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The Extension of Short-time Work Schemes during the Great Recession: A Story of Success?

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The extension of short-time work schemes during the Great Recession: A story of success?

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Abstract

This paper evaluates the effectiveness of short-time work [STW] extensions — e.g. relaxing eligibility criteria or implementing new STW schemes — in the OECD during and after the Great Recession. First, we find that the dampening effect of STW on the unemployment rate diminishes at higher take-up rates. Second, only countries with preexisting STW schemes were able to fully exploit the benefits of STW. Third, the effects of STW are strongest when GDP growth is deeply negative at the beginning of recessions. Our results indicate that STW is most effective when used as a fast-responding automatic stabilizer.

JEL Classifications: E24, J23, J63, J65, J68

Keywords: job destruction, labor policy, short-time work, unemployment

1 Introduction

During the Great Recession, the extension of short-time work [STW]¹ schemes became a widespread practice. Pressure from rising unemployment rates pushed policy makers in 15 out of 34 OECD countries to extend existing STW schemes — typically by (temporarily) relaxing eligibility criteria (Hijzen & Venn 2011). Seven OECD countries not operating a STW scheme up until then even decided to implement such a system at short notice. In total, no less than 25 OECD countries operated a STW scheme in 2009/10. As a result, STW take-up surged to unprecedented levels (Cahuc & Carcillo 2011). Recent evidence suggests that the use of STW was very successful.² In particular, STW helps to reconcile why the (unconditional) cross-country correlation between the drop in output and the subsequent rise in unemployment — also known as Okun’s law — was so extremely low at that time (IMF 2010, OECD 2010).³

In other words, the recent surge in STW was only partly due to the fact that more distressed firms met the eligibility criteria — the “rule based” component when STW acts as an automatic stabilizer (Balleer et al. 2015). Rather, the “discretionary” component, i.e. the temporary relaxation of STW eligibility criteria, played a very important role — both within and across countries (Hijzen & Martin 2013). STW eligibility criteria are designed to minimize deadweight losses that arise whenever workers whose jobs are not at risk participate in STW schemes. Against this background, it is hardly surprising that Boeri & Bruecker (2011) find a sizable amount of deadweight loss during the Great Recession. In addition to that, Balleer et al. (2015) argue that temporary STW extensions are even less effective, because expectations of forward-looking market participants remain unaffected. Therefore, we expect that the dampening effect of STW on the unemployment rate diminishes at high take-up rates. Furthermore, we question that newly established schemes are able to fully exploit the benefits of STW (mainly due to implementation lags Boeri & Bruecker 2011).

In order to evaluate the effectiveness of the above-mentioned STW extensions, we estimate a distributed lag version of Okun’s law. For this purpose, we use macroeconomic panel data from 2007Q1-2010Q4. Besides the STW take-up rate, we control for the institutional structure of national labor markets. In addition, we explicitly distinguish between STW schemes already in operation before the outbreak of the Great Recession and newly established ones. We then apply the two-step difference GMM estimator (Arellano & Bond 1991) with Windmeijer-corrected errors. This estimator deals appropriately with endogeneity issues arising from (i) the so-called “dynamic panel bias” (Nickell 1981), and (ii) simultaneous changes in unemployment and STW (Boeri & Bruecker 2011, Cahuc & Carcillo 2011).

¹STW is a marginal employment subsidy targeted at temporarily distressed firms. Firms that reduce working hours along the intensive margin pay wages only for actual hours worked, while a government-financed fund partially compensates the affected employees for their loss of income (Wießner 2016). The main advantage of STW is that it aims at preventing individual unemployment, thereby avoiding adverse consequences such as the loss of (firm-specific) human capital (Kruppe & Scholz 2014).

²See the cross-country studies by Arpaia et al. (2010), Boeri & Bruecker (2011), Cahuc & Carcillo (2011), Hijzen & Venn (2011), and Hijzen & Martin (2013). Evidence from firm level data is rather mixed, but often suffers from negative selection bias; see Calavrezo et al. (2010) and Calavrezo & Lodin (2012) for France, as well as Bellmann & Gerner (2011), Boeri & Bruecker (2011), Kruppe & Scholz (2014), and Bellmann et al. (2015) for Germany. See also the recent work of Braun & Brügemann (2014) on the welfare effects of STW.

³See also Cazes et al. (2013), who emphasize the role of employment protection legislation in this context. Ball et al. (2013), by contrast, argue that the observed low cross-country correlation is in line with the historical experience (which is documented, e.g., in Lee 2000 or Sögner & Stiassny 2002).

Our main findings can be summarized as follows. First, the marginal dampening effect of STW on unemployment is large at low take-up rates. But then, at higher take-up rates, the effect becomes less intense and then eventually diminishes. Second, only countries with preexisting STW schemes were able to fully exploit the benefits of STW. Third, the effects of STW are strongest when GDP growth is deeply negative. Our results thus casts doubt on the widespread practice to relax STW eligibility criteria during recessions. Rather, it seems important that STW take-up responds fast at the beginning of a recession and is brought down quickly in the early recovery. Most newly established STW schemes failed to realize this goal, very likely due to implementation lags.

In contrast to previous studies that have investigated the effects of STW during and after the Great Recession, we *(i)* explicitly capture that the effects are nonlinear and *(ii)* include the STW take-up rate in first differences (like Cahuc & Carcillo 2011) instead of levels (as Boeri & Bruecker 2011, Hijzen & Venn 2011, and Hijzen & Martin 2013). The difference specification takes into account that increases in STW dampen the rise in the unemployment rate in recessions. But in the early recovery, when STW schemes expire, the unemployment rate declines less because firms simply increase working hours of former STW participants back to normal instead of hiring new employees. In contrast to Cahuc & Carcillo (2011), however, we use (the distributed lag version of) Okun’s law as the basis of our estimation strategy.

The remainder of this paper is organized as follows. Section 2 documents the data and describes the estimation strategy. Section 3 presents and discusses the results. Section 4 performs a number of robustness checks. Section 5 concludes.

2 Data and Estimation Strategy

2.1 Data

STW is a popular labor market policy instrument in recessions. Already before the outbreak of the Great Recession, 18 out of the current 34 OECD countries had been operating a STW scheme (Cahuc & Carcillo 2011). In response to the crisis, 15 out of these 18 countries introduced new STW measures or adjusted existing ones (Hijzen & Venn 2011).⁴ Seven OECD countries not operating a STW scheme up until then even decided to implement such a system at short notice. Together with the three OECD countries that did not extend their existing STW schemes in the years 2009-2010, in total 25 OECD countries operated a STW scheme at that time.⁵ Hence, in 2009, use of STW across the OECD surged to unprecedented levels (Cahuc & Carcillo 2011).

Following most of the literature, we measure STW usage intensity by the take-up rate, i.e. the share of all employees participating in public STW schemes.⁶ The data are available for 21 OECD countries, covering the period 2007Q1-2010Q4.⁷ As can be seen from Figure 1, STW take-up in Belgium in 2007Q1 — well before the outbreak of the Great Recession — is more

⁴Country-specific extension measures are summarized in Boeri & Bruecker (2011, Table A1).

⁵The remaining seven OECD countries never operated a STW scheme and for two OECD countries, Chile and Israel, information on the use of STW is not available (see Cahuc & Carcillo 2011 and Table 1).

⁶In addition to this extensive margin measure, we examine the impact of the average hours reduction per STW participant (AHR) in Section 4 on robustness checks.

⁷We thank Alexander Hijzen for kindly sharing his data. Unlike the publicly available OECD (2015) series “Incidence of economic short-time work”, the constructed series is designed to capture public STW only if it is

than eight times higher than in any other country in our sample. This indicates that —unlike elsewhere — the Belgian STW scheme is not only designed to dampen unemployment increases in recessions, but is extensively used through all phases of the business cycle. For this reason, we exclude Belgium from the remaining analysis

Our baseline data set includes 15 countries with a STW scheme established before 2007Q1, five countries that have introduced a new STW scheme during the Great Recession, and seven countries that have not operated a public STW scheme at any time (see Cahuc & Carcillo 2011, and Table 1). Figure 1 also shows peak STW take-up rates for all 27 countries in our baseline data set (and Belgium). We observe that, in most countries, take-up rates peaked in 2009Q2. Apart from Belgium, peak STW take-up was highest in Slovenia, Japan, Germany and Luxembourg (between 3.5%-5%), followed up by Italy, Switzerland, the Czech Republic, and Finland (around 2%). Take-up in the Slovak Republic rose to 1.25%, while take-up in Ireland, Austria, France and the Netherlands was just slightly higher than 1%. In all other countries, take-up remained below 1% (or even nil) at the peak of the Great Recession. We also note (see Figure 2) that the cut in STW take-up rates back to normal took place very rapidly in some countries, while in some other countries take-up remained persistently high during the recovery in 2010 and 2011. Three countries (Denmark, Slovenia, Spain) suffer from missing values. The difference GMM estimator (below) deals with this issue appropriately.

Besides that, our final panel data set consists of the growth rate of seasonally adjusted real GDP and the seasonally adjusted harmonized unemployment rate (including the OECD-wide average).⁸ In addition, we construct the following three dummy variables: The first dummy variable, D_{NEW} , is set to unity for the five countries in our sample that have introduced a new STW scheme during the crisis and zero otherwise; the second dummy variable, D_{EPL} , is set to 1 for those 13 countries where the OECD index of employment protection legislation [EPL] is above the median (2.44) and zero otherwise; and the third dummy variable, D_{UB} , is set to unity for those 13 countries whose OECD index of the unemployment benefit replacement rate [UB] is above the median (34%) and zero otherwise (see Table 1 for an overview).⁹

2.2 Estimation Strategy

2.2.1 Dynamic Panel Model

The main aim of this paper is to quantify the impact of STW policy interventions on the unemployment rate during the Great Recession. The starting point of our analysis (see the first line of Equation 1) is the autoregressive distributed lag version of Okun’s law (see, e.g. Owyang &

for economic (and not for seasonal or technical) reasons. In addition, the authors made best efforts to harmonize the cross-country data. Further details can be found in Hijzen & Venn (2011).

⁸The quarterly OECD series “harmonised unemployment rates” for Switzerland starts only in 2010Q1. We therefore time-aggregate monthly SECO (<http://www.amstat.ch/>) data on registered unemployment to a quarterly frequency (2007Q1-2015Q4), seasonally adjust the resulting series, and then regress the OECD series on the overlapping sample of the SECO series. We lead the SECO series by one quarter to capture the time lag in registered unemployment. The final estimate used in this paper is given as: $u_{t,OECD} = 1.46 + 0.92 \times u_{t+1,SECO}$.

⁹We use version 3 of the index “strictness of employment protection — individual and collective dismissals (regular contracts)” to measure EPL and “average of net replacement rates over 60 months of unemployment, overall average over four family types and two earnings levels, family does not qualify for top ups” to measure UB. Due to gaps in the EPL data base in the years 2006 and 2007, we measure both indices in 2008. Given the low degree of time-variation in both series (Cahuc & Carcillo 2011), endogeneity issues are very unlikely to arise.

Sekhposyan 2012), i.e. we regress current changes in the unemployment rate in country n , $\Delta U_{n,t}$, on past changes in the unemployment rate, $\Delta U_{n,t-1}$, current real output growth, $\Delta \ln(GDP_{n,t})$, and past real output growth, $\Delta \ln(GDP_{n,t-1})$:

$$\begin{aligned} \Delta U_{n,t} = & \delta \Delta U_{n,t-1} + \sum_{i=0}^1 [\alpha_i \Delta \ln(GDP_{n,t-i}) + \\ & + \alpha_{i+2} D_{EPL} * \Delta \ln(GDP_{n,t-i}) + \alpha_{i+4} D_{UB} \times \Delta \ln(GDP_{n,t-i})] \\ & + \varphi_1 \Delta STW_{n,t} + \varphi_2 \Delta STW_{n,t}^2 + \varphi_3 \Delta (D_{NEW} \times STW_{n,t}) \\ & + \varphi_4 \Delta STW_{n,t} \times \Delta \ln(GDP_{n,t}) + \sum_{i=0}^1 \delta_{i+1} \Delta \bar{U}_{t-i} + \Delta \epsilon_{n,t} \end{aligned} \quad (1)$$

The lagged dependent variable, $\Delta U_{n,t-1}$, is included as regressor to eliminate serial correlation (Knotek II 2007). Current real output growth captures the countercyclicality of unemployment, whereas lagged real output growth accounts for delays in the adjustment of unemployment to changes in economic activity (Ball et al. 2013). Table 3.5 in IMF (2010) documents that both phenomena are widespread in our sample.

In the second line of Equation (1), we interact current and lagged real output growth with both institutional dummy variables, D_{EPL} and D_{UB} respectively. The interaction terms capture that the responsiveness of the unemployment rate over the business cycle depends on the institutional structure of national labor markets (Hijzen & Martin 2013). In particular, search theory of the labor market predicts that a high replacement rate increases the responsiveness of the unemployment rate (Hagedorn & Manovskii 2008), whereas the impact of strict EPL is a-priori ambiguous (Jung & Kuhn 2014).

In the third line of Equation (1), the change in the linear take-up rate, $\Delta STW_{n,t}$, captures that increases in STW dampen the rise in the unemployment rate in recessions. But in the early recovery, when STW schemes expire, the unemployment rate declines less because firms simply increase working hours of former STW participants back to normal instead of hiring new employees. Hence, in contrast to Boeri & Bruecker (2011), Hijzen & Venn (2011), and Hijzen & Martin (2013), we include the STW take-up rate in first differences (like Cahuc & Carcillo 2011) and not in levels. In contrast to Cahuc & Carcillo (2011), however, we use (the distributed lag version of) Okun’s law as the basis of our estimation strategy.

Next, also in the third line of Equation (1), we include the first difference of the squared take-up rate, $\Delta STW_{n,t}^2$. This term captures that the dampening effect of STW on the unemployment rate may diminish at high STW take-up rates. As argued by Hijzen & Martin (2013), the recent surge in STW was only partly due to the fact that more distressed firms met the eligibility criteria — the “rule based” component when STW acts as an automatic stabilizer (Balleer et al. 2015). Rather, the “discretionary” component, i.e. the temporary relaxation of STW eligibility criteria, played a very important role — both within and across countries. STW eligibility criteria are designed to minimize deadweight losses that arise whenever workers whose jobs are not at risk participate in STW schemes.¹⁰ Against this background, it is hardly surprising that Boeri & Bruecker (2011) find a sizable amount of deadweight loss at that time. In addition to

¹⁰A related phenomenon are displacement effects (Hijzen & Venn 2011). These effects occur when former STW participants are laid-off as soon as the STW compensation runs out. Unfortunately, owing to the short sample

that, [Balleer et al. \(2015\)](#) argue that temporary STW extensions are even less effective, because expectations of forward-looking market participants remain unaffected.

Still in the third line of Equation (1), we interact the change in the STW take-up rate with the dummy variable representing newly established STW schemes: $\Delta STW_{n,t} \times D_{NEW}$. This specification captures the hypothesis that only long-established schemes are able to fully exploit the benefits of STW. This may be the case because workers, firms, and public administration staff need some time to learn how to use a newly established STW scheme ([Boeri & Bruecker 2011](#)) or because it also takes some time to build trust among market participants that the new system is not only a temporary policy move (related to the argument by [Balleer et al. 2015](#)). Moreover, the implementation of some new STW schemes simply may have come too late to avoid the bulk of lay-offs during the Great Recession.

In the fourth line of Equation (1), we interact the change in the STW take-up rate with current real output growth, $\Delta STW_{n,t} \times \Delta \ln(GDP_{n,t})$. Based on the arguments developed above, deadweight losses are minimized if the use of STW is restricted to short and severe recessions ([Boeri & Bruecker 2011](#)), i.e. STW take-up should respond fast at the beginning of a recession and be brought down quickly in the early recovery. Hence, we expect that the coefficient of the “timing effect” is positive.

Finally, still in the fourth line of Equation (1), we include the change in the current and in the lagged OECD-wide unemployment rate, $\sum_{i=0}^1 \Delta \bar{U}_{t-i}$. [Table 2](#) shows that, similarly to time dummies (see [Section 3.3](#)), we thus also control for shocks common to all countries, but increase the instrument count only by 2 (instead of $T - 2 = 14$). This is important, because both the [Arellano & Bond \(1991\)](#) test for second order autocorrelation and the [Windmeijer \(2005\)](#) correction (used in the estimation procedure described below) assume no correlation across countries in the idiosyncratic disturbance ([Roodman 2009a](#)).

2.2.2 GMM Estimation Procedure

Our dynamic panel is subject to two potential sources of endogeneity. First, the STW take-up rate increases systematically when the labor market is slack ([Boeri & Bruecker 2011](#), [Cahuc & Carcillo 2011](#)). Thus, the standard OLS estimator tends to underestimate the dampening effect of STW on the unemployment rate (“simultaneity bias”). Second, the inclusion of the lagged dependent variable, $\Delta u_{n,t-1}$, as regressor may give rise to the so-called “dynamic panel bias” ([Nickell 1981](#)) in our short panel ($T < 20$, see [Judson & Owen 1999](#)).

In order to address both sources of endogeneity, we use the two-step difference GMM estimator with [Windmeijer](#)-corrected errors.¹¹ This estimator uses lagged levels of all endogenous variables and the current values of all exogenous variables as instruments to estimate the change in the endogenous variables ([Anderson & Hsiao 1982](#)).¹² In order to address instrument prolifer-

period, we are unlikely to capture fully these effects, partly also because in some countries lay-offs directly after participation in STW schemes are prohibited.

¹¹This estimator builds on [Anderson & Hsiao \(1982\)](#), [Holtz-Eakin et al. \(1988\)](#), and [Arellano & Bond \(1991\)](#). We first include all variables in levels (for instance, “log real GDP” instead of “real GDP growth”) and then use the [Stata \(2015\)](#) command `xtabond2` ([Roodman 2009a](#)) with the option `nolevels`, which differences all variables automatically. As a result, equation (1) is estimated. The Difference-in-Hansen test statistic (p-value: 0.052) clearly favors difference GMM over system GMM ([Arellano & Bover 1995](#), [Blundell & Bond 1998](#)).

¹²All instruments that enter in levels pass the unit root test of [Breitung \(2000\)](#) and [Im, Pesaran & Shin \(2003\)](#).

ation — which may overfit the endogenous variables — we (*i*) “collapse” the set of instruments and (*ii*) set the “laglimits” to 2 and 3 (Roodman 2009a). We also use the Hansen (1982) test for overidentifying restrictions and the Arellano & Bond (1991) test for second order autocorrelation to check the validity of our instruments. In addition, we apply the Windmeijer (2005) correction, which produces more accurate standard errors solving the downward bias in small samples (Roodman 2009a). A further advantage of difference GMM over other IV-estimators is that, when using an unbalanced panel, there is no trade-off between the lag-length and the sample size (Holtz-Eakin et al. 1988).

3 Results

The current section presents the estimated results. The “baseline specification” uses the two-step difference GMM estimator (Arellano & Bond 1991) with Windmeijer-corrected errors and controls for shocks common to all countries by including (lags of) the OECD-wide unemployment rate (Subsection 3.1). To check plausibility, we also report the results based on the corresponding “OLS specification” (Subsection 3.2) and the “time dummies specification” (Subsection 3.3). Subsection 3.4 discusses the quantitative implications of our estimates.

3.1 Baseline Specification

As can be seen in Table 3, the estimated linear component of an increase in STW, $\Delta STW_{n,t}$, is negative and significant at the 1% level. We also note that the coefficient is not significantly different from one in absolute value (as in Cahuc & Carcillo 2011). A coefficient equal to (minus) one implies that — ignoring the impact of all other (STW) terms — a one percentage point increase in the STW take-up rate leads to a one percentage point decrease in the unemployment rate. This (macro level) estimate seems surprisingly large, given that (*i*) the average reduction in working hours per STW participant is not more than 20%-40% in most OECD countries (see Figure 6 in Hijzen & Venn 2011) and (*ii*) evidence from firm level studies is rather inconclusive and mixed (see Footnote 2). However, in contrast to this strand of the literature, our study does not suffer from the negative selection bias of participating firms and captures all the indirect effects of STW arising from stabilizing aggregate demand and/or employment multiplier effects.

The estimated coefficient of the change in the squared STW take-up rate, $\Delta STW_{n,t}^2$, captures that the effect of an increase in the STW take-up rate may be nonlinear. We note that the estimate is positive and significant at the 1% level. Jointly, the linear and the quadratic STW coefficient predict that the dampening effect of STW on the unemployment rate follows a u-shaped relationship (see Figure 3, blue line), which is also significant at the 1% level according to the Lind & Mehlum (2007) test statistic.¹³ This implies that the (large) marginal effect of STW at low take-up rates eventually diminishes at take-up rates around 3.9%. This value is within the range of observed take-up rates during the Great Recession.

Moreover, we find that the (net) linear effect is more than 50% lower (and no longer significant at the 10% level) in those countries that have introduced a new STW scheme in response to

¹³To be precise, a monotone or inversely u-shaped relationship is rejected at all common significance levels. In addition, we note that the second derivative is (significantly) greater than zero.

the crisis. Together with the quadratic STW coefficient, which is the same for both preexisting and new STW schemes,¹⁴ the implied u-shape (p-value: 0.057) reaches its minimum already at STW take-up rates around 2% (see Figure 3, red line). The estimated dampening effect at this level of take-up is not higher than 0.5 percentage points. In summary, the effects of STW are significantly smaller in “new STW” countries.

The estimate of the interaction term between the change in STW take-up and GDP growth, $\Delta STW_{n,t} \times \Delta \ln(GDP_{n,t})$, measures how the dampening impact of STW on the unemployment rate changes over the business cycle. We note that the STW “timing effect” has the expected sign and is significant at the 10% level.¹⁵ This implies that the linear component is weaker (stronger) when GDP growth is positive (negative). Figure 4 illustrates that, at 2% GDP growth, the dampening effect never exceeds one percentage point and the maximum effect is reached already at take-up rates around 2%. At -4% GDP growth, the maximum dampening effect is higher than seven percentage points, which is reached at take-up rates around 6%. The latter prediction indicates substantial (un-)employment gains when GDP growth is deeply negative. Thus, STW take-up should be boosted at the beginning of a recession and brought down quickly in the early recovery. By contrast, STW take-up in most countries did not rise steeply at the beginning of the Great Recession in 2008Q4 — when GDP growth was deeply negative — but with a delay of about 2 quarters in 2009Q2 — when GDP growth was again slightly positive. This indicates that many STW schemes may fail to exploit their large potential, simply because implementation lags prevent a faster response.

The coefficients from the underlying distributed lag version of Okun’s law all have the expected sign. The impact of the lagged dependent variable is positive and significant at the 1% level. The impact of current and past output growth is negative, but only the coefficient of the lagged term is significant (at the 5% level). From the institutional interaction variables, only the EPL dummy interacted with current GDP growth, $D_{EPL} * \Delta \ln(GDP_{n,t})$, is significant at the 10% level (with a negative sign). Put differently, strict EPL amplifies unemployment fluctuations over the business cycle, whereas the level of UB has no significant effects.

Finally, we note that the statistics of the Hansen test for overidentifying restrictions and the Arellano & Bond test for second order autocorrelation remain within normal limits.

3.2 OLS Specification

Column 2 of Table 3 reports the coefficients when we estimate our dynamic panel using OLS, i.e. we ignore that STW increases systematically when the labor market is slack. Therefore, OLS coefficients of STW-related terms can be interpreted as a lower bound estimate (Boeri & Bruecker 2011, Cahuc & Carcillo 2011). But, in our setting, this may be misleading because OLS also ignores the dynamic panel bias (Nickell 1981). To infer a more robust estimate of the lower bound, we re-estimate our baseline specification, but instrument only the lagged dependent variable and not the STW-related terms (see column 3). As expected, we find that the OLS

¹⁴In Section (4) on robustness checks, we additionally interact D_{NEW} with the change in the squared STW take-up rate, $\Delta STW_{n,t}^2$. The coefficient is very far from being significant.

¹⁵Note that the interpretation of the corresponding coefficient is not the same as in Boeri & Bruecker (2011), Hijzen & Venn (2011), and Hijzen & Martin (2013), because we estimate the impact of STW on unemployment in first differences.

estimates are much smaller in magnitude (by 40-85%) and their significance is reduced, but prevails at lower levels. Only the u-shape becomes insignificant.

3.3 Time Dummies Specification

Furthermore, we include the full set of time dummies instead of (lags of) the change in the OECD-wide unemployment rate — the standard treatment to control for shocks common to all countries (Roodman 2009a). Yet, in our dynamic panel, the inclusion of time dummies increase the instrument count by $T - 2 = 14$ to 30, such that the number of instruments exceeds the number of countries $N = 27$. Based on the simulation results of Andersen & Sorensen (1996) and Bowsher (2002), Roodman (2009b) cautions against instrument proliferation, as this may overfit the instrumented variables, leads to imprecise estimates of the optimal weighting matrix, and weakens the Hansen (1982) test of instrument validity.

As can be seen in column 4 of Table 3, all STW-related terms but the “timing effect” remain significant and keep the expected sign. However, the coefficient of the lagged dependent variable, $\Delta U_{n,t-1}$, seems implausibly low. In addition, the Hansen test statistic shows an implausibly perfect p-value of 0.999. Further checks, summarized in Table 4, corroborate that the drop in the coefficient of $\Delta U_{n,t-1}$ is very likely due to instrument proliferation. When we remove the four institutional (*EPL* and *UB*-related) controls — and thus reduce the number of instruments by four — the coefficient of $\Delta U_{n,t-1}$ is neither sensitive to the way how we control for common shocks (compare column 2 with column 4), nor significantly different from our baseline specification (column 3). In addition, the Hansen test statistic falls in both cases. This evidence supports the use of the OECD-wide unemployment rate instead of time dummies.

3.4 Discussion

In the previous section, we have identified two key factors of successful STW schemes. First, as the marginal dampening effect is decreasing, STW should be used to a carefully judged extent. Second, STW is most effective at the beginning of recessions when GDP growth is deeply negative. In the following, we examine which country used STW more successfully than others. For this purpose, we determine the country-specific difference between the actual unemployment rate at peak take-up and the (counterfactual) unemployment rate in the absence of STW (akin to Boeri & Bruecker 2011). Table 5 illustrates that the total dampening effect was largest in Germany (-5.01), followed up by Luxembourg (-4.00) and Finland (-2.98). Both Germany and Luxembourg used STW extensively, with peak take-up rates equal to 4.15 and 3.90, respectively. Finland, on the other hand, shows the largest “success ratio”, i.e. each percentage point increase in STW take-up led to a reduction in the unemployment rate of about 1.6 percentage point (which points to substantial multiplier effects). Less successful STW schemes were, for instance, Japan and the Slovak Republic. Japan is the country with the second highest peak take-up rate (4.59), but the estimated impact is disappointingly low (-1.42). In the Slovak Republic, the estimated impact is even positive (0.10).

Next, we decompose the total dampening effect into the nonlinear component (due to the linear and the quadratic term) and the “timing effect”. As can be seen from Columns 6-7, the nonlinear component follows the same pattern as depicted in Figure 3. The effect is strong at

low take-up rates, but then becomes less intense and eventually diminishes when take-up exceeds 3.9%. Moreover, we note that preexisting STW schemes outperformed newly established ones. In contrast to the nonlinear component, the “timing effect” is more dispersed. We argue that it is actually the “timing effect” which explains why Germany, Finland, and the Czech Republic (a “new STW” country!) performed so well. Those three STW schemes responded relatively quickly, i.e. STW rose fastest when GDP growth was deeply negative. Quite the opposite, implementation lags in Japan and the Slovak Republic were large — which explains why these countries were not able to fully exploit the benefits of STW.

4 Robustness Analysis

The following section presents a large number of robustness checks. In particular, we evaluate various sample exclusions and modify the set of independent variables.

4.1 Sample Exclusions

Intensive Margin of STW We measure STW usage intensity by the take-up rate, i.e. the share of all employees participating in public STW schemes. The scope of this extensive margin measure may be limited, because the average hours reduction per STW participant (AHR) differs substantially across OECD countries. However, quarterly AHR data are not available. For a set of 16 OECD countries (of which 14 are in our sample), [Hijzen & Venn \(2011\)](#) provide annual estimates of AHR throughout the year 2009 (when STW take-up was highest). Based on this evidence, we remove those five countries where AHR was highest/lowest and then re-estimate our model.¹⁶ Given that the incentives to keep a worker (instead of firing her) are stronger when the maximum permissible hours reduction per STW participant is high, it seems not implausible that STW schemes in high AHR countries may be more effective.

On the contrary, [Table 6](#) shows that both the linear and the quadratic STW term rise (fall) in absolute value when we exclude high (low) AHR countries from the sample.¹⁷ This may be the case because STW in high AHR countries is used as a substitute for temporary layoffs ([Hijzen & Venn 2011](#)), which may give rise to displacement effects. Moreover, the insignificant “timing effect” when low AHR countries are excluded points to another possible explanation. As can be seen in [Figure 1](#), all low AHR countries (but Poland) are “early adopters”, i.e. STW take-up peaks in 2009Q3 or earlier, while all high AHR countries are “late adopters”, i.e. STW take-up does not peak before 2009Q4 (i.e. in the early recovery). This indicates that many “late adopters” failed to exploit the large potentials of STW, simply because implementation lags prevented higher take-up when GDP growth was deeply negative at the beginning of the Great Recession. Unfortunately, as all high AHR countries are “late adopters”, we are unable to disentangle the effects of these two alternative channels.

¹⁶AHR was highest in Finland, Italy, Norway, Portugal, and Spain; and lowest in Austria, France, Germany, the Netherlands, and Poland.

¹⁷For “new STW” countries, the net effect is given by the sum of both linear coefficients. Also this measure rises (falls) when high (low) AHR countries are excluded.

Other Sample Exclusions Still in Table 6, we first exclude all “new STW” countries. Second, we exclude two “outliers”, i.e. Ireland and Spain. In these two countries, the rise in unemployment relative to the drop in GDP growth was far higher than in any other country in our sample.¹⁸ Third, we exclude all countries that have never operated a STW scheme. As above, we observe that in some cases the “timing effect” turns insignificant. All other STW-related coefficients are robust to these sample exclusions.

Jackknife Resampling Table 7 summarizes the results of a full `jackknife` (Stata 2015) resampling scheme. In particular, we re-estimate the baseline specification $N = 27$ times, while excluding one country each time from the sample. The linear and the quadratic STW term remain highly significant in all 27 cases. The “timing effect” turns insignificant in eight of the 27 subsamples (except for Poland, all of these countries are “early adopters”). The “new STW” interaction term loses significance at the 10% level only in the case of Japan. As can be seen from Figures 1 and 3, Japan is the country with the second highest peak take-up rate. Japan thus belongs to the group of three countries that exhibited take-up rates above the estimated threshold beyond which the dampening effect of STW bottoms out. Therefore, it seems not very surprising that including Japan appears important to appropriately identify the nonlinear relationship between changes in STW take-up and unemployment.

4.2 Alternative Independent Variables

Alternative STW Terms As already noted in Section 3.1, the baseline specification captures that the linear effect of STW may be lower in “new STW” countries, but the quadratic term is imposed to be the same across all STW countries. Therefore, Table 8 reports the results when we additionally interact the first difference of the squared take-up rate with the dummy variable representing “new STW” countries, $D_{NEW} * \Delta STW_{n,t}^2$. To control for instrument proliferation (see Section 3.3), we estimate this specification with (column 2) and without (column 1) institutional controls. We observe that, in both cases, the corresponding coefficient is far from being significant at all common levels.¹⁹ In addition, the minimum of the estimated u-shape for “new STW” countries lies at 10.3% take-up — which is more than four times higher than peak take-up among all “new STW” countries (1.9% in the Czech Republic). For this reason, the [Lind & Mehlum](#) test (trivially) fails to reject a monotone or inversely u-shaped relationship.

In addition, we consider not only current, but also lagged terms of all four STW-related variables. No matter whether we include institutional controls (column 4) or not (column 3), no single lagged STW-related term is significant at the 10% level. In column 5 and 6, we include the quadratic term from column 1 and 2, together with the lagged terms from column 3 and 4. Only in one of these two cases, one single added coefficient ($\Delta STW_{n,t-1} \times D_{NEW}$) is significant. Thus, as above, [Footnote 19](#) applies here accordingly.

¹⁸Note that Estonia and Greece experienced a similarly sharp rise in unemployment, but in response to a much deeper decline in GDP.

¹⁹For this reason, the insignificance of the linear interaction dummy for “new STW” countries (only column 2) and the “timing effect” (columns 1 and 2) does not constitute a major concern.

Additional Institutional Controls Our baseline specification captures that the responsiveness of the unemployment rate over the business cycle depends on the institutional structure of national labor markets. In particular, we control for the generosity of UB and the strictness of EPL. In the following, we evaluate two alternative institutional controls that may be relevant in our dynamic panel. In particular, following IMF (2010) and Boeri & van Ours (2013), a decentralized wage bargaining structure may reduce the responsiveness of the unemployment rate as it enhances downward-wage flexibility, whereas a large share of temporary employment contracts tends to increase the responsiveness of the labor market.

For this reason, we define two additional dummy variables. The first dummy variable, D_{CBI} , is set to unity for the 15 countries in our sample where the centralized bargaining index [CBI] developed by Visser (2015)²⁰ is greater or equal to 3 (on a scale from 1 to 5) and zero otherwise; the second dummy variable, D_{STE} , is set to unity for the 13 countries in our sample where the share of temporary employment in total dependent employment [STE] as measured by the OECD in 2008²¹ is above the median (12%) and zero otherwise (see Table 1). Table 9 shows that none of the added control variables is significant. Thus, Footnote 19 applies also here.

Interactions between STW and Institutions Hijzen & Martin (2013) argue that the institutional structure of national labor market may not only affect the responsiveness of the unemployment rate over the business cycle, but also the effectiveness of STW. For instance, downward wage flexibility induced by decentralized wage bargaining may limit the scope of STW (Boeri & Bruecker 2011). Therefore, we interact the institutional dummy variables not only with current and lagged GDP growth, but also with the current change in STW. Table 10 shows that none of the STW interaction terms is significant (see also Footnote 19). The insignificance of the *EPL*-related term is particularly interesting, because it implies that not only high-EPL Continental European countries may benefit from STW, but also low-EPL Anglo-Saxon countries.

5 Conclusion

This paper quantifies the effectiveness of STW policy interventions during the Great Recession. In particular, we examine whether the dampening effect of STW on the unemployment rate diminishes at higher STW take-up rates and whether STW schemes already established at the outbreak of the Great Recession outperformed those that were newly introduced in response to the crisis. For this purpose, we estimate a distributed lag version of Okun’s law, using macroeconomic data from the OECD. We show that (i) the marginal dampening effect of STW on unemployment is large at low take-up rates, but then the effect becomes less intense and eventually diminishes at higher take-up rates and (ii) only countries with preexisting STW schemes were able to fully exploit the benefits of STW. In addition, we find that (iii) the effect of STW is strongest when GDP growth is deeply negative.

²⁰We use the 2008 value of “coordination of wage setting”. Iceland is missing in the ICTWSS data base. According to the Icelandic Confederation of Labour (2016), the vast majority (about 88%) of the Icelandic workforce is covered by collective bargaining agreements. Hence, we set D_{CBI} for Iceland to unity.

²¹As the 2008 value for the United States is missing in the data base, we use the last available value from 2005.

Our first result (*i*) calls for strict eligibility criteria to avoid large deadweight losses at high STW take-up rates. Given that a significant share of the increase in STW during the Great Recession can be attributed to relaxed eligibility criteria (Hijzen & Martin 2013), this finding also casts doubt on the widespread practice to extend STW schemes during recessions. Our second result (*ii*) indicates that market participants indeed need some time to learn how to use a newly established STW scheme (Boeri & Bruecker 2011) or that the implementation of some new STW schemes simply may have come too late to avoid the bulk of lay-offs during the Great Recession. For this reason, we conclude that STW is not a suitable quick-fix solution to rising unemployment in recessions. Our third result (*iii*) implies that STW take-up should be boosted at the beginning of a recession and brought down quickly in the early recovery. In summary, our results indicate that STW is most effective when used as a fast-responding automatic stabilizer.

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A Figures

A.1 Changes in STW Take-up during the Great Recession

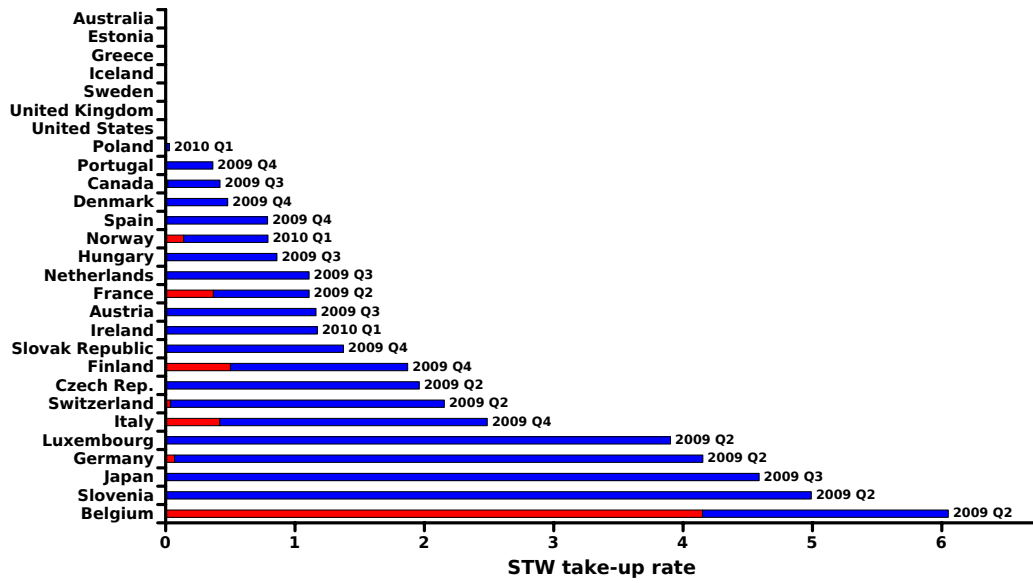


Figure 1: The figure plots the change in STW take-up between 2007Q1 (red) and the country specific peak (blue, see the label for the exact date).

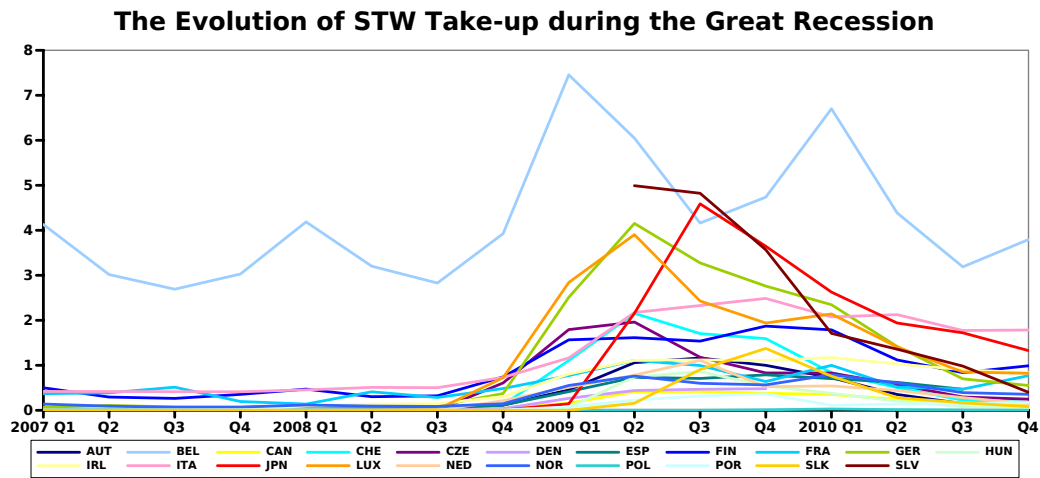


Figure 2: The figure plots STW take-up rates between 2007Q1 and 2010Q4 for all countries in our sample.

A.2 The Nonlinear Effect of STW on Unemployment

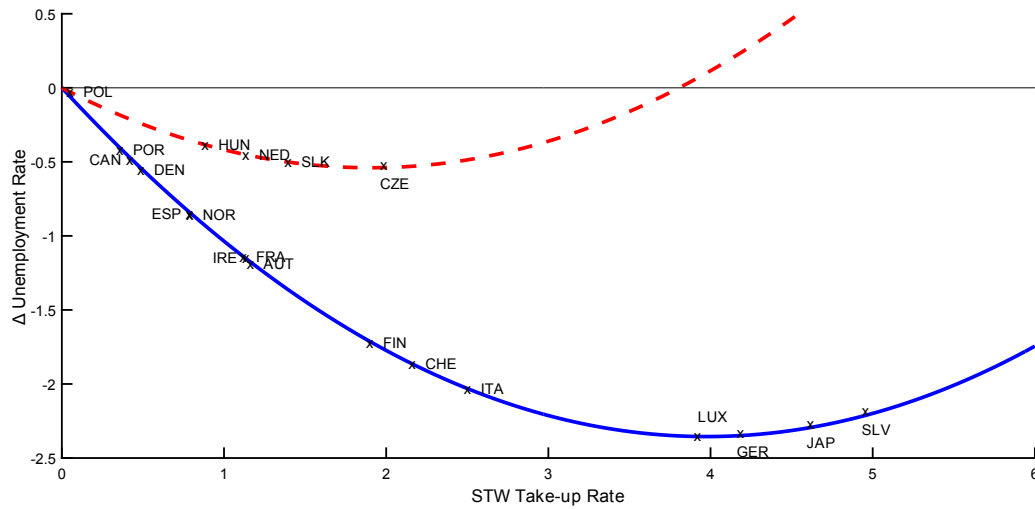


Figure 3: The figure illustrates the nonlinear dampening effect of STW take-up on the unemployment rate when GDP growth is nil (average GDP growth in our sample is 0.1%). The marks display country-specific peak take-up rates and the corresponding effect. The blue line depicts the effect for preexisting schemes, while the red line plots the effect for “new STW” countries.

A.3 Timing of STW over the Business Cycle

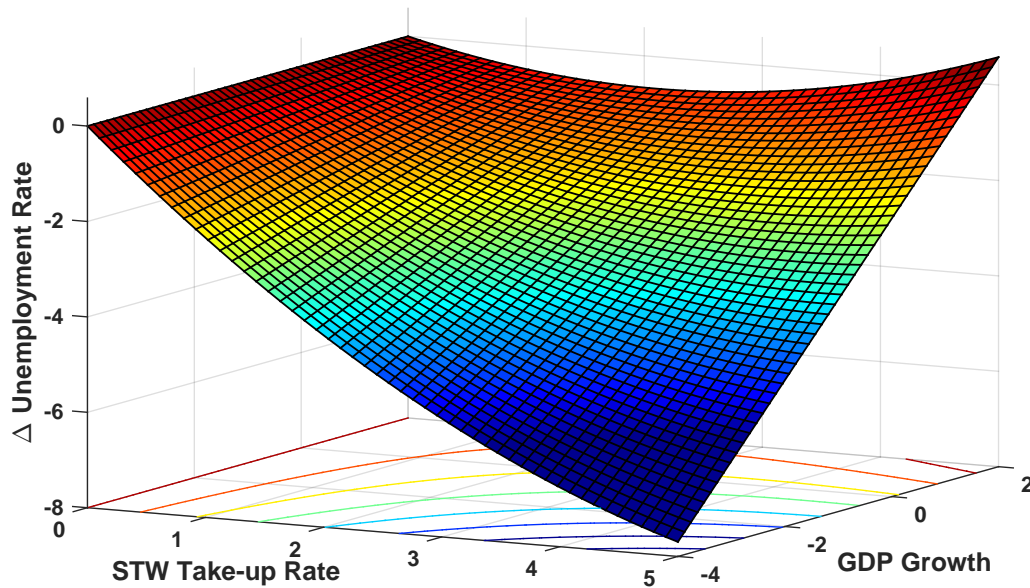


Figure 4: The figure plots the estimated dampening effect of STW take-up rates on the unemployment rate at different values of GDP growth. The “contour lines” represent all possible take-up/GDP growth combinations that yield the same dampening effect on the unemployment rate in percentage points — stepwise from orange (-1) to dark blue (-7).

B Tables

B.1 Countries in Our Sample

	Country	STW Scheme	Data Availability	EPL	UB	STE	CBI	Comment
1	Australia	No STW	Yes	0	1	0	0	
2	Austria	STW	Yes	0	1	0	1	
3	Belgium	STW	Yes					excluded
4	Canada	STW	Yes	0	0	1	0	
5	Chile	No Information	No					
6	Czech Republic	New STW	Yes	1	0	0	0	starts in 2008Q4
7	Denmark	STW	Yes	0	1	0	1	missing values after 2009Q4
8	Estonia	No STW	Yes	0	0	0	0	Cahuc & Carcillo (2011): No Information
9	Finland	STW	Yes	0	1	1	1	
10	France	STW	Yes	1	1	1	0	
11	Germany	STW	Yes	1	1	1	1	
12	Greece	No STW	Yes	1	0	0	1	
13	Hungary	New STW	Yes	0	0	0	0	starts in 2009Q1
14	Iceland	No STW	Yes	1	1	0	1	
15	Ireland	STW	Yes	0	1	0	1	
16	Israel	No Information	No					not mentioned in Cahuc & Carcillo (2011)
17	Italy	STW	Yes	1	0	1	1	
18	Japan	STW	Yes	0	0	1	1	
19	Korea	STW	No					
20	Luxembourg	STW	Yes	1	0	0	0	
21	Mexico	New STW	No					
22	Netherlands	New STW	Yes	1	1	1	1	starts in 2008Q4
23	New Zealand	STW	No					
24	Norway	STW	Yes	0	1	0	1	
25	Poland	New STW	Yes	0	0	1	0	starts in 2009Q4
26	Portugal	STW	Yes	1	1	1	0	
27	Slovak Republic	New STW	Yes	1	0	0	0	starts in 2009Q1
28	Slovenia	STW	Yes	1	0	1	1	Cahuc & Carcillo (2011): No Information missing values before 2009Q2 missing value in 2010Q4
29	Spain	STW	Yes	1	1	1	1	
30	Sweden	No STW	Yes	1	1	1	1	
31	Switzerland	STW	Yes	0	0	1	1	
32	Turkey	STW	No					
33	United Kingdom	No STW	Yes	0	0	0	0	
34	United States	No STW	Yes	0	0	0	0	Cahuc & Carcillo (2011): STW in 17 states

Table 1: The table classifies all current OECD member countries by their STW policy during the Great Recession: preexisting “STW”, “New STW”, and “No STW” at any time. We adapt the classification of Cahuc & Carcillo (2011) with the following modifications. We consider Slovenia a “STW” country, as market participants were already experienced in using indirectly subsidized STW (see below). Estonia and the United States (only 17 states operated a STW scheme, see Crimmann et al. 2012) are considered “No STW” countries (as in Hijzen & Martin 2013). Information on STW in Israel is missing. STW take-up rates were kindly provided by Alexander Hijzen in form of a Stata and an Excel file. We use the Stata file, but overwrite the series on Germany (to remove the seasonal pattern), Luxembourg (to rectify the missing conversion into percentages), Slovenia (to set zero take-up prior to 2009Q1 to “missing”), and Switzerland (to obtain a complete series) using the Excel data from 2007Q1-2010Q4. The ambiguity in the case of Slovenia is likely due to the fact that STW in Slovenia has a long tradition (going back to the early 1990s, see Godfrey & Richards 1997, Section 8.8.4), but the system was not directly subsidized in the time before January 2009 (Mandl 2010). Both before and after this policy change, STW in Slovenia was most intensively used by firms in manufacturing — a sector that benefited substantially from various other employment subsidies in the time before 2009Q1 (Economic Issues 2009, p. 14). In other words, there was positive (indirectly subsidized) take-up already before 2009Q1, but the exact extent is unknown — and even if it was known, the values before and after 2009Q1 would not be comparable. For this reason, it seems more appropriate to set the values prior to 2009Q1 to “missing” than to zero. Finally, we note that EPL, UB, CBI, and STE refer to the institutional interaction dummies.

B.2 Time Dummies vs. OECD-wide Unemployment Rate

	Period-wise RSME	Reduction
no control for common shocks	4.87	0.0%
full set of time dummies	0.14	97.2%
OECD-wide unemployment rate	3.03	37.7%
OECD-wide unemployment rate with one lag	1.98	59.4%

Table 2: The table displays the period-wise root mean squared error (RMSE) of four different specifications. For each of the $T - 2$ time periods, we determine the sum of squared country-specific errors. We then sum up these $T - 2$ sums before we take the square root.

B.3 Baseline Specification

	OECD UNEM			Time Dummies
	GMM	OLS	GMM-2	GMM
$\Delta U_{n,t-1}$	0.616 (0.168)***	0.645 (0.072)***	0.691 (0.162)***	0.469 (0.210)**
$\Delta STW_{n,t}$	-1.185 (0.318)***	-0.235 (0.098)**	-0.246 (0.074)***	-0.931 (0.443)**
$\Delta STW_{n,t}^2$	0.150 (0.034)***	0.030 (0.018)*	0.033 (0.010)***	0.130 (0.060)**
$\Delta STW_{n,t} \times D_{NEW}$	0.618 (0.192)***	0.375 (0.168)**	0.363 (0.158)**	0.788 (0.184)***
$\Delta STW_{n,t} \times \Delta \ln(GDP_{n,t})$	0.276 (0.149)*	0.039 (0.022)*	0.035 (0.021)	0.296 (0.239)
$\Delta \ln(GDP_{n,t})$	-0.021 (0.033)	-0.043 (0.028)	-0.039 (0.023)	-0.068 (0.048)
$\Delta \ln(GDP_{n,t-1})$	-0.044 (0.020)**	-0.035 (0.028)	-0.034 (0.023)	-0.044 (0.017)**
$\Delta \ln(GDP_{n,t}) \times EPL$	-0.069 (0.036)*	-0.026 (0.025)	-0.028 (0.022)	-0.027 (0.053)
$\Delta \ln(GDP_{n,t-1}) \times EPL$	0.02 (0.015)	0.037 (0.024)	0.038 (0.015)**	0.015 (0.024)
$\Delta \ln(GDP_{n,t}) \times UB$	-0.023 (0.042)	0.027 (0.023)	0.027 (0.020)	-0.008 (0.067)
$\Delta \ln(GDP_{n,t-1}) \times UB$	-0.014 (0.021)	-0.016 (0.022)	-0.017 (0.016)	-0.015 (0.022)
Number of countries	27	27	27	27
Number of observations	364	364	364	364
Number of instruments	18		14	30
Joint-Significance	0	0.020	0.013	0.002
U-Shape Test	0.001	0.237	0.087	0.072
$p[\Delta STW_{n,t} \times (1 + D_{NEW})] = 0$	0.113	0.418	0.445	0.758
R-Squared		0.687		
Hansen test	0.924		0.642	0.999
AB-test AR(2)	0.385		0.768	0.998

Table 3: The table displays the results of our benchmark specification (column 1), the OLS specification (column 2), the GMM specification where STW-related variables are not instrumented (column 3), and the time dummies specification (column 4). We also report p-values of F-tests on joint significance of all four STW-related coefficients, p-values of Lind & Mehlum (2007) u-shape tests, and p-values of F-tests on joint significance of both linear STW-related coefficients. Stars (*, **, ***) indicate significance at the 10%, 5%, and 1% level, respectively.

B.4 Instrument Proliferation

	Quarter dummies		OECD Unemployment	
	Institution	No Inst	Institution	No Inst
$\Delta U_{n,t-1}$	0.469 (0.210)**	0.595 (0.181)***	0.616 (0.168)***	0.673 (0.184)***
$\Delta STW_{n,t}$	-0.931 (0.443)**	-1.120 (0.380)***	-1.185 (0.318)***	-1.096 (0.354)***
$\Delta STW_{n,t}^2$	0.130 (0.060)**	0.158 (0.049)***	0.150 (0.034)***	0.137 (0.034)***
$\Delta STW_{n,t} \times D_{NEW}$	0.788 (0.184)***	0.742 (0.222)***	0.618 (0.192)***	0.668 (0.263)**
$\Delta STW_{n,t} \times \Delta \ln(GDP_{n,t})$	0.296 (0.239)	0.268 (0.231)	0.276 (0.149)*	0.265 (0.173)
$\Delta \ln(GDP_{n,t})$	-0.068 (0.048)	-0.073 (0.037)*	-0.021 (0.033)	-0.062 (0.032)*
$\Delta \ln(GDP_{n,t-1})$	-0.044 (0.017)**	-0.029 (0.013)**	-0.044 (0.020)**	-0.030 (0.015)*
$\Delta \ln(GDP_{n,t}) \times EPL$	-0.027 (0.053)		-0.069 (0.036)*	
$\Delta \ln(GDP_{n,t-1}) \times EPL$	0.015 (0.024)		0.020 (0.015)	
$\Delta \ln(GDP_{n,t}) \times UB$	-0.008 (0.067)		-0.023 (0.042)	
$\Delta \ln(GDP_{n,t-1}) \times UB$	-0.015 (0.022)		-0.014 (0.021)	
Number of instruments	30	26	18	14
Joint-Significance	0.002	0.011	0.000	0.000
Hansen test	0.999	0.882	0.924	0.871
AB-test AR(2)	0.998	0.577	0.385	0.342

Table 4: The table displays the results of our baseline specification and the time dummies specification, with and without institutional controls. We also report p-values of F-tests on joint significance of all four STW-related coefficients. Stars (*, **, ***) indicate significance at the 10%, 5%, and 1% level, respectively.

B.5 Estimated Effect of STW on Unemployment

Country	Peak Take-Up	ΔQrt	Total		Nonlinear		Timing	
			Effect	Success	Effect	Success	Effect	Success
Austria	1.16	2	-1.50	129%	-1.17	101%	-0.33	28%
Canada	0.42	1	-0.60	144%	-0.45	107%	-0.15	36%
Czech Rep.*	1.96	0	-2.03	104%	-0.54	27%	-1.49	76%
Denmark	0.48	1	-0.72	151%	-0.53	111%	-0.19	39%
Finland	1.87	0	-2.98	159%	-1.14	61%	-1.84	98%
France	1.11	1	-0.98	88%	-0.71	64%	-0.27	24%
Germany	4.15	0	-5.01	121%	-2.25	54%	-2.76	66%
Hungary*	0.86	1	-0.52	60%	-0.38	44%	-0.14	16%
Ireland	1.17	1	-1.54	131%	-1.18	101%	-0.35	30%
Italy	2.49	1	-2.15	87%	-1.55	62%	-0.61	24%
Japan	4.59	2	-1.42	31%	-2.28	50%	0.85	-19%
Luxembourg	3.90	1	-4.00	102%	-2.34	60%	-1.66	43%
Netherlands*	1.11	2	-0.75	67%	-0.44	40%	-0.30	27%
Norway	0.79	-1	-0.72	91%	-0.68	86%	-0.04	4%
Poland*	0.03	5	-0.01	36%	-0.02	56%	0.01	-21%
Portugal	0.36	1	-0.42	115%	-0.40	111%	-0.01	4%
Slovak Rep.*	1.37	2	0.10	-7%	-0.50	36%	0.59	-43%
Slovenia	4.99	-	-2.18	44%	-2.18	44%	-	-
Spain	0.79	1	-1.08	137%	-0.84	107%	-0.24	30%
Switzerland	2.15	2	-2.25	105%	-1.81	84%	-0.44	20%

Table 5: The table reports the country-specific peak STW take-up rate (column 2), the lag length (in quarters) between the deepest fall in GDP and the sharpest rise in STW take-up (column 3), and the difference between the actual unemployment rate at peak take-up and the estimated (counterfactual) unemployment rate in the absence of STW (column 4). Column 5 gives the ratio between the negative of the value in column 4 and the value in column 2. In columns 6-9, we decompose the total effect into the nonlinear effect (stemming from the linear and quadratic coefficient) and the “timing effect”. Stars indicate newly established STW schemes.

B.6 Robustness: Excluding Groups of Countries

	High AHR	Low AHR	New STW	Outliers	Only STW
$\Delta U_{n,t-1}$	0.486 (0.111)***	0.796 (0.182)***	0.741 (0.160)***	0.577 (0.246)**	0.599 (0.230)**
$\Delta STW_{n,t}$	-1.337 (0.212)***	-0.823 (0.324)**	-0.872 (0.366)**	-1.324 (0.288)***	-1.151 (0.262)***
$\Delta STW_{n,t}^2$	0.175 (0.020)***	0.110 (0.033)***	0.115 (0.041)***	0.159 (0.032)***	0.153 (0.032)***
$\Delta STW_{n,t} \times D_{NEW}$	0.553 (0.182)***	0.872 (0.350)**		0.621 (0.300)**	0.607 (0.199)***
$\Delta STW_{n,t} \times \Delta \ln(GDP_{n,t})$	0.282 (0.150)*	0.090 (0.187)	0.157 (0.167)	0.348 (0.162)**	0.229 (0.141)
$\Delta \ln(GDP_{n,t})$	-0.025 (0.043)	-0.007 (0.030)	-0.008 (0.024)	-0.024 (0.039)	0.008 (0.047)
$\Delta \ln(GDP_{n,t-1})$	-0.068 (0.015)***	-0.035 (0.024)	-0.041 (0.017)**	-0.036 (0.024)	-0.055 (0.036)
$\Delta \ln(GDP_{n,t}) \times EPL$	-0.095 (0.043)**	-0.039 (0.024)	-0.046 (0.032)	-0.073 (0.039)*	-0.100 (0.061)
$\Delta \ln(GDP_{n,t-1}) \times EPL$	0.031 (0.014)**	0.035 (0.016)**	0.034 (0.016)*	0.003 (0.021)	0.028 (0.024)
$\Delta \ln(GDP_{n,t}) \times UB$	0.000 (0.057)	-0.008 (0.034)	-0.023 (0.038)	-0.041 (0.046)	-0.064 (0.073)
$\Delta \ln(GDP_{n,t-1}) \times UB$	-0.017 (0.024)	-0.007 (0.022)	-0.014 (0.017)	-0.015 (0.027)	0.003 (0.028)
Number of countries	22	22	22	25	18
Number of observations	295	294	294	336	266
Number of instruments	18	18	16	18	18
Joint Significance	0.000	0.003	0.002	0.000	0.000
Hansen test	0.986	0.449	0.999	0.864	0.917
AB-test AR(2)	0.617	0.443	0.243	0.438	0.813

Table 6: The table displays the results of following sample exclusions. We exclude the five countries with the highest (lowest) AHR; all “New STW” countries; the two “outliers”, i.e. Ireland & Spain; and all countries without a STW scheme. Stars (*, **, ***) indicate significance at the 10%, 5%, and 1% level, respectively.

B.7 Robustness Check: Jackknife Resampling

		Coeff.	Std. Err.	P-Value	Sig.
Australia	$\Delta STW_{n,t}$	-1.189	0.285	0.000	***
	$\Delta STW_{n,t}^2$	0.151	0.031	0.000	***
	$\Delta STW_{n,t} \times D_{NEW}$	0.615	0.171	0.000	***
	$\Delta STW_{n,t} \times \Delta \ln(GDP_{n,t})$	0.281	0.142	0.058	*
	test on joint significance			0.000	***
Austria	$\Delta STW_{n,t}$	-1.052	0.333	0.004	***
	$\Delta STW_{n,t}^2$	0.135	0.035	0.001	***
	$\Delta STW_{n,t} \times D_{NEW}$	0.645	0.264	0.022	**
	$\Delta STW_{n,t} \times \Delta \ln(GDP_{n,t})$	0.211	0.148	0.164	
	test on joint significance			0.000	***
Canada	$\Delta STW_{n,t}$	-1.183	0.312	0.001	***
	$\Delta STW_{n,t}^2$	0.150	0.033	0.000	***
	$\Delta STW_{n,t} \times D_{NEW}$	0.627	0.189	0.003	***
	$\Delta STW_{n,t} \times \Delta \ln(GDP_{n,t})$	0.280	0.147	0.068	*
	test on joint significance			0.000	***
Czech Rep.	$\Delta STW_{n,t}$	-0.937	0.291	0.003	***
	$\Delta STW_{n,t}^2$	0.123	0.029	0.000	***
	$\Delta STW_{n,t} \times D_{NEW}$	0.680	0.348	0.061	*
	$\Delta STW_{n,t} \times \Delta \ln(GDP_{n,t})$	0.174	0.155	0.273	
	test on joint significance			0.000	***
Denmark	$\Delta STW_{n,t}$	-1.173	0.327	0.001	***
	$\Delta STW_{n,t}^2$	0.147	0.035	0.000	***
	$\Delta STW_{n,t} \times D_{NEW}$	0.624	0.195	0.004	***
	$\Delta STW_{n,t} \times \Delta \ln(GDP_{n,t})$	0.281	0.154	0.080	*
	test on joint significance			0.000	***
Estonia	$\Delta STW_{n,t}$	-1.268	0.407	0.004	***
	$\Delta STW_{n,t}^2$	0.153	0.039	0.001	***
	$\Delta STW_{n,t} \times D_{NEW}$	0.743	0.348	0.042	**
	$\Delta STW_{n,t} \times \Delta \ln(GDP_{n,t})$	0.340	0.195	0.094	*
	test on joint significance			0.000	***
Finland	$\Delta STW_{n,t}$	-1.371	0.269	0.000	***
	$\Delta STW_{n,t}^2$	0.174	0.025	0.000	***
	$\Delta STW_{n,t} \times D_{NEW}$	0.621	0.164	0.001	***
	$\Delta STW_{n,t} \times \Delta \ln(GDP_{n,t})$	0.336	0.158	0.044	**
	test on joint significance			0.000	***
France	$\Delta STW_{n,t}$	-1.072	0.332	0.003	***
	$\Delta STW_{n,t}^2$	0.138	0.035	0.000	***
	$\Delta STW_{n,t} \times D_{NEW}$	0.688	0.247	0.010	***
	$\Delta STW_{n,t} \times \Delta \ln(GDP_{n,t})$	0.225	0.150	0.146	
	test on joint significance			0.000	***
Germany	$\Delta STW_{n,t}$	-1.232	0.420	0.007	***
	$\Delta STW_{n,t}^2$	0.151	0.043	0.002	***
	$\Delta STW_{n,t} \times D_{NEW}$	0.698	0.223	0.004	***
	$\Delta STW_{n,t} \times \Delta \ln(GDP_{n,t})$	0.292	0.201	0.159	
	test on joint significance			0.000	***

		Coeff.	Std. Err.	P-Value	Sig.
Greece	$\Delta STW_{n,t}$	-1.189	0.283	0.000	***
	$\Delta STW_{n,t}^2$	0.152	0.031	0.000	***
	$\Delta STW_{n,t} \times D_{NEW}$	0.585	0.174	0.002	***
	$\Delta STW_{n,t} \times \Delta \ln(GDP_{n,t})$	0.267	0.135	0.059	*
	test on joint significance			0.000	***
Hungary	$\Delta STW_{n,t}$	-1.225	0.353	0.002	***
	$\Delta STW_{n,t}^2$	0.153	0.037	0.000	***
	$\Delta STW_{n,t} \times D_{NEW}$	0.626	0.217	0.008	***
	$\Delta STW_{n,t} \times \Delta \ln(GDP_{n,t})$	0.291	0.157	0.076	*
	test on joint significance			0.000	***
Iceland	$\Delta STW_{n,t}$	-1.150	0.308	0.001	***
	$\Delta STW_{n,t}^2$	0.148	0.034	0.000	***
	$\Delta STW_{n,t} \times D_{NEW}$	0.631	0.186	0.002	***
	$\Delta STW_{n,t} \times \Delta \ln(GDP_{n,t})$	0.246	0.144	0.099	*
	test on joint significance			0.000	***
Ireland	$\Delta STW_{n,t}$	-1.225	0.249	0.000	***
	$\Delta STW_{n,t}^2$	0.155	0.027	0.000	***
	$\Delta STW_{n,t} \times D_{NEW}$	0.577	0.175	0.003	***
	$\Delta STW_{n,t} \times \Delta \ln(GDP_{n,t})$	0.282	0.146	0.065	*
	test on joint significance			0.000	***
Italy	$\Delta STW_{n,t}$	-1.197	0.314	0.001	***
	$\Delta STW_{n,t}^2$	0.151	0.034	0.000	***
	$\Delta STW_{n,t} \times D_{NEW}$	0.613	0.188	0.003	***
	$\Delta STW_{n,t} \times \Delta \ln(GDP_{n,t})$	0.286	0.157	0.080	*
	test on joint significance			0.000	***
Japan	$\Delta STW_{n,t}$	-0.887	0.335	0.014	**
	$\Delta STW_{n,t}^2$	0.125	0.043	0.007	***
	$\Delta STW_{n,t} \times D_{NEW}$	0.491	0.290	0.102	
	$\Delta STW_{n,t} \times \Delta \ln(GDP_{n,t})$	0.168	0.129	0.203	
	test on joint significance			0.000	***
Luxembourg	$\Delta STW_{n,t}$	-1.289	0.336	0.001	***
	$\Delta STW_{n,t}^2$	0.159	0.035	0.000	***
	$\Delta STW_{n,t} \times D_{NEW}$	0.657	0.206	0.004	***
	$\Delta STW_{n,t} \times \Delta \ln(GDP_{n,t})$	0.398	0.184	0.040	**
	test on joint significance			0.000	***
Netherlands	$\Delta STW_{n,t}$	-1.126	0.370	0.005	***
	$\Delta STW_{n,t}^2$	0.145	0.040	0.001	***
	$\Delta STW_{n,t} \times D_{NEW}$	0.684	0.189	0.001	***
	$\Delta STW_{n,t} \times \Delta \ln(GDP_{n,t})$	0.242	0.169	0.163	
	test on joint significance			0.000	***
Norway	$\Delta STW_{n,t}$	-1.120	0.338	0.003	***
	$\Delta STW_{n,t}^2$	0.143	0.037	0.001	***
	$\Delta STW_{n,t} \times D_{NEW}$	0.637	0.230	0.010	***
	$\Delta STW_{n,t} \times \Delta \ln(GDP_{n,t})$	0.236	0.138	0.100	*
	test on joint significance			0.000	***

		Coeff.	Std. Err.	P-Value	Sig.
Poland	$\Delta STW_{n,t}$	-1.166	0.340	0.002	***
	$\Delta STW_{n,t}^2$	0.146	0.035	0.000	***
	$\Delta STW_{n,t} \times D_{NEW}$	0.628	0.218	0.008	***
	$\Delta STW_{n,t} \times \Delta \ln(GDP_{n,t})$	0.281	0.165	0.101	
	test on joint significance			0.000	***
Portugal	$\Delta STW_{n,t}$	-1.209	0.308	0.001	***
	$\Delta STW_{n,t}^2$	0.152	0.032	0.000	***
	$\Delta STW_{n,t} \times D_{NEW}$	0.586	0.186	0.004	***
	$\Delta STW_{n,t} \times \Delta \ln(GDP_{n,t})$	0.278	0.148	0.072	*
	test on joint significance			0.000	***
Slovak Republic	$\Delta STW_{n,t}$	-1.180	0.192	0.000	***
	$\Delta STW_{n,t}^2$	0.152	0.021	0.000	***
	$\Delta STW_{n,t} \times D_{NEW}$	0.554	0.163	0.002	***
	$\Delta STW_{n,t} \times \Delta \ln(GDP_{n,t})$	0.257	0.103	0.020	**
	test on joint significance			0.000	***
Slovenia	$\Delta STW_{n,t}$	-1.572	0.323	0.000	***
	$\Delta STW_{n,t}^2$	0.166	0.040	0.000	***
	$\Delta STW_{n,t} \times D_{NEW}$	0.920	0.216	0.000	***
	$\Delta STW_{n,t} \times \Delta \ln(GDP_{n,t})$	0.415	0.177	0.027	**
	test on joint significance			0.000	***
Spain	$\Delta STW_{n,t}$	-1.221	0.299	0.000	***
	$\Delta STW_{n,t}^2$	0.158	0.035	0.000	***
	$\Delta STW_{n,t} \times D_{NEW}$	0.571	0.176	0.003	***
	$\Delta STW_{n,t} \times \Delta \ln(GDP_{n,t})$	0.269	0.146	0.078	*
	test on joint significance			0.000	***
Sweden	$\Delta STW_{n,t}$	-1.183	0.281	0.000	***
	$\Delta STW_{n,t}^2$	0.152	0.031	0.000	***
	$\Delta STW_{n,t} \times D_{NEW}$	0.583	0.170	0.002	***
	$\Delta STW_{n,t} \times \Delta \ln(GDP_{n,t})$	0.251	0.135	0.075	*
	test on joint significance			0.000	***
Switzerland	$\Delta STW_{n,t}$	-1.076	0.348	0.005	***
	$\Delta STW_{n,t}^2$	0.140	0.040	0.002	***
	$\Delta STW_{n,t} \times D_{NEW}$	0.667	0.246	0.012	**
	$\Delta STW_{n,t} \times \Delta \ln(GDP_{n,t})$	0.199	0.135	0.152	
	test on joint significance			0.000	***
United Kingdom	$\Delta STW_{n,t}$	-1.190	0.302	0.001	***
	$\Delta STW_{n,t}^2$	0.150	0.032	0.000	***
	$\Delta STW_{n,t} \times D_{NEW}$	0.634	0.185	0.002	***
	$\Delta STW_{n,t} \times \Delta \ln(GDP_{n,t})$	0.279	0.145	0.066	*
	test on joint significance			0.000	***
United States	$\Delta STW_{n,t}$	-1.185	0.305	0.001	***
	$\Delta STW_{n,t}^2$	0.150	0.033	0.000	***
	$\Delta STW_{n,t} \times D_{NEW}$	0.624	0.184	0.002	***
	$\Delta STW_{n,t} \times \Delta \ln(GDP_{n,t})$	0.277	0.145	0.068	*
	test on joint significance			0.000	***

Table 7: The table depicts the results when we estimate the baseline specification 27 times, while excluding one country each time from the sample. Stars (*, **, ***) indicate significance at the 10%, 5%, and 1% level, respectively.

B.8 Robustness: Alternative STW Terms

	(i) Quadratic New STW		(ii) STW-Variable Lags		Both: (i) + (ii)	
$\Delta U_{n,t-1}$	0.659 (0.190)***	0.615 (0.183)***	0.714 (0.106)***	0.725 (0.096)***	0.669 (0.140)***	0.678 (0.125)***
$\Delta STW_{n,t}$	-1.054 (0.361)***	-1.135 (0.384)***	-0.760 (0.402)*	-0.818 (0.400)*	-0.902 (0.422)**	-0.961 (0.392)**
$\Delta STW_{n,t-1}$			0.053 (0.258)	0.08 (0.209)	0.069 (0.222)	0.100 (0.195)
$\Delta STW_{n,t}^2$	0.135 (0.036)***	0.146 (0.041)***	0.111 (0.047)**	0.118 (0.051)**	0.130 (0.054)**	0.137 (0.049)***
$\Delta STW_{n,t-1}^2$			-0.013 (0.031)	-0.016 (0.027)	-0.013 (0.028)	-0.017 (0.026)
$\Delta STW_{n,t} \times D_{NEW}$	0.807 (0.414)*	0.713 (0.464)	0.426 (0.239)*	0.430 (0.207)**	0.254 (0.486)	0.262 (0.345)
$\Delta STW_{n,t-1} \times D_{NEW}$			0.182 (0.181)	0.179 (0.154)	0.504 (0.603)	0.483 (0.248)*
$\Delta STW_{n,t}^2 \times D_{NEW}$	-0.059 (0.147)	-0.034 (0.173)			0.123 (0.318)	0.118 (0.177)
$\Delta STW_{n,t-1}^2 \times D_{NEW}$					-0.168 (0.274)	-0.164 (0.131)
$\Delta STW_{n,t} \times \Delta \ln(GDP_{n,t})$	0.227 (0.180)	0.237 (0.176)	0.071 (0.131)	0.081 (0.116)	0.106 (0.126)	0.118 (0.124)
$\Delta STW_{n,t-1} \times \Delta \ln(GDP_{n,t-1})$			0.004 (0.028)	0.002 (0.018)	0.006 (0.021)	0.004 (0.018)
$\Delta \ln(GDP_{n,t})$	-0.060 (0.032)*	-0.022 (0.033)	-0.041 (0.018)**	-0.025 (0.025)	-0.049 (0.025)*	-0.029 (0.028)
$\Delta \ln(GDP_{n,t-1})$	-0.029 (0.016)*	-0.044 (0.022)*	-0.025 (0.010)**	-0.040 (0.019)**	-0.029 (0.012)**	-0.047 (0.021)**
$\Delta \ln(GDP_{n,t}) \times EPL$		-0.064 (0.039)		-0.038 (0.026)		-0.039 (0.028)
$\Delta \ln(GDP_{n,t-1}) \times EPL$		0.022 (0.017)		0.037 (0.013)**		0.034 (0.012)***
$\Delta \ln(GDP_{n,t}) \times UB$		-0.016 (0.044)		0.007 (0.031)		0.001 (0.034)
$\Delta \ln(GDP_{n,t-1}) \times UB$		-0.011 (0.022)		-0.012 (0.015)		-0.006 (0.016)
Number of countries	27	27	27	27	27	27
Number of observations	364	364	363	363	363	363
Number of instruments	16	20	18	22	21	25
U-Shape Test	0.003	0.003	0.035	0.025	0.021	0.011
U-Shape Test (NEW)	trivial	trivial			trivial	trivial
Hansen test	0.918	0.939	0.983	0.977	0.998	0.998
AB-test AR(2)	0.399	0.446	0.499	0.467	0.499	0.461

Table 8: The table depicts our results when (i) we allow for a different quadratic STW effect in “New STW” countries and when (ii) lagged changes in STW take-up are considered. Stars (*, **, ***) indicate significance at the 10%, 5%, and 1% level, respectively.

B.9 Robustness: Alternative Institutional Controls

	CBI	STE	CBI & STE
$\Delta U_{n,t-1}$	0.623 (0.177)***	0.622 (0.163)***	0.634 (0.176)***
$\Delta STW_{n,t}$	-1.127 (0.320)***	-1.276 (0.326)***	-1.18 (0.320)***
$\Delta STW_{n,t}^2$	0.143 (0.033)***	0.162 (0.033)***	0.151 (0.033)***
$\Delta STW_{n,t} \times D_{new}$	0.577 (0.230)**	0.712 (0.238)***	0.661 (0.289)**
$\Delta STW_{n,t} \times \Delta \log(GDP_{n,t})$	0.269 (0.167)	0.278 (0.144)*	0.259 (-0.16)
$\Delta \log(GDP_{n,t})$	-0.036 (0.030)	-0.008 (0.038)	-0.026 (0.030)
$\Delta \log(GDP_{n,t-1})$	-0.035 (0.022)	-0.049 (0.021)**	-0.039 (0.024)
$\Delta \log(GDP_{n,t}) \times EPL$	-0.064 (0.030)**	-0.075 (0.039)*	-0.069 (0.030)**
$\Delta \log(GDP_{n,t-1}) \times EPL$	0.022 (0.016)	0.024 (0.013)*	0.028 (0.013)**
$\Delta \log(GDP_{n,t}) \times UB$	-0.051 (0.049)	-0.019 (0.039)	-0.056 (0.055)
$\Delta \log(GDP_{n,t-1}) \times UB$	0.004 (0.028)	-0.010 (0.018)	0.012 (0.032)
$\Delta \log(GDP_{n,t}) \times CBI$	0.043 (0.045)		0.061 (0.054)
$\Delta \log(GDP_{n,t-1}) \times CBI$	-0.027 (0.026)		-0.035 (0.032)
$\Delta \log(GDP_{n,t}) \times STE$		-0.049 (0.057)	-0.056 (0.052)
$\Delta \log(GDP_{n,t-1}) \times STE$		0.009 (0.023)	0.016 (0.024)
Number of instruments	20	20	22
Number of countries	27	27	27
Joint Significance	0.000	0.000	0.000
Hansen test	0.877	0.930	0.865
AB-test AR(2)	0.434	0.387	0.465

Table 9: The table depicts the results when the set of institutional controls is extended to the centralized bargaining index (CBI) and the share of temporary employment (STE). Stars (*, **, ***) indicate significance at the 10%, 5%, and 1% level, respectively.

B.10 Robustness: Interactions between STW and Labor Market Institutions

	Institutions interacted with STW				
	<i>EPL</i>	<i>UB</i>	<i>CBI</i>	<i>STE</i>	<i>EPL & UB</i>
$\Delta U_{n,t-1}$	0.644 (0.143)***	0.624 (0.208)***	0.682 (0.191)***	0.701 (0.226)***	0.601 (0.163)***
$\Delta STW_{n,t}$	-1.175 (0.239)***	-0.91 (0.341)**	-1.509 (0.519)***	-1.195 (0.386)***	-0.985 (0.196)***
$\Delta STW_{n,t}^2$	0.152 (0.019)***	0.123 (0.042)***	0.154 (0.041)***	0.153 (0.031)***	0.145 (0.023)***
$\Delta STW_{n,t} \times D_{new}$	0.664 (0.162)***	0.531 (0.280)*	1.001 (0.418)**	0.753 (0.457)	0.577 (0.248)**
$\Delta STW_{n,t} \times \Delta \log(GDP_{n,t})$	0.26 (0.108)**	0.114 (0.101)	0.354 (0.216)	0.324 (0.154)**	0.162 (0.034)***
$\Delta STW_{n,t} \times EPL$	-0.031 (0.175)				-0.156 (0.177)
$\Delta STW_{n,t} \times UB$		0.176 (0.174)			0.23 (0.155)
$\Delta STW_{n,t} \times CBI$			0.282 (0.187)		
$\Delta STW_{n,t} \times STE$				-0.104 (0.223)	
$\Delta \log(GDP_{n,t})$	-0.023 (0.024)	-0.05 (0.028)*	-0.071 (0.026)**	-0.049 (0.026)*	-0.034 (0.033)
$\Delta \log(GDP_{n,t-1})$	-0.045 (0.016)**	-0.033 (0.033)	-0.017 (0.022)	-0.021 (0.022)	-0.053 (0.023)**
$\Delta \log(GDP_{n,t}) \times EPL$	-0.077 (0.034)**				-0.051 (0.023)**
$\Delta \log(GDP_{n,t-1}) \times EPL$	0.016 (0.017)				0.023 (0.016)
$\Delta \log(GDP_{n,t}) \times UB$		-0.002 (0.032)			0.005 (-0.04)
$\Delta \log(GDP_{n,t-1}) \times UB$		0.004 (0.034)			0.005 (0.024)
$\Delta \log(GDP_{n,t}) \times CBI$			0.003 (0.036)		
$\Delta \log(GDP_{n,t-1}) \times CBI$			-0.023 (0.026)		
$\Delta \log(GDP_{n,t}) \times STE$				-0.079 (0.051)	
$\Delta \log(GDP_{n,t-1}) \times STE$				-0.016 (0.038)	
Number of instruments	18	18	18	18	22
Hansen test	0.977	0.788	0.722	0.806	0.924
AB-test AR(2)	0.382	0.588	0.327	0.345	0.603

Table 10: The table depicts the results when the linear STW term is interacted with the institutional dummy interaction terms. Stars (*, **, ***) indicate significance at the 10%, 5%, and 1% level, respectively.