

Short-Time Working and Working Time Reduction: Which Tendencies?

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Abstract

Short-time working (STW) is a device which permits firms to avoid lay-offs in case of strong economic temporary difficulties. Between 1995 and 2005, French STW authorisations have strongly decreased in a context of working time reduction and of change in the laws of the device. This paper tries to answer to the following questions: has working time reduction decreased STW authorisations? Has anticipating working time reduction a stronger influence on STW? Answering these questions consists in measuring the average treatment effect of working time reduction on STW authorisations. This test raises the selection bias methodological problem. To circumvent it, we estimate evaluation models with matching estimators. Econometric modelling will be implemented on a balanced panel of 6 189 French establishments, obtained by merging three data sources: the “STW authorisations” databases, the “Working Time Reduction” database and firm databases. The results of the econometric estimation highlight a global diminution in the STW authorizations due to working time reduction.

Key words:

Short –time working, flexibility, working time reduction, econometric evaluation methods, matching estimators, average treatment effects.

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Introduction

The fast modifications in firms' environment associated to a strong competition and the diffusion of information and communication technologies generate an increasing need for flexibility. A rich empirical literature concerning the evolution of flexibility practices has developed. In France, this literature mainly analyzes the use of various types of employment contracts (fixed-term contracts, temporary work) or of overtime. Employers are using these types of contracts in order to face slacks and peaks of activity. Fixed-term contract and temporary work use progressed strongly in France. Their utilisation reaches today a 10 % level. French literature is also focused on the implementation and the evaluation of the working time reduction (WTR). Many papers present the WTR as an occasion for employers to introduce or to amplify flexibility in their firms. Once WTR implemented, the legislation concerning the short-time working (STW) recourse evolved. Until now no study has analyzed the impact of the WTR on the STW recourse.

STW is a device which permits firms to avoid lay-offs in case of strong economic temporary difficulties or exceptional circumstances such as: disasters, important building work and restructuring, supplying difficulties, etc. By applying STW, the establishment can temporarily reduce its activity below the legal working time duration or it can temporarily stop a part or its entire activity. The flexibility generated by the STW use is treated only in a peripheral way in the French empirical literature. Meanwhile, its efficiency according to the possible methods of implementation is discussed in many countries (Wright, 1991; Mosley, 1995; Houseman & Abraham, 1995; Abowd & Allain, 1997). The similar instruments to the French STW device are: the STW instrument in Great Britain, the Italian "Cassa Integrazione Guadagni" (CIG), the German "Kurzarbeitergeld", the "Short-Time Compensation Program" (United States and Canada) or under certain aspects the "temporary layoffs" instrument (United States). In France, the studies analyzing the STW device are primarily qualitative. They underline the adjustment methods of STW to the economic situation. From a quantitative point of view, each year, the Statistical Department of the French Ministry of Labor describes the recourse to the STW authorisations.

Although no data is available to directly measure the effective use of STW, the Statistical Department of the French Ministry of Labor in collaboration with the Departmental Directions of Work and Employment monthly produce the STW authorization files. The STW authorizations represent the number of days required by the establishments and authorized by the Departmental Directions of Work and Employment. The STW days remunerated by a specific allowance are called STW compensated days. In general, establishments do not entirely use the STW authorisations. Between 1995 and 2005, approximately half of the STW authorized days were compensated. Thus, STW

authorisations represent an estimated indicator of the establishments' needs in terms of STW and they are a sign of a preventive strategy.

In average, between 1995 and the 2005, STW authorizations have affected nearly 1 % of the French establishments and 2 % of their employees. STW authorizations have strongly decreased during this period. In 2005, 1.8 million STW days were authorized in France. Eight years before, at an equivalent economic situation, the number of STW authorized days was approximately six times higher.

Between 1995 and 2005, a series of shocks could affect STW authorizations: in 1996, the disappearance of a similar device (the TRILD), WTR and the STW reform which accompanied it, various economic shocks, bad weather in 2000, etc. In this paper, we study the impact of the WTR on the STW recourse. More precisely, we concentrate on the reduction of the effective working time duration in the context of one of the WTR laws (the Aubry II law).

A great symmetry exists between STW and WTR, since STW represents a working time flexibility tool (Brunhes, 1989). Moreover, in the economic literature, STW is mainly analyzed in the context of the flexibility theory. STW can also be studied in accordance with other theoretical approaches such as the market segmentation, the theory of the "implicit contracts" (for more details see Rosen, 1985) or the "flexicurity" approach.

In this article, the data impose us the flexibility approach. Flexibility can be defined as a mode of adaptation of the firms to the requirements of the market. It can also represent a labor force management type. The current debate on the increasing need for flexibility led to many definitions of this concept (Boyer, 1986). Generally, in order to categorize flexibility we can cross two criteria (Atkinson & Meager, 1986; Goudswaard & de Nanteuil, 2000). The first one opposes numerical flexibility to functional flexibility. The second one opposes external flexibility to internal flexibility.

The STW device represents on the one hand, a quantitative flexibility tool because it acts on the volume of worked hours, and on the other hand, it is an internal flexibility tool since it affects the workers of the establishment. Intern numerical flexibility tools principally touch the working time organization (partial time, WTR, etc).

From a legal point of view, WTR permits establishments to increase their performances mainly because of the working time reorganization. 67% of the French firms which reduced their working time in 1999 and modified their organization, consider that this allowed them to better adapt to the activity fluctuations. Consequently, by modifying the internal working time organization, establishments should reduce their recourse to the flexible practices such as STW.

From this point of view, WTR and the change in the STW legislation which accompanied it would imply a decrease in the STW authorizations. WTR is a very complex instrument, whose implementation was progressively made (between 1996 and 2005). Within establishments, methods and periods of implementation are very heterogeneous. Some establishments reduce their working time in an anticipated way, others do not. After the reduction of the legal working time duration (the legal working time duration reduced from 39 hours per week to 35 hours), some establishments did not reduce their effective working time preferring to pay for overtime. To take into account the heterogeneity of the WTR within French establishments, we suppose that the effects of the WTR on the STW device are stronger as the WTR was implemented in an anticipated way. Consequently, this leads to test two hypotheses:

H1: establishments which reduced in an anticipated way their effective working time duration ask less for STW authorizations than those which did not reduce their working time.

H2: establishments which reduced in an anticipated way their effective working time duration ask less for STW authorizations than those which reduced their effective work duration in a no anticipated way.

In the second hypothesis, the paper compares two populations which both reduced their working time (anticipator WTR establishments and no-anticipator WTR establishments). Testing these two hypotheses requires the measure of the average treatment effect of the anticipated WTR on STW authorizations. This raises the selection bias methodological problem because the choice of reducing working time is not independent to the STW recourse. For this reason, we test evaluation models with matching estimators (Heckman & Ichimura and Todd, 1998) on a balanced panel of 6 189 French establishments. Establishments in our data belong to firms with at least 50 employees and they cover all industries. The sample is obtained by merging three data sources: the “STW authorisations” databases, the “Working Time Reduction” database and firm databases.

The results of the comparison between the anticipator WTR establishments and those that didn't reduce at all their working time are very contrasted (H1). Moreover, the differences between the STW recourse are weak. Concerning the comparison between the anticipator WTR establishments and the no-anticipator WTR establishments, results are more convincing by their importance (H2). So, in this case, the anticipation of the WTR decreases very strongly the STW recourse. Much more than the WTR, it seems that its anticipation is at the origin of a weaker use of the STW device. Some economic indicators help understanding this phenomenon: good levels of labor productivity bring closer the

anticipator WTR establishments to those who did not reduce their working time, and clearly differentiate them from the no-anticipator WTR establishments.

The article is organized as follows. In the first section, we present the STW device, its change of legislation and its evolution between 1995 and 2005. Data and the models are described in the second section. Results are analyzed in the third section. Conclusion summarizes the principal results and discusses them.

I. The Short-Time Working Device

I-1- STW legislation

The objective of the STW device is to help establishments to overcome economic difficulties and to avoid the dismissal of their employees. STW can be considered as a tool of preventive economic aid, which allows employees to keep a contractual bond with their employer. Employees perceive a compensation for their loss of wages caused by the temporary stop of activity. When STW exceeds four weeks, this phenomenon is called *total STW*. In this case, employees with a suspended contract can benefit from unemployment allowance (for a maximal duration of 6 months).

The decree of June 28th, 2001 gives the current STW legislation. This decree is directly related to the implementation of the WTR device. The STW recourse becomes conditioned by the methods of the WTR application. The main goal of the decree is to refocus STW on its initial role of maintaining employees in employment in case of strong economic difficulties. Once the WTR implemented, overtime or STW should not constitute any more the two only means of adaptation to the variations of activity. Since 2001, establishments have had to use in priority the adjustment methods associated to WTR.

The reform seeks to clarify applicable procedures, while modifying three dimensions of the STW regulation: the compensation, the attribution and the refunding of the STW device. After June 2001, obtaining STW authorizations procedure becomes more complex although the legislator's ambition is to preserve the accessibility to the device. In this context, we question about the possible substitutability between the various devices of intern numerical flexibility (WTR and STW) and about the impact of the STW legislative change.

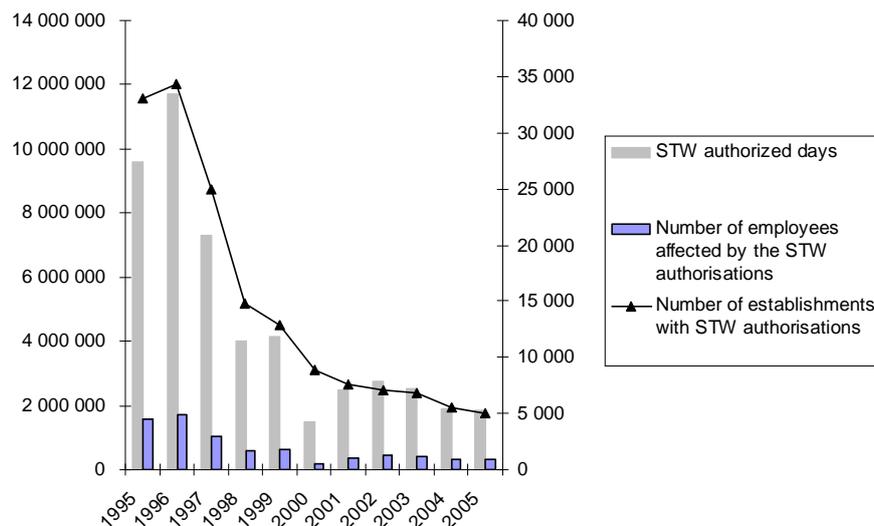
WTR represents the most important shock which affected STW between 1995 and 2005. The WTR impact expresses a double shock:

- From January 1st, 2000, the legal duration of work was reduced to 35 hours per week for the firms with more than 20 employees and from January 1st, 2002 for the firms with 20 employees or less. The flexibility induced by the WTR could lead to a reduction in the STW recourse by a substitution effect.
- The reduction of the legal working time duration made unsuited the STW legislation. The 2001 decree may have disincentive effects related to the STW use.

These two measurements carried out jointly, are part of the same reform and their effects on the STW authorizations cannot be identified separately.

I-2 STW authorisations between 1995 and 2005

Graph 1: Tendencies over 11 years



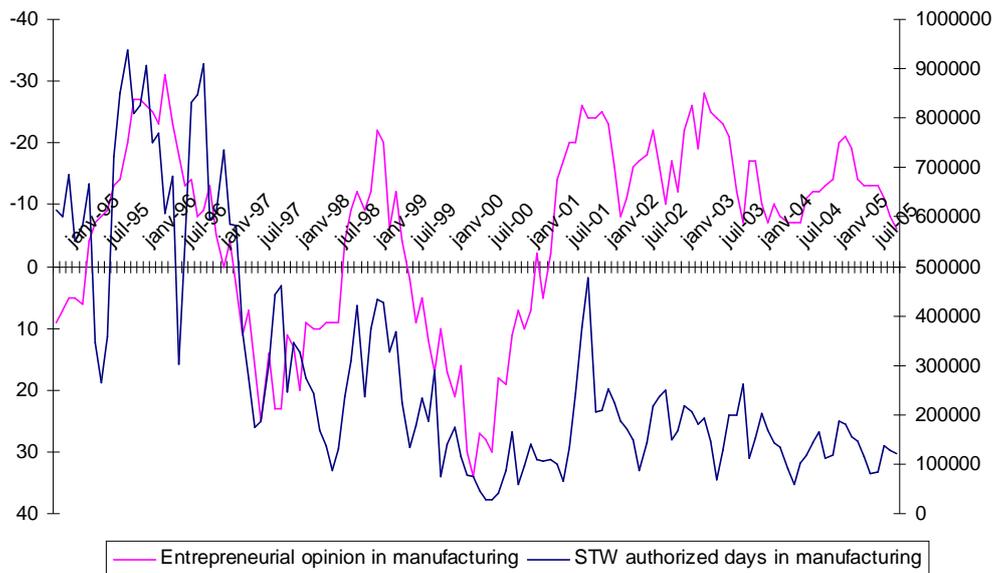
Source: Annual STW authorization panel obtained from the monthly STW authorization databases covering the period 1995- 2005 (the Statistical Department of the French Ministry of Labor and the Departmental Directions of Work and Employment).
Field: more than 93 000 French establishments having STW authorizations (all sizes and all industries).

Graph 1 describes the evolution of the STW authorizations between 1995 and 2005 through three measures: the number of STW authorized days (on the left scale), the number of employees affected by the STW authorizations (on the left scale) and the number of establishments which obtained the STW authorizations (on the right scale)¹. STW authorizations strongly decreased for the three measures. Between 1996 and 2005, the number of authorized days was divided by 6 (it decreased from 11.7 million to 1.8 million) and the number of employees affected by the authorizations decreased

¹ For a complete description of the STW recourse between 1995 and 2005 see Calavrezo & Duhautois and Walkowiak, 2006.

from 1.7 million to 300 000 (a 82 % fall). Concerning the number of establishments with STW authorisations, the fall reaches 85 %, diminishing from 34 000 establishments to 5 000. At the end of the '90thies, the decreasing can be partly related to a constant economic growth. From 2001, date of the economic reversal, the increase in the STW recourse was not massive. We can assume that establishments are less concerned with the STW authorizations as a consequence of the WTR implementation.

Graph 2: Economic situation and number of STW authorized days in manufacturing



Source: Monthly survey of the economic situation (the French National Institute of Statistics) and monthly STW authorization databases (the Statistical Department of the French Ministry of Labor and the Departmental Directions of Work and Employment).

Field: Manufacturing

Note reading: The left scale is reversed so that the high part of the graph indicates a degraded economic situation and the low part a good economic situation.

But does the economic situation entirely explain the downward trend of the STW recourse? Graph 2 presents the connection between the economic situation and the STW use over the last decade by illustrating two monthly series: the entrepreneurial opinion in manufacturing (on the left scale) and the number of STW authorized days in manufacturing (on the right scale). This graph highlights the good adjustment between the business cycle and the STW authorizations. Between 1995 and 2005, STW authorizations can be regarded as a good indicator of the economic situation because STW authorizations are contracyclical. The graph also shows a weak disconnection in 1998 which coincides with the moment of implementation of one of the WTR laws and a strong disconnection when the legal work duration is obligatorily reduced for the firms with more than 20 employees (in 2000). This graph seems to confirm the importance of the impact of the WTR on the STW recourse.

II. The empirical approach

II-1 The data

In order to evaluate the causal effect of the anticipated WTR on the STW authorizations, we will utilize three databases: the “STW authorisations” databases, the “Working Time Reduction” database and firm databases.

The monthly STW authorization databases are produced by the Statistical Department of the French Ministry of Labor in collaboration with the Departmental Directions of Work and Employment. These databases provide exhaustive information about STW authorisations obtained by French establishments between 1995 to 2005. The establishments belong to all industries. The available information relates to the number of STW authorized days, the number of employees affected by the authorizations, the causes of the recourse (economic situation, provisioning difficulties, disasters, bad weather, modernization or reorganizations, other exceptional circumstances), the perimeter of the use of the device (the entire establishment or a part of the establishment) as well as the former STW recourse. Certain variables concerning the characteristics of the establishments (size, industry, etc.) are also available. From 2002, the collected data were enriched by the effective working time duration, the compensation rate, etc. The number of STW authorized days measure imperfectly the number of STW compensated days. This information is available only several years after the use of the STW device. Thus, the number of STW authorized days represents an indicator of the entrepreneurial anticipations. If we want to analyze the effective use of this device with the STW authorisations, this indicator overestimates the STW recourse. Meanwhile tendencies can be regarded as representative of the French economy. From these databases we constituted an exhaustive STW authorisation panel. The panel covers 93 068 French establishments of all industries, which had at least a STW authorization recourse between 1995 and 2005.

The "Working Time Reduction" database contains the declarations and the agreements of the firms which reduced their working time in order to benefit of the social security reduction. The database is produced by the social security covering organizations in collaboration with the Statistical Department of the French Ministry of Labor and the Departmental Directions of Work and Employment. The database not being exhaustive, the field of the analysis is restricted to the establishments belonging to firms with at least 50 employees. This reduces the STW authorisation panel to 6 767 establishments. The "Working Time Reduction" database provides information on the characteristics of the establishments and of the firms they belong to. In order to analyze the impact of the WTR on the STW

authorisations we must take into account the WTR date (the WTR year). The period of the implementation of the WTR device is 1998-2003.

Firm databases contain firm data and they are produced by the French National Institute of Statistics. They cover the period 1994-2003. The databases contain the whole tax printed papers for the firms which have a sales turnover higher than 533 000 euros. These quasi-exhaustive databases permit to characterize the economic situation of the firms to which the establishments belong between 1994 and 2003. These databases also permit to identify survivor firms over this period. As a result we will work on a balanced panel. Controlling for firm survival can cause a causal effect estimation bias because we eliminate the most affected firms by the economic situation. This control is nevertheless necessary, because it neutralizes the effects of the creation-destruction and reorganization of firms associated with the economic situation who would strongly bias the estimators.

These three data sources represent a rich statistical equipment which permits to study the WTR effect on the STW recourse. We will finally work on a sample of 6 189 French establishments which belong to perennial firms between 1995 and 2003. This final sample is quasi-exhaustive: it includes all the establishments belonging to firms with at least 50 employees and which had at least once a STW authorization.

II-2 Econometric model

Establishments which anticipated the WTR make the object of a non-random selection process concerning the anticipating phenomenon (their economic performance, the economic difficulties, etc) and even of a process of auto-selection (if anticipating WTR is considered as an element of their internal strategy). That means that the WTR is not independent of the STW recourse. This can induce a selection bias. WTR and STW represent two working time flexibility instruments. We can suppose that an establishment reducing its working time duration has a particular flexibility need or it is subjected to specific economic conditions which can explain its recourse to STW. Consequently, reducing the effective working time duration cannot be regarded as random; WTR is not independent of the STW recourse. The absence of the independence is found in the texts of law, since the establishments can use STW only if they "exploited" the potentialities of the WTR implementation.

To circumvent this selection bias, we will estimate evaluation models with matching estimators. This approach is mainly adopted in the French literature treating causality of the WTR on employment. Evaluation models with matching estimators consist in building for each establishment having reduced

in an anticipated way the effective duration of work time a counterfactual exposed to the same economic conditions. The counterfactual is built from the establishments which did not reduce their working time (H1) or which reduced it in a way no anticipated way (H2). By comparing the STW recourse of the two establishments, we are able to determine the causal impact of the anticipated WTR on the STW authorizations.

Evaluation models with matching estimators were initially developed by Rubin² (1974) in order to study the efficiency of the medical treatments. These models were improved (Heckman and his various co-authors) and were mobilized in economy, in particular to test the efficiency of job training programs (for a complete review literature see Heckman, Smith & Lalonde, 1999).

Evaluation model with matching estimators

Let us note T_i , a binary variable indicating if the individual received or not the i treatment ($T_i = 1$ if the individual is treated, $T_i = 0$ if not). The efficiency of the treatment is measured through the result y_i . Thus each individual, will have two potential results: y_0 (if $T_i = 0$) and y_1 (if $T_i = 1$). y_0 and y_1 are never observed simultaneously, since an individual either is treated, or untreated, but never both at the same time. In other words, only the true health of the individual, noted Y , is observed: $Y = y_1 T_i + y_0 (1 - T_i)$.

Only the couple (Y, T_i) is observed for each individual. Rubin (1974) defines the average treatment effect (the causal effect) of a treatment as the difference between what would be the health of an individual if he were treated and what it would be if he were not it: $C = y_1 - y_0$.

The average treatment effect is unobservable and individual, and consequently its distribution is not identifiable. If the assignment of the treatment were random, in other words if the property of independence is respected $(y_0, y_1) \perp T_i$ there would be no selection bias and then we could identify the following effects:

- The average causal effect on all the population $C = E(y_1 - y_0)$: it's the variation of the performance observed if the treatment is given to all the individuals.

² Determining the effect of a medical treatment by comparing the health of the treated patients with the health of those who do not receive the treatment (and who are in good health) can give only a very biased idea of its efficiency. That is a consequence of the fact that the assignment of the treatment is not random. To correct this selection bias, Rubin (1974) showed that the experiment must be perfectly controlled, in other words the attribution of the treatment must be made randomly.

- The average causal effect on the treated $C_{treated} = E(y_1 - y_0 | T_i = 1)$: it's the evaluation in the usual sense of the term.

- The average causal effect on the no-treated $C_{no-treated} = E(y_1 - y_0 | T_i = 0)$: it's a prospective evaluation.

In the majority of cases, the property of independence is not valid. A solution would be to compare the health of each individual having received the treatment with the health of an identical counterfactual who did not receive the treatment. To identify statistically the counterfactual an approach consists in building a group of control (a counterfactual population) for which the distribution of a number of observable characteristics (X – matching variables) is the same as for the group receiving the treatment. Consequently, the property of independence is respected $(y_0, y_1) \perp T_i | X$. When many matching criteria must be taken into account, finding a counterfactual can be problematic. Rubin and Rosenbaum (1983) solved this problem by showing that conditional independence with the X variables was equivalent to the independence compared to the propensity score. The propensity score constitutes a one-dimension summary of the matching variables and it estimates the probability of being exposed to the treatment, conditionally to these variables. By using this propensity score, the counterfactual individuals can be determined in several ways. In this work, we used the Kernel estimator of Heckman, Ichimura and Todd (1997, 1998). For the calculation of the Kernel estimator for the treated, each no-treated individual takes part in the construction of the counterfactual of the treated individual. The weight of the no-treated in the constitution of the counterfactual is given according to the distance between their score and the score of the considered individual. In order to appreciate the extent of the selection bias, we can compare the values of the matching estimators to the simple variation of performance between the individuals who have the treatment and the others (naive estimators).

In this paper, anticipating WTR constitutes the treatment for which we want to measure the impact on the STW recourse. So, we must distinguish the treatment groups (establishments which reduced their working time an anticipated way) and the counterfactual groups (which are not concerned by the WTR anticipation). The counterfactual groups are used to build the counterfactuals. They are identified by using the «Working Time Reduction» database. Several STW dimensions can be affected by the WTR. These dimensions measure the performance in terms of reduction in the STW recourse. They are calculated from the STW authorisation panel. In order to build the counterfactual establishments, we introduce a series of matching criteria by mobilizing the firm databases and the STW authorisation panel.

Groups of treatment and counterfactual groups

All the establishments of the sample saw the legal duration of working time reducing to 35 hours in 2000. Meantime, the reduction of the effective working time duration varied strongly from one establishment to another because legal duration and effective working time duration do not coincide inevitably. Before 2000, for the firms with more than 20 employees, the legal working time duration was set at 39 hours per week. Firms who anticipated the implementation of the WTR could have an effective working time duration set at 35 hours. Conversely, after 2000, although the legal duration of work is 35 hours for the establishments of our sample, we can identify establishments with an effective working time duration set to 39 hours. In this case they prefer to pay for overtime. In order to take into account the heterogeneity of establishments' behaviours regarding WTR, three categories of establishments are distinguished: the anticipator WTR establishments (they gather the establishments having reduced the effective working time duration before January 1, 2000), the no-anticipator WTR establishments (they belong to firms which reduced the effective working time duration since 2000) and establishments that did not reduce their working time (this last category represents the rest of the establishments of the sample. These establishments are not present in the «Working Time Reduction» database.).

From our 6189 establishments, 1193 (19 %) are anticipator working time reduction establishments, 2607 (42 %) are no-anticipator working time reduction establishments and the rest (39 %) are establishments that did not reduce their working time. So 61 % of the establishments reduced the effective working time duration.

In the case of the first hypothesis, the group of treatment is consisted by anticipator WTR establishments and the counterfactuals will be sought among establishments that did not reduce their working time. Formally, the treatment variable is written:

$$T_1 = \begin{cases} 1, & \text{if the establishment anticipated the WTR} \\ 0, & \text{if not} \end{cases}$$

For the second hypothesis, the treated individuals are the anticipator WTR establishments, but the counterfactual group is represented by the no anticipating WTR establishments. Formally, the second treatment variable is written:

$$T_2 = \begin{cases} 1, & \text{if the establishment anticipated WTR} \\ 0, & \text{if the establishment reduced the working time in a not anticipated way} \end{cases}$$

Performance variables

Several dimensions of the STW recourse can be affected by the WTR. To quantify the evolutions of the STW authorizations, five categories of indicators are used: having STW authorisations after the WTR; variation of the number of STW authorised days; variation of the number of employees before and after the WTR; variation of the part of employees affected by the STW authorizations and the variation of the authorized STW duration per employee.

Effects of the WTR can vary in time. Are they immediate? Are they durable or temporary? By using longitudinal data, we can evaluate the impact of the anticipated WTR up to three years after its implementation. These indicators are calculated on more or less broad temporal windows in order to highlight the effects of the WTR in the short or medium run. These five categories of measures as their methods of calculation are presented in appendix 1.

Matching criteria

In order to neutralize the effects related to the difficulties of the economic situation, we must take into account control variables like the value added variation rate and the quartiles of the apparent labor productivity³ (all calculated one year before the WTR). These variables result from the firm databases. The interest of these economic variables is underlined in several French articles on the WTR evaluation.

Moreover, several French papers concerning the WTR evaluation show that the size and the industry permit to correct mostly of the selection bias. So the matching criteria finally retained are: the value added variation rate and the quartiles of the labor productivity, the industry defined at two-digit level⁴ and the establishment size (four classes of size: less than 20 employees, from 20 to 49 employees, from 50 to 499 employees and 500 employees and more).

III - Results

We begin by studying the anticipated WTR determinants (section III-1) to then concentrate on the differences in the STW recourse between on the one hand, anticipating WTR establishments and those

³ The apparent labor productivity for one year T is defined as the ratio of the value added of the year T and the number of employees for the same year. The distribution of the apparent labor productivity permits to identify the four quartiles.

⁴ The French nomenclature of economic activities –NAF 36.

which did not reduce working time (section III-2) and on the other hand, anticipating WTR establishments and no anticipating WTR establishments (section III-3).

III-1-Anticipated working time reduction determinants

In this section, we estimate the probability of anticipating WTR with a logit model by introducing the matching variables previously presented (see table 1). Generally, the establishments' size mainly determines the retained strategy regarding the WTR. We observe that the probability of anticipating WTR increases with the class of size on the two samples (sample 1 - 3582 establishments -corresponds to the first hypothesis and the sample 2 -3800 establishments- corresponds to the second hypothesis). Working at a fine industry level (NAF 36) permits to capture certain effects such as those related to productivity.

In the manufacturing, where the “manufacture of metal products” industry is taken as reference, one of the most anticipating WTR industries, on both samples, is the “manufacture of wearing apparel and leather” industry. In the service industries, the “health and social work” industry as the “operational service” industry⁵ have the stronger anticipating WTR probability on the two samples. These results are confirmed by French papers which specify that WTR conventions are firstly signed in the industries mentioned above. On the first sample, there is only the construction industry which has a lower probability of anticipating WTR. Globally, manufacturing establishments have a higher anticipating WTR propensity than service industries establishments.

Moreover, the anticipating WTR probability decreases with the rank of the quartiles. The establishments belonging to firms with low apparent labor productivity (the first quartile) are more anticipating WTR than the establishments belonging to firms with the strongest labor productivity (the fourth quartile). This can be explained by the fact that the first establishments hope that the early WTR implementation will cause a productivity profit. The evolution of the distributions of apparent labor productivity quartiles consolidates this interpretation: 33 % of the anticipating WTR establishments belonging to the first quartile improved their productivity one year after the WTR (they change of quartile) and 50 % of them two years afterwards. In other words, the establishments having a high productivity are not encouraged to anticipate the WTR since the potential productivity profits would be less important. Nevertheless, these results can be also related to a more complex phenomenon: the age of the firm in the context of the WTR strategy. Generally low apparent labor productivities may correspond to “young” firms.

⁵ This industry contains: “renting of machinery and equipment without operator and of personal and household goods”, “computer and related activities” and “other business activities”.

The effect of the value added variation rate taken a year before the WTR is not significant on the first sample, but it is positively and significantly correlated with the WTR on the second sample. This variable is a measure of the economic situation. The results show that the anticipating WTR establishments and those which did not reduce their working time do not have a sufficiently different economic situation to explain the WTR anticipation. These results also suggest that the anticipator WTR establishments have a better economic situation than the no anticipating WTR establishments.

The logit model helps estimating the propensity score for each establishment. This measure represents the individual probability to have anticipated WTR according to the matching variables. This step is fundamental for the evaluation models with matching estimators' implementation. These models require a sufficiently important common support. The size of the common support depends on the quality of the model. If the matching variables explain very well this probability and in the extreme case where they explain it perfectly, the densities of the score conditionally to the treatment are Dirac masses. In this case the supports are disjointed and no pairing is possible.

For example, on the first sample, 64 % of the anticipating WTR establishments have an estimated probability to have reduced WTR in an anticipated way lower than 0.5 and conversely 12 % of the establishments that did not reduce their working time have a probability of having anticipated WTR higher than 0.5. The two distributions are largely overlapped. Moreover, as the number of the establishments that did not reduce their working time is high (2 times greater), pairing is possible.

III-2- Comparison of the anticipating WTR establishments and those which did not reduce their working time

If the anticipating WTR establishments and those which did not reduce their working time are subjected to the same economic situation (see table 1), can WTR explain an evolution in terms of STW behaviour?

To answer to this question, evaluation models with matching estimators were tested by taking as a counterfactual population the establishments that did not reduce their working time. It is also interesting to focus on the role of the anticipated WTR for the establishments having a recurring STW use. An establishment with a recurring STW recourse is an establishment which between 1995 and 2005 had at least two STW utilisations. The results are presented in table 2.

The comparison between the establishments that did not reduce their working time and the anticipating WTR establishments release contrasted results. On the two samples, WTR anticipation does not implicitly cause a reduction in the STW recourse.

On the total sample, the anticipating WTR establishments have, at two years, an increase of 5 points of their STW recourse in comparison to the establishments which did not reduce their working time. At three years the increase is even stronger reaching about 9 points. The variation of the employees' part affected by STW is also positive (at three years, + 11 points). We observe the same result for the STW duration (at two years, + 4 hours). This result confirms the intuitions given by the descriptive statistics (see appendix 2): the establishments that did not reduce their working time would be establishments in good economic health which benefit exceptionally from the STW authorizations just like the anticipating WTR establishments.

In several cases, the WTR does not affect the STW recourse. For example, the anticipated WTR does not impact the fact of having STW authorizations at the very short run (one year after the WTR). We can explain this result by the fact that the WTR represents a shock which would imply structural changes in the organization. The effects on the STW would appear two or three years afterwards. Moreover, the impact of the anticipated WTR is stronger as the temporal window is broad. The effects of the WTR anticipation require time to appear.

If the anticipating WTR establishments resort more intensely to STW after the WTR, do they benefit of more STW authorized days and cover more employees than the establishments that did not reduce their working time? Concerning the number of STW authorized days, on all temporal windows, the anticipated WTR leads to a strong average decrease. For example, the variation of the STW authorized days at three years indicates a 198 days average decrease. Knowing that for this hypothesis the sample covers 1193 establishments which reduced their working time in an anticipated way, that would mean that the anticipated WTR would explain a decrease of about 236 000 STW days. Consequently, at a macroeconomic level this gives us an idea about the strong fall of the STW recourse, illustrated in graph 1.

An advantage of the evaluation models with matching estimators is the control of the selection bias. Comparing the naive estimator to the matching ones gives a measure of this bias (see table 2). For the global sample, the values of the naive estimators are almost always lower than those of the other estimators. That means that the naive estimator underestimates the extent of the STW reduction.

Does the anticipated WTR, have an impact on the STW recourse of the recurring establishments? The anticipated WTR impacts neither the recourse to the STW nor the average STW duration. For the

other measures, the impacts are negative and much more important than on the global sample. At two years, with the matching estimator, the anticipated WTR led to an average reduction of 30 employees affected by the STW. The sample of recurring establishments contains 522 anticipating WTR establishments. We can conclude that the anticipated WTR implied a fall of more than 15 000 employees affected by the STW authorizations.

III-3- Comparison of the anticipating WTR and the no-anticipating WTR establishments

Within the establishments which reduced their working time, is the impact of WTR stronger for the establishments which anticipated it? To answer to this question, two samples were considered: a global sample and a sample for the recurring establishments. The results of the evaluation of the causal effect (see table 3) confirm the second hypothesis: the anticipated WTR decreases the STW recourse. The results of this hypothesis are clearer. The impact of the anticipation of the WTR is negative for all of the STW measures. This result confirms the efficiency of the anticipated WTR on the STW recourse.

Once again, the effects of the anticipated WTR seem to be gradual. The broader the temporal window, the stronger the impact of the WTR. On the global sample, at one year, the anticipating WTR establishments decrease by 6 points their STW recourse and at two years by 7 points. For the number of employees and the part of the employees touched by the STW, the strongest effects are recorded two years after the anticipated WTR. Lastly, at three years, the anticipated WTR induces an average fall of 593 days. On the global sample, that can hide a fall of more than 700 000 STW authorized days. These results are even stronger than those obtained in the preceding section.

In addition, are the effects of the impact of the anticipated WTR more important for the sample of the recurring establishments? According to the definition of the recurrence, the anticipated WTR at three years, with the matching estimator, implies a reduction of 1134 STW authorized days. The sample of recurring establishments contains 522 anticipating WTR establishments. We can thus conclude that the anticipated WTR could imply a fall of more than 590 000 STW authorized days.

The evaluations of the second hypothesis were also carried out on a bigger sample. For this exercise, the effects are negative but they remain less strong than on the initial sample. This new estimate confirms the robustness of the results.

Conclusion

The principal contribution of this article relates to the analysis of the impact of the anticipated working time reduction on the short-time working recourse. Several dimensions of the short-time working device can be affected by the working time reduction: the number of short-time working authorized days, the number and the part of employees affected by the device and the average duration of short-time working. These dimensions measure the performance in terms of reduction in the short-time working recourse.

Implementation of evaluation models with matching estimators released for the first hypothesis (*establishments which reduced in an anticipated way their effective working time duration ask less for short-time working authorizations than those which did not reduce their working time*) a contrasted fall of the short-time working measures and a clear reduction regarding the second hypothesis (*establishments which reduced in an anticipated way their effective working time duration ask less for short-time working authorizations than those which reduced their effective work duration in a no anticipated way*). The working time reduction impact is stronger as the period between the working time reduction implementation and the measure of indicators of performance is important. That is due to the fact that effects of the working time reduction anticipation require time to appear. One of the results of the first hypothesis shows that, at three years, there is a 236 000 fall of short-time working authorized days for establishments which anticipated working time reduction. A result of the second hypothesis underlines a more important effect, a fall of 708 000 short-time working authorized days. So the working time reduction partly explains the strong decrease of the short-time working authorizations between 1995 and 2005.

In this article, we do not answer the following questions: is short-time working a management tool among others? If so, how do establishments manage short-time working in terms of complementarity and substitutability with the other flexibility instruments? In particular, new researches are necessary to verify if the increase in temporary work and fixed-term contracts at the end of the 90thies came to replace the short-time working device.

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Table 1: Probability of anticipating WTR according to the two hypotheses'

	Hypothesis 1	Hypothesis 2
Intercept	-1.54 (***)	-2.23 (***)
Establishment size		
Less than 20 employees	REF.	REF.
From 20 to 49 employees	-0.06 (ns)	0.08 (ns)
From 50 to 499 employees	0.34 (***)	0.17 (ns)
500 employees and more	1.16 (***)	1.00 (***)
Industries		
Agriculture, forestry, fishing	0.09 (ns)	2.18 (***)
Manufacture of food products	0.51 (**)	1.13 (***)
Manufacture of wearing apparel, leather	1.50 (***)	1.42 (***)
Publishing, printing	1.00 (**)	0.60 (*)
Manufacture of pharmaceutical products, etc.	0.39 (ns)	1.30 (**)
Manufacture of household equipments	0.67 (***)	1.05 (***)
Manufacture of motor vehicles	0.45 (*)	0.79 (***)
Manufacture of other transport equipment	0.31 (ns)	0.12 (ns)
Manufacture of machinery and equipment	-0.16 (ns)	0.16 (ns)
Manufacture of electrical and optical equipment	0.24 (ns)	0.47 (ns)
Manufacture of mineral products	-0.05 (ns)	0.12 (ns)
Manufacture of textiles	0.39 (**)	0.55 (***)
Manufacture of wood and paper	0.56 (**)	0.29 (ns)
Manufacture of rubber and plastic products	0.86 (***)	0.42 (**)
Manufacture of Naive metals and fabricated metal products	REF.	REF.
Manufacture of electrical and optical equipment	0.41 (ns)	0.60 (**)
Automotive fuel production	2.55 (**)	14.16 (ns)
Electricity, gas and water supply	-11.22 (ns)	-
Construction	-0.32 (*)	0.65 (***)
Sale, maintenance and repair of motor vehicles	-0.57 (ns)	0.97 (**)
Wholesale trade	0.03 (ns)	0.87 (***)
Retail trade, repairing	0.26 (ns)	0.82 (***)
Transports	0.66 (***)	1.15 (***)
Financial intermediation	-	-
Real estate activities	0.03 (ns)	1.90 (ns)
Post and telecommunications	-0.45 (ns)	0.77 (ns)
Consultancy and assistance	0.06 (ns)	0.87 (***)
Operational services	1.18 (***)	3.36 (***)
Research and development	-11.19 (ns)	-12.48 (ns)
Hotels et restaurants	-0.59 (**)	0.36 (ns)
Community, social and personal service activities	-0.58 (ns)	-0.44 (ns)
Private households with employed persons	0.37 (ns)	1.36 (**)
Education	-11.46 (ns)	-
Health and social work	1.47 (***)	1.03 (**)
Extra-territorial organizations	-	-
Value added variation rate	0.07 (ns)	0.93 (***)
Apparent labor productivity		
First quartile	0.56 (***)	0.81 (***)
Second quartile	0.09 (ns)	0.30 (**)
Third quartile	0.14 (ns)	0.35 (***)
Forth quartile	REF.	REF.
2 Log-likelihood	4558.60	4728.89
Number of treated individuals	1193	1193
Number of no treated individuals	2389	2607

Source: Sample obtained from the pairing of three data sources 1) the annual STW authorisation panel (the Statistical Department of the French Ministry of Labor and the Departmental Directions of Work and Employment); 2) the «Working Time Reduction» database (the Statistical Department of the French Ministry of Labor and the social security covering organizations); 3) the firm databases covering the period 1994 -2003 (the French National Institute of Statistics)

Field: 6189 French establishments belonging to firms with at least 50 employees and which had at least one STW recourse between 1995 and 2005

*** statistically significant at 1 % level, ** statistically significant at 5 % level and * statistically significant at 10 % level; NS means statistically not significant.

Table 2: Estimates of the causal effect of the WTR anticipation on the STW authorizations. Comparison between anticipating WTR establishments and those which did not reduce their working time

Measurement	Global sample				Recurring sample			
	Naive estimator	Kernel estimator			Naive estimator	Kernel estimator		
		Global	Treated	Not-treated		Global	Treated	Not-treated
AUTCP ₁	ns	ns	ns	ns	ns	ns	ns	ns
AUTCP ₂	0.20	0.02	0.05	ns	ns	ns	ns	-0.03
AUTCP ₃	0.41	0.07	0.09	0.06	ns	ns	ns	ns
VARNJA ₁	-93.36	-69.61	ns	-74.19	-214.02	ns	ns	-171.83
VARNJA ₂	-157.02	-136.36	-157.87	-125.91	-298.18	ns	ns	ns
VARNJA ₃	-174.27	-153.51	-198.19	-131.28	-396.05	-343.11	-511.72	ns
VARSA _{L1}	ns	ns	ns	-4.34	ns	-9.69	ns	-11.76
VARSA _{L2}	ns	ns	ns	-7.37	-23.91	-22.94	-30.53	-18.65
VARSA _{L3}	ns	ns	ns	ns	ns	-19.25	ns	-14.83
VARPS ₁	-0.02	-0.02	ns	-0.03	-0.06	-0.06	-0.04	-0.07
VARPS ₂	ns	ns	ns	ns	-0.04	-0.04	ns	-0.05
VARPS ₃	0.08	0.10	0.11	0.09	ns	ns	ns	ns
VARDA ₁	ns	ns	ns	ns	ns	ns	ns	ns
VARDA ₂	ns	ns	0.51	ns	ns	ns	ns	ns
VARDA ₃	0.77	0.91	1.07	0.83	ns	ns	ns	ns

Source: Sample obtained from the pairing of three data sources 1) the annual STW authorisation panel (the Statistical Department of the French Ministry of Labor and the Departmental Directions of Work and Employment); 2) the «Working Time Reduction» database (the Statistical Department of the French Ministry of Labor and the social security covering organizations); 3) the firm databases covering the period 1994 -2003 (the French National Institute of Statistics)

Field: anticipator WTR establishments and those which did not reduce their working time. They are statistically significant at a 10 % level; ns = statistically not significant.

Table 3: Estimates of the causal effect of the WTR anticipation on the STW authorizations. Comparison between anticipating and no-anticipating WTR establishments

Measurement	Global sample				Recurring sample			
	Naive estimator	Kernel estimator			Naive estimator	Kernel estimator		
		Global	Treated	Not-treated		Global	Treated	Not-treated
$AUTCP_1$	-0.49	-0.06	-0.06	-0.06	-0.49	-0.08	-0.07	-0.08
$AUTCP_2$	-0.37	-0.08	-0.07	-0.08	-0.43	-0.11	-0.09	-0.11
$AUTCP_3$	ns	-0.03	ns	-0.04	-0.30	-0.08	-0.07	-0.08
$VARNA_1$	-143.05	-171.05	-151.96	-178.12	-275.05	-269.75	-286.29	-263.63
$VARNA_2$	-347.13	-388.69	-390.14	-388.37	-650.03	-651.79	-761.90	-611.57
$VARNA_3$	-518.93	-522.45	-593.80	-496.57	-899.97	-849.82	-1134.92	-744.80
$VARSA_1$	-9.56	-12.25	-11.09	-12.66	-18.45	-21.72	ns	-21.50
$VARSA_2$	-21.11	-24.84	-27.61	-23.82	-45.21	-42.66	-56.07	-37.69
$VARSA_3$	-18.80	-21.11	-19.36	-21.78	-40.57	-41.51	-54.25	-36.80
$VARPS_1$	-0.06	-0.07	-0.05	-0.07	-0.09	-0.11	-0.07	-0.12
$VARPS_2$	-0.11	-0.12	-0.11	-0.13	-0.16	-0.19	-0.15	-0.21
$VARPS_3$	-0.10	-0.12	-0.10	-0.12	-0.17	-0.20	-0.17	-0.21
$VARDA_1$	-0.62	-0.74	-0.60	-0.79	-1.00	-1.12	-0.96	-1.18
$VARDA_2$	-1.09	-1.37	-1.21	-1.43	-1.45	-1.68	-1.48	-1.75
$VARDA_3$	-1.35	-1.64	-1.54	-1.68	-1.56	-1.80	-1.71	-1.83

Source: Sample obtained from the pairing of three data sources 1) the annual STW authorisation panel (the Statistical Department of the French Ministry of Labor and the Departmental Directions of Work and Employment); 2) the «Working Time Reduction» database (the Statistical Department of the French Ministry of Labor and the social security covering organizations); 3) the firm databases covering the period 1994 -2003 (the French National Institute of Statistics)

Field: anticipator and no-anticipator WTR establishments and

They are statistically significant at a 10 % level; ns = statistically not significant.

Appendix 1: Categories of STW measures⁶

Having STW authorisations after the WTR	$AUTCP_1 = \begin{cases} 1 & \text{si } NJA_{t+1} \neq 0 \\ 0 & \text{sinon} \end{cases}$
	$AUTCP_2 = \begin{cases} 1 & \text{si } NJA_{t+1} \neq 0 \text{ ou } NJA_{t+2} \neq 0 \\ 0 & \text{sinon} \end{cases}$
	$AUTCP_3 = \begin{cases} 1 & \text{si } NJA_{t+1} \neq 0 \text{ ou } NJA_{t+2} \neq 0 \text{ ou } NJA_{t+3} \neq 0 \\ 0 & \text{sinon} \end{cases}$
Variation of the number of STW authorized days	$VARNJA_1 = NJA_{t+1} - NJA_{t-1}$
	$VARNJA_2 = \frac{1}{2}(NJA_{t+1} + NJA_{t+2}) - \frac{1}{2}(NJA_{t-2} + NJA_{t-1})$
	$VARNJA_3 = \frac{1}{3}(NJA_{t+1} + NJA_{t+2} + NJA_{t+3}) - \frac{1}{3}(NJA_{t-3} + NJA_{t-2} + NJA_{t-1})$
Variation of the employees affected by the STW authorizations	$VARSA_1 = SAL_{t+1} - SAL_{t-1}$
	$VARSA_2 = \frac{1}{2}(SAL_{t+1} + SAL_{t+2}) - \frac{1}{2}(SAL_{t-2} + SAL_{t-1})$
	$VARSA_3 = \frac{1}{3}(SAL_{t+1} + SAL_{t+2} + SAL_{t+3}) - \frac{1}{3}(SAL_{t-3} + SAL_{t-2} + SAL_{t-1})$
Variation of the part of employees affected by the STW device	$VARPS_1 = PARTSAL_{t+1} - PARTSAL_{t-1}$
	$VARPS_2 = \frac{1}{2}(PARTSAL_{t+1} + PARTSAL_{t+2}) - \frac{1}{2}(PARTSAL_{t-2} + PARTSAL_{t-1})$
	$VARPS_3 = \frac{1}{3}(PARTSAL_{t+1} + PARTSAL_{t+2} + PARTSAL_{t+3}) - \frac{1}{3}(PARTSAL_{t-3} + PARTSAL_{t-2} + PARTSAL_{t-1})$
Variation of the average duration of the STW assignments	$VARD_1 = DUREE_{t+1} - DUREE_{t-1}$
	$VARD_2 = \frac{1}{2}(DUREE_{t+1} + DUREE_{t+2}) - \frac{1}{2}(DUREE_{t-2} + DUREE_{t-1})$
	$VARD_3 = \frac{1}{3}(DUREE_{t+1} + DUREE_{t+2} + DUREE_{t+3}) - \frac{1}{3}(DUREE_{t-3} + DUREE_{t-2} + DUREE_{t-1})$

⁶t defines the WTR year : t = 1998, ..., 2003 ; NJA defines the number of STW authorized days ; NBSAL defines the number of employees affected by the STW authorisations ; PARTSAL defines the part of employees affected by the STW authorisations and DUREE defines the average duration per employee of the STW measured en authorized days.

Appendix 2: Distribution of the STW measures according to the categories of the establishments

%	Establishment category		
	Anticipating WTR establishments	Establishments which did not reduce their working time	No-anticipating WTR establishments
$AUTCP_1 = 1$	10.48	9.46	13.69
$AUTCP_2 = 1$	19.20	14.73	22.82
$AUTCP_3 = 1$	29.84	20.68	29.50
$VARNJA_1 < 0$	91.20	92.59	88.23
$VARNJA_2 < 0$	83.99	88.41	80.48
$VARNJA_3 < 0$	76.11	83.93	75.91
$VARSA_1 < 0$	91.03	92.67	88.19
$VARSA_2 < 0$	83.65	88.61	81.01
$VARSA_3 < 0$	75.78	83.88	76.45
$VARPS_1 < 0$	91.03	92.38	89.19
$VARPS_2 < 0$	83.74	88.15	80.51
$VARPS_3 < 0$	75.86	83.21	75.30
$VARD_1 < 0$	91.28	92.34	88.11
$VARD_2 < 0$	84.16	88.24	80.67
$VARD_3 < 0$	76.28	84.05	76.79

Source: Sample obtained from the pairing of three data sources 1) the annual STW authorisation panel (the Statistical Department of the French Ministry of Labor and the Departmental Directions of Work and Employment); 2) the «Working Time Reduction» database (the Statistical Department of the French Ministry of Labor and the social security covering organizations; 3) the firm databases covering the period 1994 -2003 (the French National Institute of Statistics)

Field: 6189 French establishments belonging to firms with at least 50 employees and which had at least one STW recourse between 1995 and 2005