than the minimum of the biggest PS values. Note that this may not be satisfying (see M. Lechner [2001] for instance). Nevertheless, our results are not heavily linked to that assumption. Finally, we perform our matching estimator using the whole propensity score specification (i.e. considering all variables).

[29]The results dealing with the estimation of the probabilistic model on the whole COI sample aren't written out. They may be nonetheless presented by the author on request.

Table 6: **Average Treatment Effect for a firm of being reorganized (2 organizational devices or more) on her WTR date of implementation and on other WTR variables provided by the administrative surveys'agreements, restricted on the common support. Following the propensity score specification does or not take account for the 1997 employment level. Overall sample is under consideration.**

	$\mathbf{ATE}^a$				
Variable/ Estimator	Naive	Kernel^{b,c}	Kernel^{b,d}	Kernel^c	Kernel^d
Already a WTR^e:	0.134*** (0.016)	−0.007 (0.019)	−0.016 (0.019)	0.053*** (0.019)	0.054*** (0.019)
Date^f :					
of Agreement	−0.063 (0.044)	−0.072 (0.064)	−0.067 (0.045)	−0.103** (0.051)	−0.098* (0.054)
of Implementation	−0.177*** (0.042)	−0.092* (0.056)	−0.077 (0.058)	−0.169*** (0.047)	−0.161*** (0.048)
Delay	−0.114*** (0.031)	−0.020 (0.036)	−0.024 (0.038)	−0.077** (0.033)	−0.071** (0.032)
Job creation :					
Commitment^h	0.082*** (0.02)	0.043* (0.024)	0.040 (0.025)	0.046* (0.024)	0.049** (0.025)
Jobs created^i	6.10 *** (0.608)	1.514** (0.722)	1.714** (0.747)	4.332*** (0.608)	4.404*** (0.619)
Incentives ^{e}:	−0.032 (0.021)	−0.010 (0.026)	−0.015 (0.026)	−0.028 (0.021)	−0.028 (0.021)
	$\mathbf{ATET}^j$				
Already a WTR^e:	0.134*** (0.016)	−0.019 (0.021)	−0.033 (0.021)	0.052*** (0.020)	0.050** (0.020)
Date^f :					
of Agreement	−0.063 (0.044)	−0.088 (0.071)	−0.050 (0.073)	−0.117** (0.054)	−0.110** (0.055)
of Implementation	−0.177*** (0.042)	−0.100 (0.067)	−0.041 (0.069)	−0.180*** (0.050)	−0.169*** (0.050)
Delay	−0.114*** (0.031)	−0.021 (0.039)	−0.026 (0.040)	−0.079** (0.037)	−0.074** (0.036)
Job creation :					
Commitment^h	0.082*** (0.02)	0.047* (0.025)	0.042* (0.026)	0.051** (0.025)	0.052** (0.025)
Jobs created^i	6.108*** (0.608)	1.963** (0.923)	2.195** (0.949)	4.931*** (0.743)	5.037*** (0.747)
Incentives ^{e}:	−0.032 (0.021)	−0.013 (0.026)	−0.032 (0.027)	−0.029 (0.021)	−0.011 (0.025)

Notes :   Bootstraped standard errors in brackets. Significancy levels : * (10%), **(5%), ***(1%). ^{a,j}Average Treatment Effect (resp. on the Treated). ^{b}Propensity score specification does include the 1997 employment level. ^{c,d}Matching on the propensity score (resp. on the log-odd ratio). ^{e,h}Percentage difference.^{f}Difference in years. ^{g}Date of agreement relatively to each law, difference in years.

Sources :   Author's computations after merging Manufacturing part of COI survey, and administrative survey of Robien and Aubry I and II agreements.

on job creations, iii) on more job creations but iv) didn't get more often incentives (which is not surprising given previous section and non signifiacant on a 10% level).

However, as a consequence of checking for choice-based sampling and so of matching on the estimated log-odd ratio rather than on the estimated propensity score, causal effects have in general the "expected sign" but become non significant (except for the fact the company commit on job creations (as to ATET) and on how many; for the WTR date of implementation, but at a 15% significance level (ATET) – Table 6, second column). Moreover, these results appear to be strongly linked to the within the company 1997 employment level being included or not in propensity score specification. Indeed, this variable seems to be highly correlated to the number of organizational devices and therefore to our reorganization definition (χ^2 statistics higher than 90[30]; see also Tables 4 and 5). There is suspicion for this variable to be an endogen of our treatment variable: for instance, a company which makes use of n devices in 1997 but who saw the number of workers concerned by each of these devices either remaining stable or decrease[31] since 1994 indicates us these devices were already in use in 1994; meanwhile, the number of workers may have varied. This variable is for instance expected to influence both the reorganization and the WTR date of implementation (see Appendix 1). Since this variable could be caused by our treatment, we may want to exclude it from the logistic model, since conditioning on it would block the part of the causal effect that acts through this variable (J. Pearl [2000]). Consequently, we re-estimate propensity score removing the 1997 within the firm employment level from explanatory variables. This does not lead to too much changes in the probability model statistics (see Table 9 in appendix). In this case (Table 6, third and fourth columns), most ATE become significant, including the date at which the agreement was signed and the delay between the two dates.

Nevertheless, it may be rather unsatisfactory to exclude the 1997 within the firm employment level since this variable is expected to cause both the reorganization indicator and the outcome variable (considering the WTR date of implementation or the number of forecasted job creations – see previous section and Appendix 1). Hence, we separate our sample into two parts and perform our estimator using only firms employing fewer than 500 workers. This time, both matching on propensity score and on the log-odd ratio lead to similar and significant results: reorganization seems to imply i) an earlier WTR (looking at the date of implementation rather than at having already or not implemented a WTR, or at the date agreements were signed), ii) more often job creation commitment and iii) more forecasted job creations[32]. Since WTR were very often negotiated together with reorganizations of the work (annualization

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[30]Note that the status of the firm (i.e. either being part of a larger (french or foreign) group, or being an independant firm) is not taken into account in the propensity score specification, because this variable is not available for food industries. Restricting our sample to industries without food ones and including our considered variable in the propensity score specification, the χ^2 statistic decreases but our final results remain unchanged.

[31]Or in some case when that number increases, as it is not simply linked to the adoption of a new device since 1994 (something we may not be sure in this case).

[32]Note that for Aubry II or Aubry II precursor devices (representing 65% of the whole firm sample), no job creation commitment were required. Moreover, the differences between those coefficients and the previous ones are not significant.

among other) to allow firms to offset j) the hourly wage rate increase and jj) the individual productivity decrease following the WTR, reorganized companies were certainly the first who reorganize further when implementing the WTR[33]. The impact on the delay is still non significant except in the case when the propensity score does not take account of the 1997 within the firm employment level (see Table 7). If we have a look at the simple nearest neighbour and the re-weighting estimates, we see no significant result, except in the case of the reweighting one, considering job creation commitment. In fact, variances of this estimates are often far wider than those of the Nadaraya Watson one, as expected and bias is not necessarily smaller. Hence, we trust our Nadaraya Watson estimates. All these findings seem to hold whatever the theshold we consider (at a level of 3, 4, 5 or 6 devices in particular).

3.4   What about a more general indicator?

Since our indicator may appear to be a rather crude one, we can consider a less aggregated estimator, namely the exact number of devices in use within the firm. Applying matching estimators in this case implies comparing, for instance, firms using (m) organizational devices to firms using $(m - k)_{k>0}$ devices. In the multiple treatment analysis framework, the pairwise comparison estimator may be as follows:

$$
\begin{aligned}
\alpha_0^{m,m-k} &\equiv E\left(Y_m - Y_{m-k}|T \in [m, m-k]\right) \\
&= \theta_0^{m,m-k} P\left(T = m|T \in [m; m-k]\right) \\
&\quad -\theta_0^{m-k,m}\left(1 - P\left(T = m|T \in [m; m-k]\right)\right)
\end{aligned} \tag{11}
$$

with: $\theta_0^{m,m-k} \equiv E\left(Y_m - Y_{m-k}|T = m; T \in [m, m-k]\right)$

and $\theta_0^{m-k,m} \equiv E\left(Y_m - Y_{m-k}|T = m-k; T \in [m, m-k]\right)$. (11) represents the average difference in the outcomes when receiving the treatment (m) or the treatment $(m - k)$, this conditionnally to the fact the treatment is either (m) or $(m - k)$. This estimator corresponds exactly to the ATE if there are only two treatments. It also implies we will have to lead a lot of comparisons (72 exactly)[34]. Like in the two treatment case, counterfactuals ($E\left(Y_{m-k}|T = m, T \in [m, m-k]\right)$ and $E\left(Y_m|T = m - k, T \in [m, m-k]\right)$) have to be estimated. The conditional independence assumption re-writes:

$$
(Y_0, ..., Y_m, Y_{m-k}, ..., Y_{10}) \amalg T|X \tag{12}
$$

Under this assumption, we have (see T. Brodaty et al. [1999]):

$$
(Y_m, Y_{m-k}) \amalg T|P^{m|m-k}(X), T \in [m; m-k], k > 0 \tag{13}
$$

---

[33]Note however that the actual version (may 2003) of the administrative WTR survey's agreements does not allow to check whether or not and what sort of reorganization the firm chooses to implement while adopting a WTR, contrary to previous versions (2001 and before) of this file.

[34]Otherwise, other estimators may be considered such that the unconditionnal pairwise treatment effect or aggregate/ composite treatment effects, perhaps more suited in the case of the multiple treatment effect framework (see M. Lechner [2000]) The same problem appears in the first quoted estimand.

Table 7: **Average Treatment Effect for a firm of being reorganized (2 organizational devices or more) on her WTR date of implementation and on other WTR variables provided by the administrative surveys'agreements, restricted on the common support. Following the propensity score specification does or not take account for the 1997 employment level. Only firms with fewer than 500 workers are under consideration.**

	ATE[a]				
Variable/ Estimator	Naive	Kernel[b,c]	Kernel[b,d]	Kernel[c]	Kernel[d]
Already a WTR[e]:	0.105*** (0.017)	0.003 (0.020)	0.0016 (0.019)	0.042** (0.019)	0.040** (0.019)
Date[f] :					
of Agreement	−0.029 (0.047)	−0.061 (0.056)	−0.059 (0.057)	−0.066 (0.052)	−0.069 (0.052)
of Implementation	−0.146*** (0.045)	−0.091* (0.053)	−0.089* (0.054)	−0.150*** (0.047)	−0.143*** (0.047)
Delay	−0.117*** (0.033)	−0.038 (0.034)	−0.037 (0.034)	−0.084** (0.034)	−0.079** (0.034)
Job creation :					
Commitment[h]	0.078*** (0.023)	0.049* (0.026)	0.051** (0.027)	0.049** (0.025)	0.049** (0.025)
Jobs created[i]	2.160*** (0.312)	0.982*** (0.371)	1.004*** (0.375)	1.528*** (0.344)	1.525*** (0.341)
Incentives [e]:	−0.0054 (0.021)	0.006 (0.024)	0.006 (0.024)	0.009 (0.024)	0.009 (0.024)
	ATET[j]				
Already a WTR[e]:	0.105*** (0.017)	−0.007 (0.022)	−0.011 (0.023)	0.038** (0.019)	0.036* (0.022)
Date[f] :					
of Agreement	−0.029 (0.047)	0.071 (0.058)	−0.067 (0.059)	−0.080 (0.060)	−0.080 (0.056)
of Implementation	−0.146*** (0.045)	0.098* (0.057)	−0.083 (0.056)	−0.168*** (0.053)	−0.162*** (0.050)
Delay	−0.117*** (0.033)	−0.038 (0.038)	−0.037 (0.038)	−0.092** (0.040)	−0.091** (0.040)
Job creation :					
Commitment[h]	0.078*** (0.023)	0.053** (0.026)	0.055** (0.025)	0.056** (0.025)	0.056** (0.025)
Jobs created[i]	2.160*** (0.312)	1.315*** (0.418)	1.342*** (0.390)	1.765*** (0.354)	1.780*** (0.340)
Incentives [e]:	−0.005 (0.022)	0.007 (0.023)	0.007 (0.024)	0.013 (0.023)	0.012 (0.024)

Notes :   Bootstraped standard errors in brackets. Significancy levels : * (10%), **(5%), ***(1%). [a,j]Average Treatment Effect (resp. on the Treated). [b]Propensity score specification does include the 1997 employment level. [c,d]Matching on the propensity score (resp. on the log-odd ratio). [e,h]Percentage difference.[f]Difference in years. [g]Date of agreement relatively to each law, difference in years.

Sources :   Author's computations after merging Manufacturing part of COI survey, and administrative survey of Robien and Aubry I and II agreements.

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where matching is this time performed on the balancing score:

$$P^{m|m-k}(X) \equiv \frac{P^m(X)}{P^{m,m-k}(X)} \equiv \frac{P(T=m|X)}{P(T=m|X) + P(T=m-k|X)} \qquad (14)$$

which is computed, once a polytomic logistic regression was performed[35].

Looking at Table 12 to 15, we see that results are more ambiguous, more often unsignificant than for the previous reorganization indicator. Firstly, as the "device gap" is small (i.e. equal to one or two devices), estimators – the naive one, as well as the Nadaraya Watson one – are more often unsignificant (at a 10% level). Secondly, as this gap becomes wider, a greater number of organizational devices in use within the firm implies an earlier WTR implementation, more often job creation commitment and more forecasted job creations, as well as benefiting less often from incentives. Thirdly, including the 1997 employment level in the polytomic logistic regression specification lead to far fewer significant impact of reorganization on the way working time reduction was implemented in the firm, except as to commiting on job creations or benefiting from incentives (Table 15).

4   Conclusion

In this study, we wanted to analyse how the firm reorganization of the work may have had an impact on its Working Time Reduction date of implementation, as well as on its commitment on job creations, on the fact it gets or not incentives. To do this, we adopt the definition of reorganization retained by P. Osterman [1994], M. Gittleman et al. [1998], already used in V. Janod and A. Saint-Martin [2003] to study the causal effect of reorganization on performances and based on the number of organizational devices in use within the company. As a first attempt, we consider as a definition for reorganization, the fact for the firm to use "at least two organizational devices"; then we compare firms following the exact number of organizational devices she uses. Our "intuition" is as follows: WTR devices favour reorganized firms, which already make use of more "innovative" practices (annualization for instance) but are not necessarily the more flexible. Those firms, which employ workers with higher wages, tend do implement earlier a WTR and commit more often on job creations.

Thanks to a merge of the COI ("Changements Organisationnels et l'Informatisation") survey, which deals with organizational constraints and market strategy "elements" within French firms in 1997, and administrative Working Time Reduction surveys' agreements (May 2003 version), in which we find information on firms which have implemented a WTR since 1996, we first presented some evidence on WTR features among both reorganized and non reorganized companies. Our descriptive statistics lead to subtantial differences between the two groups (reorganized companies tend to implement earlier a WTR, to commit more often and on more job creations). However, some determinants of reorganization - organizational contraints as well as market strategy variables and other individual characteristics –

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[35]Findings resulting from this estimation are not reported here, but are available on request.

may also affect our WTR variables of interest. Using propensity score methods to non-experimental causal studies, we try to evaluate the impact of reorganization on WTR features, controlling for variables previously quoted. Considering our first reorganization indicator (i.e. a firm is said to be reorganized "as soon as it makes use of at least two organizational devices") and using the Nadaraya Watson estimator, our findings go often in the same direction and are significant, either including the 1997 employment level in the propensity score specification or not, either matching on the estimated propensity score or on the estimated log-odd ratio. Reorganized firms tend i) to have implemented a WTR earlier, ii) to have commited more often and on more job creations. Since WTR were very often negotiated together with reorganization (like for instance modulation / annualization of the hours of work), reorganized firms were certainly the first who reorganize further when implementing the WTR. However, even if this effect is unsignificant, such firms benefit less often from incentives, which is not surprising because there are much more Aubry II precursors (i.e. companies who do not benefit from incentives, although having anticipated the mandatory working time reduction and being firms belonging to the private business sector). Secondly, our results seem to be rather non sensitive to the treshold we impose to define reorganization. Thirdly, the results provided by a more general indicator, comparing firms using (m) organizational devices to firms using $(m - k)$ devices, are more ambiguous: i) when the polytomic logistic regression specification does not include the 1997 within the firm employment level, previous findings holds, even if less often significant, ii) in the opposite case, the results become often unsignificant, except concerning the fact the firm commits on job creations.

Nevertheless, some limitations of our work may come from both theoretical and practical point of view and may be related. From a practical point of view, we are not sure to have controlled at best for differences in the covariates. One solution may be to match on both the estimated propensity score and on the covariates within a caliper as what was done in J. Heckman et al. [1998b]. It should be also interesting to estimate the remaining bias to compare after to before matching bias, as what was suggested by P. Rosenbaum and D. Rubin [1985] and done by B. Sianesi [2001]. Otherwise, from a theoretical point of view and as it was previously underlined, efforts remain to be done to better describe some determinants of reorganization, like the firm strategy, using either the Employer or the Employee part of the COI survey (which contains information on many practices such as cross training, meetings, companies and employees'location variables, employee education level,...). Finally, such an approach does not allow to distinguish reorganization types and to classify them (this last trouble is by now the matter of an other analysis looking more precisely at the firm strategy).

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<u>Appendix 1</u> : About mandatory WTR in France since 1996[36]

Since 1982 and the decrease of the mandatory weekly duration of work from 40 hours down to 39 hours by French governement Mauroy (January, 13th 1982), three other laws were implemented in France to promote job creations and reduce unemployment on the basis of the work sharing idea. These laws are the following: "de Robien" (June, 11th 1996), Aubry I (June, 13th 1998) and Aubry II (January, 19th 2000) laws[37].

The **'de Robien' law** (law nu. 1996 - 502) states that the firm or the establishment can benefit from cuts in employer social contributions if it reduces the effective weekly hours of work of a part or of all its employees. If she reduces her effective working time by 10 percent, firms had also either i) to increase by 10 percent ("offensive agreement") the number of the people she employs, at least for 2 years, or ii) to preserve ("defensive agreements") jobs forecasted to be suppressed (in the same proportions). In this case, the firm benefited from a 40 percent decrease in the employer social contribution the first year (i.e. during the year the agreement was signed), 30 percent during the 6 following years and this whatever the date the agreement was signed between June, 11th 1996 and the adoption of the day Aubry I law was adopted (June, 13th 1998). Higher tax reductions were given to the firm if it commits on a 15 percent (or higher) decrease of its effective working time reduction, together with a 15 percent increase (or preservation) of its employment level.

The **'Aubry I' law** (law nu. 1998 - 461) foresees to reduce the mandatory weekly hours of work from 39 hours down to 35 hours after January, 1st 2000 for firms employing more than 20 workers, after January, 1st 2002 for other. Firms anticipating the mandatory working time reduction could benefit from incentives, as soon as she commits on a 10 percent decrease of its effective weekly duration of the work, together with a 6 percent increase of its employment level ("offensive agreement") or a preservation of its employment level (in the same proportions - "defensive agreement") if she planned to fire people before turning to WTR. Incentives are given under the form of employer's social contributions reductions and correspond to a fixed amount given to the firm every year for each of the concerned workers, an amount that depend on the date the firm signs the agreement. If she signs between June, 13th 1998 and June 1999, it gets 9000 French francs per salary the first year, the amount diminushing by 1000 French francs every year ; if it signs between June and December 1999, it gets 7000 French francs the first year, 6000 the following year and so on. Tax reductions are higher if the company reduces its effective weekly duration of the work by 15 percent or more and if it commits on creating / preserving jobs by 9 percent (of its initial employment level).

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[36]This note remind an information that was largely discussed in M. Bunel [2002], V. Passeron [2000], H. Pham [2002].

[37]Recently, the Fillon law (law nu. 2003 - 47) implemented on January, 17th 2003, foresees to increase the potential overtime and replace the former Aubry II tax redution system by another one which concern all firms, either still working 39 hours, or already working 35 hours. For this reason, this law won't be of a very high importance in the framework of our study. See Pham [2003] for a small discussion dealing with that law.

The **'Aubry II' law** (law nu. 2000 - 37) confirms the reduction of the mandatory weekly duration of the work from 39 down to 35 hours after January, 1st 2000 for those firms employing more than 20 workers. As to incentives, firms implementing the 35 hours work week after January, 1st 2000 benefit from incentives only if they employ 20 or fewer than 20 people and commit on WTR and on job creations (or job preservations) at the same conditions[38] as those previously quoted for bigger than 20 workers firms before January, 1st 2000. Firms employing more than 20 workers but who do not still have implemented a WTR will benefit from a unique tax reduction decreasing with the wage rate; no incentives are given to those firms. This new employer's tax reduction system (on the small and medium wages) - we will name Aubry II structural help[39] - decreases with the wage down to 1.8 times the SMIC (French minimum wage); it replaces the old employer social contribution reduction system (1996) on the small wages, which used to be decreasing with the wage, down to 1.3 times the SMIC. For companies employing more than 20 workers, having implemented a WTR before January, 1st 2000 and having benefited from incentives before that date, the tax reduction is the sum of Aubry II structural help and of a part of the incentives she used to get before the year 2000.

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[38]Except if increasing jobs by 6 percent of the before WTR within the firm employment level means hiring fewer than 8 people: in this case, the firm is not forced to hire.

[39]Note that some firms which are (totally or partly) financed by the State are not allowed to benefit either from incentives or from the structural help (see M. Bunel [2002]).

Appendix 2 :   Surveys in use, basic and final data sources

Our study has been led on the basis of the merge of two data sources, one of which deals with recent collective Working Time Reduction agreements – Robien and Aubry I or II devices – , the other - the French "Changements organisationnels et l'Informatisation" COI survey - includes information on organizational devices and changes.

The COI survey

This survey is a matched employer-employee survey for French manufacturing and was led in 1997 (see N. Greenan and S. Hamon-Cholet [2001] for a detailed presentation). It contains information on organization contraints, organizational devices and strategies at the firm level in 1997 and the evolution between 1994 and 1997 for some of these variables. It is composed by seven firm questionnaires ("industrial enterprises", "agricultural and food industries" for industries ; "chartered accountants" and three for "do-it-yourself trade" in the services sectors) and by a salaried employee questionnaire, for which employees were randomly selected by group of 1 to 3 people per firm following her size[40]. For our purpose, we consider "industrial firms" (IF) and "food industries" (FI) surveys, whose questionnaires are quite similar – they only differ through question 23[41].

They both contain information for initially 4675 (respectively 970) enterprises in the IF survey case (respectively FI case) and give information on the use of 11 organizational devices in 1997 through questions Q4 (ISO 9001, ISO9002 and EAQF certification ; other certification system or total quality; value analysis, functional analysis or AMDEC; 5S Method or Total; Profit center organization; Formal in-house customer/ suppliers contracts; Just in time delivery and Just in time production) and Q5 (Autonomous work groups or self managed groups; Problem solving groups; Project groups). For question Q5, we constructed three dichotomous variables that take the value 1 if more than 10% of production workers are involved in the group and 0 else. Moreover, on the basis of question Q7, we built up a variable RNIV that indicates when the number of hierarchical layers increases and, on the basis of question Q6, a variable which takes the value 1 if the number of tasks done by the production worker increases between 1994 and 1997 and 0 else.

To merge theses two files and to distinguish between industries, we had to build up the NAF16 and NAF36 variables which take as a value the second letter of NF16 and NF36 when the company is part of "industrial firms" database and B and B0 otherwise, in correspondance with INSEE customs nomenclature. Else, all firms are being attributed a coefficient (POND variable) that measures the importance of the firm, following her size (number of salaried employees) and the business sector she is member of in the whole population (see N. Greenan and S. Hamon-Cholet [2001] for more details). We exclude all firms for which POND and NAF16 have no value

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[40]Contrarily to the firm questionnaire, salaried employees that have been questionned about their working conditions come from companies employing only 50 or more people.

[41]Note that at the moment, we let aside the questionnaire about "chartered accountants", because it is quite different from the two first cited. We'll look at such a case later.

or more generally for which we have no available information or those for which there were at least one missing value (case of more than 540 companies). After those operations, there are still 5104 companies remaining in our sample (24269.4 when taking into account the POND coefficient).

Robien, Aubry I and II Administrative surveys' agreements

This file refers to Robien (June, 11th 1996), Aubry I (June, 13th 1998) and Aubry II (January, 19th 2000) laws and contains data on collective Working Time Reduction (WTR) agreements: the WTR date of implementation, the date at which agreements were signed between Employers and Unions; the type of WTR agreement (i.e. if the production unit commits on job creations only, on job creations and preservations, on job preservation only or on none of these possibilities) and the number of workers she commits on to create or to preserve[42]; the WTR size (commitment on 10% or on 15% of before before WTR weekly hours of work); whether the firm benefits from incentives, structural help, both or none of them. Otherwise, some more individual characteristics are given (firm size before WTR, sector of activity)[43], all of this at the establishment level.

For the purpose of our analysis, we need to build up three variables to compare firms in terms of their WTR date of implementation. Given that days, months and years were available for agreement signing and effective WTR date of implementation, we create four variables: the two first measure the number of days that separate the agreement signing date (respectively effective WTR date of implementation) from the date the Robien law was enforced (June, 11th 1996). Since the two considered dates do not in general coincide, we take the difference between them as a proxy for the time to be required by the establishment to implement WTR (for example to proceed to reorganizations...) after signing an agreement. The last variable refers also to the date agreements were signed, but relatively to each device, this in order to take account for differences between devices[44]. For convenience, we convert these figures in years. Else, for all three laws, three other variables have been created each one taking the 1 value when the firm signs an agreement corresponding to that device.

Concerning the type of signed agreement (commitment on job creations, job preservations, both or none of them), we built only one variable saying whether or not the establishment commit on job creations. To verify this variable was relevant, we built up another variable which takes the 1 value as job creations were different from zero and 0 else. We find identical descriptive statistics through this new variable.

As to the size of the Working Time Reduction, we try to cope with before and after weekly / annually working time to get a continuous variable dealing with the percentage reduction in the weekly hours of work. Nevertheless, establishments often declare 39 weekly hours of work before and 35 weekly hours of work after WTR and

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[42]We can not use this last variable since it appears to be affected by measurement errors (see H. Pham [2001]).

[43]Note that contrary to the former one, this file – whose version dates from May 30th 2003 – does not provide us any further information on wage compensation, after WTR reorganization (and the way firms used to achieve it).

[44]Such a variable will also be later constructed for the WTR date of implementation.

hence no more information is provided in comparison to that what is already brought through the two dichotomous variables previously quoted commiting on either 10% or on 15% WTR size). Consequently, we let this variable aside and consider only the two dichotomous ones.

Finally, we removed from sample all observations for which : i) there were at least one missing value; ii) an agreement (respectively a WTR) was declared to be signed (respectively to have been implemented) before Robien law enforcement or after 2004; iii) weekly hours of work (respectively annually hours of work) were declared to be greater after than before WTR has been implemented. This database contains 463938 establishments before and about 360000 after "cleaning".

Merging the two surveys

Before merging WTR administrative survey's agreements to COI manufacturing industries survey, we had to proceed to some modifications. Firstly and contrary to COI database, administrative WTR surveys were led at the establishment level. Given that we have the mean number of workers[45] both at the firm level and at the establishment level, we may consider only those companies with one single as soon as these two numbers are equal. However, we suffer from massive data loss: about one third of companies that are both in the WTR survey and in the COI survey disappear from our sample. Moreover, since we want to describe 1997 reorganization within the firm before she gets a WTR only through the COI survey, we do not need to exclude all "non single establishments" companies. Indeed, in the WTR files, one variable (REF) points to the reference establishment and is used to count the number of firms at the national level. Hence, we merge COI and WTR agreements by SIREN and exclude from our sample all establishments for which the reference variable takes the 0 value. Note that before proceeding to the merge, we created one variable which allows us to point at WTR firms. Finally, after merging, there were 4644 firms or 2780 firms remaining in our sample, as we take account or not for companies that still do not have implemented a WTR.

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[45]Computed on the last twelve months preceeding WTR implementation (see H. Pham [2001] for a complete dictionnary describing all variables appearing in the administrative WTR surveys'agreements).

Table 8: **Modeling the probability for a company to be reorganized (2 organizational devices or more) : maximum likelihood estimates of a binary logistic model. Sample : intersection of COI and WTR surveys.**

Explicative variables/ Specification	All attributes	Only 10% attributes
Intercept :	−3.01***	−2.87***
Sectors :		
Food industries	0.19	−
Consumption goods	−0.66***	−0.72***
Car industries	0.30	−
Equipment goods	0.48***	0.41***
Intermediary goods	ref	ref
Energy	0.10	−
Log of number of workers :	0.49***	0.51***
Rather important fators in the firm startegy :		
New products	0.30**	0.37***
Product differenciation	0.16	−
Quality improvement	0.54**	0.57***
New production processes	0.33***	0.33***
Cost reduction	−0.07	−
Organizational constraints :		
Higher market competition	0.11	−
Market uncertainty	0.02	−
Client constraints	0.21*	0.21*
Provider constraints	−0.11	−
Administrative constraints	−0.05	−
Shareholding	0.26*	0.31**
Other (merge...)	0.16	−
Equipment Use also :		
By night	0.21*	0.25**
On Saturday	0.11	−
On Sunday	−0.14	−0.25*
Production ajustment to demand:	−0.44*	−0.43**
Random ajustment	0.36^{b}**	0.34*
Expected ajustment	0.02	−
Ways used to ajust production :		
Overtime	0.02^{b}	−
Temporary labour force	0.44***	0.46***
Finite term contracts	−0.06	−
Part time work	0.52***	0.45***
Part time unemployment	−0.23	−
Modulation	0.22*	0.19*
Annualization	−0.20*	−
Subcontracting	0.09	−
Production storage	0.27***	0.28***

Notes :   Association of predicted probability and observed responses.
Percent concordant : 77.4% ; percent discordant : 22.3%. Legend for
figures: see Tables 6 and 7.

Sources :   Author's computations after merging Manufacturing part of COI survey
and administrative survey of Robien, Aubry I and II agreements.

Table 9: **Modeling the probability for a company to be reorganized : maximum likelihood estimates of a binary logistic model, WITHOUT TAKING ACCOUNT FOR THE 1997 EMPLOYMENT LEVEL in the explicative variables. Sample : intersection of COI and WTR.**

Explicative variables/ Specification	All attributes	Only 10% attributes
Intercept :	-1.13***	-0.99***
Sectors :		
Food industries	0.07	—
Consumption goods	-0.53***	-0.56***
Car industries	0.48	—
Equipment goods	0.57***	0.54***
Intermediary goods	ref	ref
Energy	0.30	—
Log of number of workers :	—	—
Rather important fators in the firm startegy :		
New products	0.39***	0.49***
Product differenciation	0.23**	—
Quality improvement	0.50**	0.55***
New production processes	0.33***	0.33***
Cost reduction	0.03	—
Organizational constraints :		
Higher market competition	0.16	0.18*
Market uncertainty	-0.02	—
Client constraints	0.15	—
Provider constraints	-0.20*	-0.20*
Administrative constraints	-0.15	—
Shareholding	0.40***	0.40***
Other (merge...)	0.28**	0.28**
Equipment Use also :		
By night	0.54****	0.53***
On Saturday	0.26**	0.27**
On Sunday	-0.20	-0.24*
Production ajustment to demand:	-0.60**	-0.53**
Random ajustment	0.39^{b}***	0.36***
Expected ajustment	0.03	—
Ways used to ajust production :		
Overtime	0.03^{b}	—
Temporary labour force	0.53***	0.56***
Finite term contracts	-0.01	—
Part time work	0.64***	0.60***
Part time unemployment	-0.11	—
Modulation	0.28**	0.25**
Annualization	-0.16	—
Subcontracting	0.10	—
Production storage	0.34***	0.36***

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Notes : Association of predicted probability and observed responses.
Percent concordant : 74.9% ; percent discordant : 24.8%. Legend for figures: see Tables 6 and 7.

Sources : Author's computations after merging Manufacturing part of COI survey, and administrative survey of Robien, Aubry I and II agreements.

Table 10: **Average Treatment Effect for a firm of being reorganized (2 organizational devices or more) on her WTR date of implementation and on other WTR variables provided by the administrative surveys'agreements, restricting to the common support. Following the propensity score specification does or not take account for the 1997 employment level. Overall sample is under consideration.**

Variable/ Estimator	ATE[a]				
	Naive	N.Nei.[c]	Re-W.[d]	N.Nei.[b,c]	Re-W.[b,d]
Already a WTR[e]:	0.134***	−0.017	−0.015	0.043*	0.040**
	(0.016)	(0.019)	(0.018)	(0.023)	(0.019)
Date[f]:					
of Agreement	−0.063	0.010	−0.021	−0.119*	−0.094
	(0.044)	(0.076)	(0.066)	(0.070)	(0.058)
of Implementation	−0.177***	−0.020	−0.039	−0.157**	−0.144***
	(0.042)	(0.067)	(0.054)	(0.068)	(0.050)
Delay	−0.114***	−0.030	−0.018	−0.038	−0.050
	(0.031)	(0.052)	(0.045)	(0.040)	(0.036)
Job creation:					
Commitment[h]	0.082***	0.022	0.039	0.046	0.054*
	(0.02)	(0.033)	(0.028)	(0.032)	(0.026)
Jobs created[i]	6.10 ***	0.870	1.470**	4.315***	4.363***
	(0.608)	(0.875)	(0.659)	(0.703)	(0.609)
Incentives [e]:	−0.032	−0.017	−0.023	−0.011	−0.013
	(0.021)	(0.035)	(0.031)	(0.031)	(0.026)
	ATET[j]				
Already a WTR[e]:	0.134***	−0.028	−0.001	0.045*	0.037*
	(0.016)	(0.023)	(0.027)	(0.026)	(0.020)
Date[f]:					
of Agreement	−0.063	0.045	0.040	−0.149*	−0.104*
	(0.044)	(0.089)	(0.107)	(0.082)	(0.062)
of Implementation	−0.177***	0.012	0.005	−0.187***	−0.156***
	(0.042)	(0.078)	(0.104)	(0.071)	(0.052)
Delay	−0.114***	−0.033	−0.035	−0.037	−0.052
	(0.031)	(0.054)	(0.046)	(0.053)	(0.039)
Job creation:					
Commitment[h]	0.082***	0.021	0.047	0.066*	0.063**
	(0.02)	(0.039)	(0.033)	(0.037)	(0.028)
Jobs created[i]	6.108***	1.253	1.826**	5.177***	5.037***
	(0.608)	(1.090)	(0.829)	(0.834)	(0.713)
Incentives [e]:	−0.032	−0.030	−0.036	−0.005	−0.015
	(0.021)	(0.039)	(0.031)	(0.038)	(0.028)

Notes :   Bootstraped standard errors in brackets. Significancy levels : * (10%), **(5%), ***(1%). [a,j]Average Treatment Effect (resp. on the Treated). [b]Propensity score specification does not include the 1997 employment level. [c,d]Nearest Neighbour matching (resp. Re-weighting) estimator. [e,h]Percentage difference.[f]Difference in years. [g]Date of agreement relatively to each law, difference in years.

Sources :   Author's computations after merging Manufacturing part of COI survey, and administrative survey of Robien and Aubry I and II agreements.

Table 11: **Average Treatment Effect for a firm of being reorganized (2 organizational devices or more) on her WTR date of implementation and on other WTR variables provided by the administrative surveys'agreements, restricting to the common support. Following the propensity score specification does or not take account for the 1997 employment level. Only firms with fewer than 500 workers are under consideration.**

	ATE[a]				
Variable/ Estimator	Naive	N.Nei.[c]	Re-W.[d]	N.Nei.[b,c]	Re-W.[b,d]
Already a WTR[e]:	0.105*** (0.017)	−0.006 (0.020)	−0.005 (0.020)	0.027 (0.022)	0.027 (0.019)
Date[f] :					
of Agreement	−0.029 (0.047)	0.007 (0.065)	−0.042 (0.065)	−0.055 (0.064)	−0.068 (0.056)
of Implementation	−0.146*** (0.045)	−0.013 (0.073)	−0.042 (0.065)	−0.129* (0.075)	−0.129*** (0.048)
Delay	−0.117*** (0.033)	−0.043 (0.041)	−0.023 (0.042)	−0.016 (0.041)	−0.061* (0.036)
Job creation :					
Commitment[h]	0.078*** (0.023)	0.040 (0.033)	0.054* (0.028)	0.050 (0.031)	0.053** (0.027)
Jobs created[i]	2.160*** (0.312)	0.659 (0.430)	0.995*** (0.361)	1.570*** (0.383)	1.462*** (0.337)
Incentives [e]:	−0.005 (0.022)	0.004 (0.031)	0.002 (0.027)	−0.022 (0.030)	0.009 (0.025)
	ATET[j]				
Already a WTR[e]:	0.105*** (0.017)	−0.029 (0.025)	−0.017 (0.019)	0.008 (0.029)	0.021 (0.019)
Date[f] :					
of Agreement	−0.029 (0.047)	0.028 (0.079)	−0.033 (0.078)	−0.099 (0.085)	−0.080 (0.067)
of Implementation	−0.146*** (0.045)	−0.012 (0.073)	−0.072 (0.056)	−0.129* (0.075)	−0.144*** (0.055)
Delay	−0.117*** (0.033)	−0.041 (0.045)	−0.042 (0.055)	−0.030 (0.050)	−0.065 (0.043)
Job creation :					
Commitment[h]	0.078*** (0.023)	0.040 (0.038)	0.065** (0.032)	0.053 (0.036)	0.058** (0.027)
Jobs created[i]	2.160*** (0.312)	0.881* (0.511)	1.256*** (0.422)	1.776*** (0.412)	1.703*** (0.344)
Incentives [e]:	−0.005 (0.022)	−0.010 (0.034)	0.005 (0.030)	0.002 (0.036)	0.015 (0.027)

Notes :   Bootstraped standard errors in brackets. Significancy levels : * (10%), **(5%), ***(1%). [a,j]Average Treatment Effect (resp. on the Treated). [b]Propensity score specification does not include the 1997 employment level. [d,c]Nearest Neighbour matching (resp. Re-weighting) estimator. [e,h]Percentage difference.[f]Difference in years. [g]Date of agreement relatively to each law, difference in years.

Sources :   Author's computations after merging Manufacturing part of COI survey, and administrative survey of Robien and Aubry I and II agreements.

Table 12: **Average Treatment Effect for a firm using (n) instead of $(n-i)$ organizational devices on her WTR date of implementation and on other WTR variables provided by the administrative surveys' agreements, restricting to the common support. Following the propensity score specification does or not take account for the 1997 employment level. Part one.**

Var./Estim.	Gap	Comparison	Naive	Kernel^{a,b}	Kernel^a
Already a WTR^c:	1 device	1 vs 0 device	0.016	-0.046^*	0.017
		2 vs 1 devices	0.058^*	0.036	0.053^*
		8 vs 7 devices	0.098^{**}	0.066^*	0.087^{**}
	2 devices	2 vs 0 devices	0.074^{***}	-0.001	0.067^{**}
		3 vs 1 devices	0.075^{***}	0.035	0.069^{***}
		4 vs 2 devices	0.055^*	0.009	0.036
		9 vs 7 devices	0.089^{**}	0.024	0.058
	3 devices	3 vs 0 devices	0.091^{***}	-0.018	0.084^{***}
		4 vs 1 devices	0.113^{***}	0.031	0.081^{***}
		6 vs 3 devices	0.093^{***}	0.015	0.064^*
		7 vs 4 devices	0.023	-0.064^*	0.005
		8 vs 5 devices	0.117^{***}	0.070^*	0.109^{***}
		10 vs 7 devices	0.119^{***}	0.037	0.094^{**}
	4 devices	4 vs 0 devices	0.129^{***}	-0.024	0.098^{**}
		5 vs 1 devices	0.112^{***}	0.033	0.092^{***}
		6 vs 2 devices	0.110^{***}	0.029	0.072^{**}
		7 vs 3 devices	0.057	-0.084^{**}	0.024
		8 vs 4 devices	0.116^{***}	0.048	0.103^{***}
		9 vs 5 devices	0.109^{**}	0.075^*	0.089^{**}
		10 vs 6 devices	0.083^{**}	0.053	0.087^{**}
	5 devices	5 vs 0 devices	0.128^{**}	-0.013	0.112^{***}
		6 vs 1 devices	0.168^{***}	0.039	0.115^{***}
		7 vs 2 devices	0.074^*	-0.098^{**}	0.027
		8 vs 3 devices	0.154^{***}	0.057	0.152^{***}
		9 vs 4 devices	0.108^{***}	0.054	0.089^{**}
		10 vs 5 devices	0.139^{***}	0.025	0.132^{**}
Date of agreement^f:	1 device	4 vs 3 devices	0.111	0.128^*	0.126
	2 devices	10 vs 8 devices	0.208^*	0.215^*	0.200^*
	4 devices	6 vs 2 devices	-0.088	-0.106	-0.150^*
		8 vs 4 devices	-0.210^*	-0.190	-0.199^*
	5 devices	6 vs 1 devices	-0.123	-0.086	-0.176^*

Notes : Significance levels: *(10%), **(5%), ***(1%). ^{a}Pairwise comparison; matching on the propensity score. ^{b}Propensity score specification does include the 1997 employment level. ^{c}Percentage difference. ^{f}Difference in years.

Sources : Author's computations after merging Manufacturing part of COI survey and administrative survey of Robien, Aubry I and II agreements.

Table 13: **Average Treatment Effect for a firm using** (n) **instead of** $(n-i)$ **organizational devices on her WTR date of implementation and on other WTR variables provided by the administrative surveys' agreements, restricting to the common support. Following the propensity score specification does or not take account for the 1997 employment level. Overall sample is under consideration. Part two.**

Var./Estim.	Gap	Comparison	Naive	Kernel^{a,b}	Kernel^a
Implementation^f :	1 device	8 vs 7 devices	-0.186^*	-0.158	-0.176^*
	2 devices	2 vs 0 devices	-0.114	-0.089	-0.117^*
		6 vs 4 devices	-0.161^{**}	-0.152^{**}	-0.172^{**}
		10 vs 8 devices	0.192^*	0.197^*	0.183
	3 devices	3 vs 0 devices	-0.160^{**}	-0.117	-0.183^{**}
		8 vs 5 devices	-0.200^{**}	-0.159	-0.197^*
	4 devices	4 vs 0 devices	-0.117	-0.073	-0.136^*
		5 vs 1 devices	-0.159^{**}	-0.104	-0.148^*
		6 vs 2 devices	-0.165^{**}	-0.141^*	-0.193^{**}
		8 vs 4 devices	-0.292^{***}	-0.282^{***}	-0.283^{***}
	5 devices	5 vs 0 devices	-0.209^{***}	-0.124	-0.214^{**}
		6 vs 1 devices	-0.228^{***}	-0.187^{**}	-0.252^{***}
		8 vs 3 devices	-0.249^{**}	-0.166	-0.245^{**}
		9 vs 4 devices	-0.198^{**}	-0.202^*	-0.230^{**}
Delay^f :	1 device	1 vs 0 devices	-0.099^*	-0.069	-0.097^*
	2 devices	2 vs 0 devices	-0.128^{**}	-0.053	-0.111^*
	3 devices	5 vs 2 devices	-0.018	0.074^*	-0.015
		6 vs 3 devices	-0.124^{***}	-0.097^*	-0.106^{**}
		8 vs 5 devices	-0.086^*	-0.067	-0.067
	4 devices	4 vs 0 devices	-0.150^{***}	-0.031	-0.026
		6 vs 2 devices	-0.077^*	-0.029	-0.052
		7 vs 3 devices	-0.135^*	-0.127^*	-0.130^{**}
		8 vs 4 devices	-0.083	-0.091^*	-0.083
	5 devices	5 vs 0 devices	-0.147^{***}	-0.046	-0.078
		6 vs 1 devices	-0.106	-0.075	-0.088^*
		8 vs 3 devices	-0.151^{***}	-0.156^{***}	-0.141^{***}
		10 vs 5 devices	-0.101^{**}	-0.019	-0.059

Notes :   Significancy levels: *(10%), **(5%), ***(1%). ^{a}Pairwise comparison; matching on the propensity score. ^{b}Propensity score specification does include the 1997 employment. ^{f}Difference in years.

Sources :   Author's computations after merging Manufacturing part of COI survey and administrative survey of Robien, Aubry I and II agreements.

Table 14: **Average Treatment Effect for a firm using** (n) **instead of** $(n-i)$ **organizational devices on her WTR date of implementation and on other WTR variables provided by the administrative surveys' agreements, restricting to the common support. Following the propensity score specification does or not take account for the 1997 employment level. Overall sample is under consideration. Part three.**

Var./Estim.	Gap	Comparison	Naive	Kernel[a,b]	Kernel[a]
Job creations[g]:	1 device	1 vs 0 device	1.256**	0.313	1.117**
		3 vs 2 devices	1.758*	1.416	1.771*
		6 vs 5 devices	2.325*	1.474	2.422*
		7 vs 6 devices	4.836*	1.981	4.930*
		10 vs 9 devices	18.345***	14.468***	17.426***
	2 devices	2 vs 0 devices	0.996*	−0.184	0.800
		4 vs 2 devices	2.754***	1.230	2.407***
		6 vs 4 devices	2.568**	1.133	2.395*
		7 vs 5 devices	7.161***	2.888	6.264***
		8 vs 6 devices	6.014**	3.125	5.789**
		10 vs 8 devices	13.670***	5.450*	11.643***
	3 devices	3 vs 0 devices	2.754***	0.890	2.391***
		4 vs 1 devices	2.494***	0.372	1.995***
		5 vs 2 devices	2.996***	1.496*	2.840***
		6 vs 3 devices	3.563***	0.923	3.445***
		7 vs 4 devices	7.404***	2.806*	6.222***
		8 vs 5 devices	8.340*	3.696	7.484**
		10 vs 7 devices	14.848*	5.563*	10.382***
	4 devices	4 vs 0 devices	3.750***	0.495	2.786***
		5 vs 1 devices	2.736***	0.782	2.431***
		6 vs 2 devices	5.322***	2.691**	5.199***
		7 vs 3 devices	8.399***	1.936	6.209***
		8 vs 4 devices	8.582***	3.167	7.904***
		9 vs 5 devices	3.665**	0.975	3.594*
		10 vs 6 devices	19.684*	8.334***	17.423***
	5 devices	5 vs 0 devices	3.992***	1.029	3.480***
		6 vs 1 devices	5.061***	1.809*	4.826***
		7 vs 2 devices	10.158***	2.693**	7.643***
		8 vs 3 devices	9.578***	2.418	8.414
		9 vs 4 devices	3.907***	1.048	3.668
		10 vs 5 devices	22.009***	7.313***	17.606***

Notes : Significance levels: *(10%), **(5%), ***(1%). [a]Pairwise comparison; matching on the propensity score. [b]Propensity score specification does include the 1997 employment level. [g]Difference in the number of forecasted job creations.

Sources : Author's computations after merging Manufacturing part of COI survey and administrative survey of Robien, Aubry I and II agreements.

Table 15: **Average Treatment Effect for a firm using (n) instead of $(n-i)$ organizational devices on her WTR date of implementation and on other WTR variables provided by the administrative surveys' agreements, restricting to the common support. Following the propensity score specification does or not take account for the 1997 employment level. Overall sample is under consideration. Part four.**

Var./Estim.	Gap	Comparison	Naive	Kernel[a,b]	Kernel[a]
Commitment[c]:	1 device	1 vs 0 devices	0.106***	0.102***	0.097***
	2 devices	2 vs 0 devices	0.087**	0.080**	0.081**
		5 vs 3 devices	0.074*	0.064*	0.058
		6 vs 4 devices	0.083**	0.082**	0.080*
	3 devices	3 vs 0 devices	0.083**	0.048	0.067*
		5 vs 2 devices	0.070*	0.072*	0.065*
		6 vs 3 devices	0.119***	0.104**	0.104***
		10 vs 7 devices	0.077	0.078*	0.082*
	4 devices	4 vs 0 devices	0.119***	0.081*	0.096**
		6 vs 2 devices	0.114***	0.119***	0.112***
	5 devices	5 vs 0 devices	0.157***	0.137***	0.146***
		6 vs 1 devices	0.095**	0.086**	0.080**
Incentives[c]:	1 device	4 vs 3 devices	−0.112***	−0.112***	−0.112***
	2 devices	4 vs 2 devices	−0.085**	−0.083**	−0.070**
		5 vs 3 devices	−0.079**	−0.085**	−0.074*
		10 vs 8 devices	−0.108**	−0.091*	−0.100*
	3 devices	4 vs 1 devices	−0.080**	−0.071*	−0.074*
		6 vs 3 devices	−0.087**	−0.052	−0.049
	4 devices	4 vs 0 devices	−0.072**	−0.060	−0.053
		7 vs 3 devices	−0.114***	−0.102**	−0.110**
		8 vs 4 devices	0.077*	0.084*	0.074
	5 devices	7 vs 2 devices	−0.086**	−0.070	−0.062

Notes :   Significancy levels: *(10%), **(5%), ***(1%). [a]Pairwise comparison; matching on the propensity score. [b]Propensity score specification does include the 1997 employment level. [c]Percentage difference.

Sources :   Author's computations after merging Manufacturing part of COI survey and administrative survey of Robien, Aubry I and II agreements.

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