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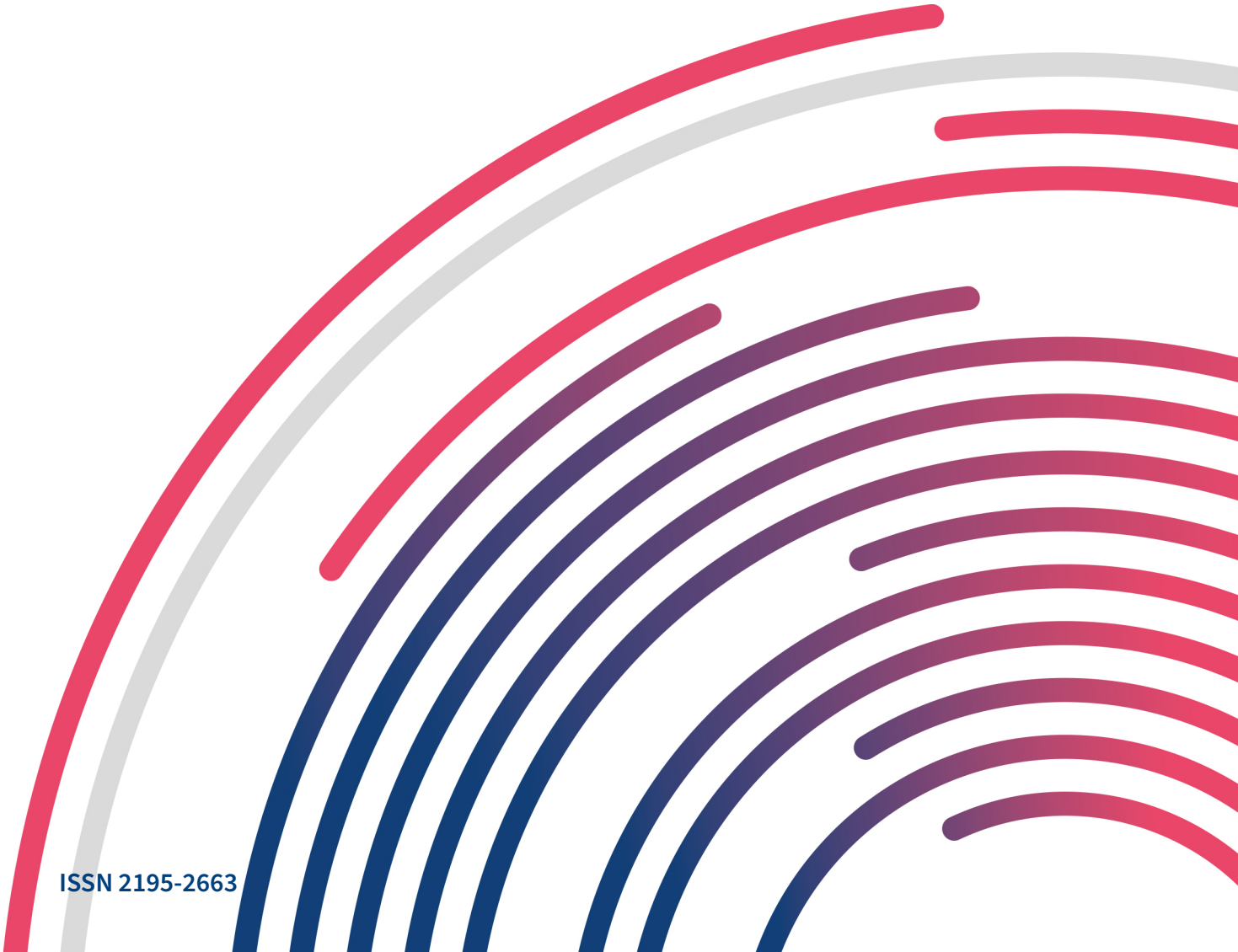

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The Employment and Windfall Effects of Short-Time Work: Evidence from Germany

Christian Kagerl (IAB)

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Contents

Abstract

I study the ramifications of the German short-time work (STW) scheme using novel administrative data on STW and drawing on evidence from establishment surveys that are linked to the administrative data. I show that, besides financial reasons, firms value and use STW because it allows them to hoard labor in a tight labor market. During the pandemic, I document a strong negative selection into STW based on measures of firm quality and productivity, a pattern not observed during the financial crisis. This selection pattern is explained by the differing types of crises and their impact on establishments. Adjusting for selection, I then investigate the employment effects of STW in the pandemic and find 3-4% higher employment levels for firms utilizing STW. This relationship, however, vanishes quickly after firms exit STW, a result driven by outflows among STW firms being initially lower, but being higher after the end of STW. Partly due to eased access rules, I additionally find that the policy's windfall effects, or deadweight losses, are large: While back-of-the-envelope calculations suggest that up to half a million jobs were saved by STW in 2020, millions of jobs were supported in total, indicating an insufficient degree of targeting.

Zusammenfassung

Ich untersuche die Auswirkungen der Kurzarbeit in Deutschland mittels neuer administrativer Daten zur Kurzarbeit und mittels von Erkenntnissen aus Betriebsbefragungen, die mit den administrativen Daten verknüpft sind. Ich zeige, dass Unternehmen die Kurzarbeit nicht nur aus finanziellen Gründen nutzen, sondern auch, weil sie damit in einem angespannten Arbeitsmarkt Arbeitskräfte horten können. Während der Pandemie dokumentiere ich eine starke negative Selektion in Kurzarbeit auf der Grundlage von Unternehmensqualität und Produktivität. Dies ist ein Muster, welches sich für die Finanzkrise nicht beobachten lässt. Dieses Selektionsmuster lässt sich durch die unterschiedlichen Arten von Krisen und ihre Auswirkungen auf die Betriebe erklären. Unter Berücksichtigung der Selektion untersuche ich dann die Beschäftigungseffekte von Kurzarbeit in der Pandemie und finde eine drei bis vier Prozent höhere Beschäftigung für Betriebe, die Kurzarbeit nutzen. Dieser Effekt verschwindet jedoch schnell, nachdem Betriebe die Kurzarbeit verlassen haben, ein Ergebnis, das darauf zurückzuführen ist, dass die Austritte unter den Kurzarbeitsfirmen anfangs niedriger, nach dem Ende der Kurzarbeit jedoch höher sind. Auch aufgrund der gelockerten Zugangsregeln stelle ich außerdem fest, dass die Mitnahmeeffekte des Instruments beträchtlich sind: Während grobe Schätzungen darauf hindeuten, dass bis zu einer halben Million Arbeitsplätze durch die Kurzarbeit im Jahr 2020 gerettet wurden, wurden insgesamt Millionen von Arbeitsplätzen unterstützt, was auf ein unzureichendes Maß an Zielgenauigkeit hinweist.

JEL

E24, J20, J65, J68

Keywords

employment, establishments, short-time work, social insurance

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1 Introduction

The pandemic has renewed interest in short-time work (STW). While the US chose to support workers who are laid off by their employers through increased unemployment benefits, leading to a sharp increase in the unemployment rate to nearly 15% in early 2020, most European economies instead opted to insure the worker-firm match explicitly. This insurance took place either through wage subsidies or, more frequently, short-time work schemes (Giupponi/Landais/Lapeyre, 2022), which allow flexible hours reductions for employees and subsidize hours not worked. The Organisation for Economic Co-operation and Development (OECD) estimates (OECD, 2021) that, on average across the OECD, about 20% of employment was supported by some kind of job retention scheme in April 2020. In Germany, Europe's largest economy and the country whose case I study, roughly 6 out of 33 million eligible employees were in STW at the height of the pandemic's first wave.

This unprecedented use of STW raises economic questions about the value and effects of these STW schemes. Are they worth it, are many job matches lastingly saved? Are there unintended consequences of the policy, e.g. windfall gains for firms or reduced reallocation through propping up firms that would otherwise no longer be viable? Using newly available data, for the case of Germany, I study the reasons why firms go into STW, the selection process and estimate employment as well as windfall effects of STW.

The theoretical argument for STW schemes (see e.g. Burdett/Wright, 1989; Boeri/Cahuc, 2023) is that layoffs may be welfare inefficient during a shock or a crisis. Financial constraints due to decreasing revenue and imperfect financial markets might force firms to cut their workforce in the short term. However, in the medium run, after the temporary downturn of demand has reversed, the firm might need these employees again and would have to hire anew. The motive to decrease employment during a shock is further driven by the fact that flexibly cutting wages by large amounts is infeasible due to the existence of downward wage rigidity (e.g. Schoefer, 2021). The resulting layoffs incur social costs, for instance arising from unemployment benefits and from a search-and-matching process with frictions. Under these circumstances, STW is welfare-efficient if the costs of the program are lower than the social costs incurred in the absence of STW. Additionally, STW saves jobs, a result that can be described as an employment effect or insurance effect. This effect constitutes the positive effect of STW.

Simultaneously, the employment effect could be counteracted by the unintended consequences of the policy. First, STW benefits could be going to job matches that would not be lost if there was no STW available, an implication Cahuc/Kramarz/Nevoux (2021)

term “windfall”[1]. Windfall can consist of free-riding or outright fraud (receiving STW benefits despite no hours reductions) or, more likely, of a firm’s employees being partially in STW despite there being no acute enough financial constraints that would lead to layoffs in the scheme’s absence. Another unintended consequence of STW would be a reduction in the labor market’s allocative efficiency coming about because the STW scheme might subsidize low-productivity matches and thus keep firms in business that only survive because of support (so-called ‘zombie firms’). From the welfare perspective, however, it would be beneficial to let these firms shut down and have their workforce become more productive in higher-quality firms. Shocks and recessions can have a cleansing effect on the economy (Foster/Grim/Haltiwanger, 2016). Ex ante, the magnitude of these effects is unclear and depends on the concrete implementation of the policy.

My analysis relies on administrative data – including novel data on STW – covering the universe of German establishments, further enriched by evidence from establishment surveys that are linked to the administrative data. I have four main findings. First, based on survey information, I show that the financial motive to choose STW (prominent in the theory of STW) is important among establishments, but that the ability of STW to flexibly maintain work processes during work loss and, especially, the motive of labor hoarding are also seen as significant reasons.

Second, based on linked data, I document adverse selection into STW. Firms with lower labor productivity and lower wage premia are significantly more likely to be in STW during the pandemic, even when adjusting for workforce composition, firm size, narrow 5-digit industries and regional differences. Interestingly, this adverse selection is not apparent for the last recession in which STW was used extensively, the financial crisis. The differing nature of the two crises explains this fact. Whereas the financial crisis disproportionately affected big exporting firms, the impact of Covid-19 was broad. With low-quality firms being in a relatively worse state before, the pandemic led to decreasing demand, temporarily shutting down and liquidity shortages, which drove selection into STW.

Third, to identify the repercussions of STW on firms’ employment, I combine (coarsened) exact matching with an event study approach, leveraging administrative data. I first make STW firms and non-STW firms comparable with respect to a broad range of observable characteristics (including 5-digit industries) and explicitly factor in the negative selection on productivity in the matching step. Controlling for firm and time fixed effects, my event-study approach therefore compares employment in STW firms to those firms without STW, where I also see no differential trends between the two groups prior to the pandemic. I find positive employment effects of STW on the order of 3-4% in the year in which a firm utilizes the policy’s benefits. However, these effects disappear quickly after STW is exited, a result that can be ascribed to STW firms having lower outflows during their STW spell but

[1] Alternatively, these windfall effects can be referred to as deadweight effects or deadweight losses.

then having higher outflows (relative to non-STW firms) afterwards. These delayed separations hold for both voluntary and involuntary outflows, although the bigger driver is voluntary outflows. This suggests that employees might perceive STW as a negative signal about the firm. I further run a broad range of econometric specification checks (e.g., inverse probability weighting) and tests (e.g., ruling out establishment death as a relevant margin) to underscore the robustness of my results.

Fourth, I provide evidence of substantial windfall effects. Back-of-the-envelope calculations based on the estimated employment coefficients imply that up to 500,000 jobs were saved by STW in 2020. Yet, 8.75 million jobs (corresponding to 3.7 million employment equivalents) were supported in total. This discrepancy suggests large windfall effects, although it is coming from a back-of-the-envelope calculation which is disregarding possibly important general equilibrium considerations. Windfall could be lessened by better targeting of shock-affected firms and by introducing an experience rating element (Burdett/Wright, 1989), which entails STW users partially paying back STW costs through increased social security contributions in the future. Corroborating evidence on windfall effects comes from some establishments collecting STW allowances despite not reporting negative pandemic effects or revenue decreases in surveys.

I contribute to several strands of the literature around STW – which is extensively surveyed in Cahuc (2024). There exists a growing body of work that uses (structural) models grounded in theory to investigate the efficiency of STW and explore counterfactuals without STW or with different rules of the policy. These models often use German data for calibration since the scheme in Germany is available outside of recessions as well (e.g. Peltonen, 2023a; Tilly/Niedermayer, 2017). Cooper/Meyer/Schott (2017), using a search model, find that STW saved jobs in 2009/2010 in Germany, but reduced the allocative efficiency with subsequent output losses. Diaz et al. (2023) report similar results for the case of Spain. Hallmann (2023), again having Germany as the case study, shows that employees at the career peak gain most from being saved by STW, but cautions that such a scheme may be ineffective in recessions caused by structural change. Related, Brey/Hertweck (2020) as well as Gehrke/Hochmuth (2021) suggest that STW is job-saving during strong downturns, but ineffective in normal times. In a general equilibrium setting, Peltonen (2023b) analyzes Germany's STW during the pandemic, also finding a strong stabilizing effect on unemployment rates. Albertini et al. (2022) show the same for France during the pandemic, but further suggest the existence of strong windfall effects. Balleer et al. (2016) hint at the importance of institutional factors with STW being more effective in countries with less flexible labor markets (i.e. higher firing costs and stricter employment protection legislation). The positive cross-country correlation between STW take-up and firing costs is empirically corroborated by Cahuc/Carcillo (2011) and Lydon/Mathä/Millard (2019).

Regarding reduced-form evidence (thus also regarding the assumptions that underpin models), the literature is relatively more sparse. Using cross-country regressions for the Great Recession Boeri/Bruecker (2011), Cahuc/Carcillo (2011) and Hijzen/Martin (2013) do not reach a common conclusion on the direction of the employment effects. For Germany, existing micro-level evidence on the firm-level by Speckesser (2010), Bellmann/Gerner (2011), Scholz (2012) and Kruppe/Scholz (2014) does not paint a clear picture of positive employment effects either. I contribute in this case by, first, utilizing newly available and high-quality administrative data on STW that can be linked to other administrative data and survey data – instead of using only limited survey data, which moreover is not always accurate in the context of STW (Kagerl/Schierholz/Fitzenberger, 2022). My second contribution is showing clear evidence of positive employment effects most of which dissipate rapidly. Related, using data from 2012, Brinkmann et al. (2024) show that an extension in the potential benefit duration of STW has no positive employment effects. Third, I provide evidence on the extent of windfall effects for the German STW scheme. This evidence, based on firm-level data, complements research by Bossler et al. (2023) building on an employee survey.

More recent studies of STW, all focusing on the financial crisis period, have sought to address the causal identification challenge of estimating employment effects on the firm-level as firms self-select into these programs. Giupponi/Landais (2023) exploit eligibility rules in the Italian scheme to estimate sizeable positive employment effects which vanish quickly after treatment ends, while cautioning that persistent crises can induce negative reallocation effects. For Switzerland, Kopp/Siegenthaler (2021) show positive employment effects based on comparing approved and denied applications for the support scheme. Cahuc/Kramarz/Nevoux (2021) utilize regional approval rate differences to arrive at positive employment effects for the French STW program that are concentrated at firms experiencing big revenue drops, but also establish a substantial degree of windfall effects. My contribution to this literature[2] is twofold: First, I analyze STW in Germany, which has different institutional rules around STW than other European nations. Compared to the US, Germany has relatively strong employment protection and exhibits lower mobility in the labor market. Second, I do not look at the Great Recession, but consider the Covid-19 pandemic, where STW was used much more extensively and which was a completely different type of shock (e.g. in terms of the shock intensity or the sectoral breadth of the shock). In addition, I show that the STW selection patterns between the two crises differ markedly.

[2] Bermudez/Cockx (2023) and Benkovskis/Tkacevs/Vilerts (2023) are two further examples documenting positive employment effects for Belgium and Latvia, respectively. Aiyar/Dao (2021) use sector-state-level data from Germany to suggest STW being preventive of unemployment increases. Biancardi/Lucifora/Origo (2022) show how unions mediate the effect of STW on firm performance measures in Italy. Kato/Kodama (2019) even document a positive impact of the Japanese STW scheme on later firm performance measures like return on assets.

I further contribute by showing which establishments select into STW and what firms find valuable about the policy instrument. German firms' motives for using STW are not restricted to the improved liquidity such schemes can provide, a main argument in the theoretical literature. The ability to keep up processes under work loss and the motive of labor hoarding (retaining employees that would be hard to replace later) are rated as just as important and as even more important, respectively. On the matter of selection into STW (a topic understudied in the literature so far), I document strong adverse selection of establishments based on firm quality and labor productivity in the pandemic; a pattern of selection that is not apparent for the Great Recession, the prior recession with extensive use of STW. This adverse selection into STW also does not match expectations, as – for instance – Giupponi/Landais (2023) suggest that prior productivity may be unrelated to being hit by the pandemic shock.

This paper is organized as follows: Section 2 describes the institutional background of STW in Germany. The establishment-level data on which my analyses build is described in Section 3. Section 4 examines what establishments find attractive about STW and which establishments select into STW and if lower-quality and less productive establishments are more likely to receive benefits. Subsequently, Section 5 investigates the employment effects of STW in the pandemic. Section 6 analyzes the extent of windfall effects. Finally, Section 7 concludes by summarizing the findings and discussing their (policy) implications.

2 Institutional Background

Germany's STW scheme nominally has three components: Benefits for companies that are restructuring (*Transferkurzarbeitergeld*), seasonal STW and *konjunkturelles Kurzarbeitergeld*, which is intended for cushioning (business cycle) shocks. The last part dwarfs the other two in size as well as importance, especially in crises, and is thus the sole focus of this study. Establishments can apply for STW through a form (*Anzeige*) at the Federal Employment Agency (FEA) when they are expecting work loss[3], but this initial application is flexible. For instance, while only workers listed in this application can receive the benefits, an establishment has an incentive to list all of its workers there, even if not all of them will need it, just to be on the safe side. After the initial notice is granted and there was a work loss in a given month, the establishment has three months to submit a second notification (*Abrechnung*) that details and tabulates the work loss of its employees in that month. The establishment has to give a reason for the work loss and, after a check, is reimbursed by the FEA according to the details of the second form. The data I use come

[3] In establishments with a works council, the works council has to first agree to the usage of STW. Yet, this step is not a hindrance in most cases.

from the granted second notification, i.e. it captures the actual work loss of the establishment for which it was reimbursed.

Crucially, only the workforce in employment subject to social security contributions ('regular employment' or 'contributory employment') can receive STW benefits, while 'marginal employment' may not. Generally, a third of an establishment's contributory workforce needs to have a reduction in working hours to be eligible for a payout; this constraint was eased to 10% (with at least 10% work loss) at the beginning of the pandemic. A firm's STW may last for 12 months at a time (interruptions of fewer than three months are not considered for this calculation), but this threshold was extended to up to 28 months during Covid (until June 2022). Section 4 provides some statistics on how STW is used. Further eased access rules during the pandemic specified that apprentices and temp agency workers were also eligible for STW and there were fewer restrictions on taking other jobs while on STW. For employees, being in STW implies that 60% of the lost hours' wages are covered by the FEA (also referred to as the *replacement rate* of STW), 67% for people with children in the household. During the pandemic up until June 2022, this rate increased to 70/77% (80/87%) if an employee was in STW for 4 (7) months and the work loss was at least 50%. Generally, the share of hours lost is flexible and may be up to 100%, i.e. effectively not working. In addition, the FEA covered the social security contributions of workers in STW until December 2021 (and 50% coverage in the first three months of 2022), a part of the wage costs not usually covered. Taken together, this implementation of the German scheme unburdens employers as it requires very little (in 2020 and 2021 near-zero) co-financing of the lost hours' wage costs; a fact where some other countries' STW schemes differ (OECD, 2021).

3 Data Sources

Until the pandemic, there was no administrative micro-level data available on the usage of short-time work in Germany. Previous studies (e.g. Kruppe/Scholz, 2014) relied on small samples from surveys of establishments or individuals and on a sample of granted notifications (*Abrechnungen*) collected in the district around Nuremberg. This study uses newly available data from the Federal Employment Agency on the take-up of STW among all establishments in Germany. More specifically, the data on STW (a data set named *BTR-KuG*) contain which establishment was in STW in a given month, how many of its employees were in STW, the preceding number split by the gender of workers and the work loss/employment equivalent in STW in the establishment[4]. Establishment-level data are available from January 2009 onwards.

[4] This latter measure essentially captures the employees' intensive margin of STW as well. For example, if an establishment has 100 full-time employees and in one month 50 of these workers are in STW for 50% of their

The big advantage of this data set is that the information on STW can be linked to other data sets on the establishment-level from the Federal Employment Agency that are collected at the Institute for Employment Research: First, to the longitudinal administrative data on establishments – the Establishment History Panel (Ganzer et al., 2023) – which, in turn, emanates from aggregating employment biographies of individual workers. From the Establishment History Panel, I obtain a plethora of information on the universe of establishments and their complete histories, including the size and constitution of their workforce (e.g., information on occupations, gender, skill, age etc.), their employment flows, their wage structure, their 5-digit-industry code and their region. Moreover, I merge AKM fixed effects (Abowd/Kramarz/Margolis, 1999) of establishments (Bellmann et al., 2020) to the data, representing establishment wage premia. From these data (STW data and Establishment History Panel with AKM-FE), I construct a data set containing all the administrative information on establishments on a yearly basis.

Second, I link this administrative data set to establishment surveys that draw their samples from the administrative data. For more specific questions on the pandemic and for information not covered in the administrative data (e.g. measuring labor productivity), I link the data to the Establishment Panel, a yearly survey of roughly 16,000 establishments (for more details see Ellguth/Kohaut/Möller, 2014). Furthermore, I use data from the BeCovid-survey on which aspects establishments value about STW. This survey covered how establishments adapted to the economic shock of the pandemic (for more details see Bellmann et al., 2022). Table 1 provides an overview of the different datasets I use.

Table 1: Overview of Datasets Used

(1)	(2)	(3)	(4)
Name Dataset	*Type*	*Coverage*	*Content Drawn*
BTR-KuG (from 2009 on)	administrative	universe	STW Histories
Establishment History Panel (BHP)	administrative	universe	Employment Histories, AKM-FE
Establishment Panel (BP)	survey	≈16.000 per year	Labor Productivity, Crisis Effects
BeCovid	survey	≈2.000 per wave	Reasons for STW

Notes: The table shows the different datasets I use and gives details on the data type, the coverage and the contents I draw from them. Every dataset can be linked with every other dataset through a common establishment identifier.
Source: own calculations. ©IAB

One peculiarity of the German scheme concerns companies that consist of multiple establishments. Establishments, whom I refer to interchangeably as firms, are the focus of the scheme and also of the analysis. However, it is possible that, e.g., the headquarters of a company (which is an establishment in itself) reports STW for subordinate establishments

respective contractual working hours, then the employment equivalent in STW (or total work loss) amounts to $50 \times 0.5 = 25\%$.

within the company structure. Survey evidence suggests that this happens occasionally (Kagerl/Schierholz/Fitzenberger, 2022) and company networks (i.e., which establishments belong to the same company) are not directly evident from the administrative data. To address this idiosyncrasy, I present the robustness of my results to only including single-plant establishments, demonstrating that this peculiarity is not an issue. The data on which establishments are single-plant come from a link of the Mannheim Enterprise Panel (Bersch et al., 2014) to the administrative data.

4 How is Short-Time Work Used and Which Establishments Go into Short-Time Work?

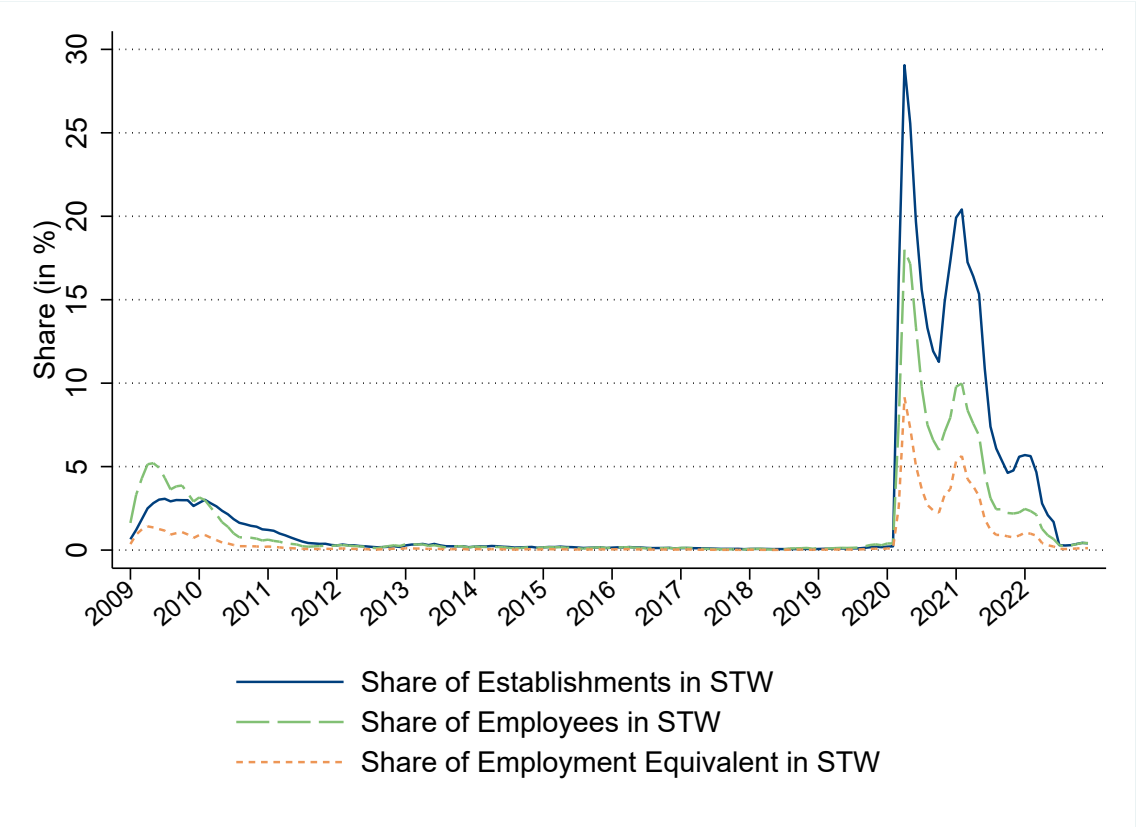
I begin by providing background numbers detailing the overall scope and patterns of STW since January 2009, the start date of the STW data. Figure 1 plots the shares of establishments, employees and employment equivalent in STW. At the height of the first lockdown in Germany in April 2020, roughly six million individuals were in STW, representing roughly 18% of the eligible workforce. Expressed in employment equivalents, which take into account the intensive margin of STW, the share of overall work that was lost (and thus subsidized) was 9% in April 2020.

Given that the decision to go into STW is made by the firm, it is also relevant to consider what share of establishments was in STW. Defining the population of establishments as all establishments that have at least one employee subject to social contributions (since only contributory employment can receive benefits), 34% of establishments had at least one month of STW in 2020 (nearly 30% in April 2020) and 22% in 2021[5]. For comparison, the share was merely 0.4% in 2019 and well below one percent for every year since 2012. The pandemic-era usage of STW additionally dwarfs the take-up in the financial crisis, which peaked at 5.2% in 2009. One noticeable pattern in Figure 1 when comparing the two crises is that the share of employees in STW was higher than the share of establishments in STW in 2009, but the reverse always holds during the pandemic.

On the level of the establishment, both crises exhibit a high degree of persistence, i.e. firms in STW use it for a relatively long time. Appendix Figure A1 plots histograms of

[5] As the population total is about 2.1 million in 2020, this implies that more than 700,000 establishments received STW benefits in 2020 and roughly 600,000 in April 2020. These numbers illustrate the strong persistence of establishments in STW. Moreover, of the about 100,000 establishments in STW at the end of 2021, more than 90% had seven or more months of STW usage since the start of the pandemic.

Figure 1: STW Shares



Notes: The graph shows shares in STW by different categories. For establishments, the number of establishments with at least one employee subject to social security contributions is used for the calculation of the shares. In the case of employees, the number of workers subject to social security contributions is used. The share of the employment equivalent in STW is obtained by setting the total employment equivalent in STW in relation to the total number of employees.
Source: own calculations. ©IAB

establishment-level measures of the intensive margin of STW, under the condition of utilizing STW at once, comparing the period January 2009 until April 2011 with the period March 2020 to June 2022. The two distributions overall are quite similar to each other, but it is evident that the intensity of work loss within an establishment was meaningfully bigger in the pandemic compared to the financial crisis.

However, the differences in STW usage between the two crises are not surprising as the two recessions constitute quite different types of negative shocks. The pandemic shock was also a health shock that, together with the containment measures, disrupted how work was done, thus particularly affecting employment. Correspondingly, the usage of STW was lower during the financial crisis, as was the average work loss when in STW. Third, the crisis in the late aughts was concentrated in manufacturing while the pandemic hit the economy much more broadly, severely affecting the service sector as well. This last observation helps

to explain the share of establishments in STW always being larger than the share of employees in 2020 and 2021, since the average establishment size in manufacturing is much larger than in the service sector. Section 4.2 below investigates the differences in STW selection patterns induced by the two recessions.

4.1 Why Establishments Take up Short-Time Work

The literature reviewed in Section 1 portends some reasons why establishments would find it attractive to use STW. For one, wage costs can be greatly reduced with STW when an economic shock hits, easing financial constraints. Not having to lay off workers keeps the workforce in place and means avoiding a potentially costly and protracted process of rehiring employment afterwards. Depending on the STW scheme, firms might also value the option of reducing hours flexibly for each individual employee (as, e.g., in the German case), leading to less disruption of work processes that are still running.

Yet, there has been little evidence on what firms themselves find valuable about the instrument of STW. To test which of these reasons are most relevant to establishments when thinking about STW, I leverage data from the twelfth wave of the BeCovid establishment survey (from April 2021), which presented establishments with four statements regarding why STW is a good instrument and to what degree establishments agreed with those statements (Kuhn et al., 2021)[6]. Three statements relate directly to the literature: keeping up work processes under work loss, keeping employees that would be hard to replace later and improving liquidity through reduced wage costs. The fourth statement considers an equality argument within the firm, namely that STW can help split losses evenly among employees. Figure 2 depicts the shares of establishments that agree[7] with each of the four statements about STW.

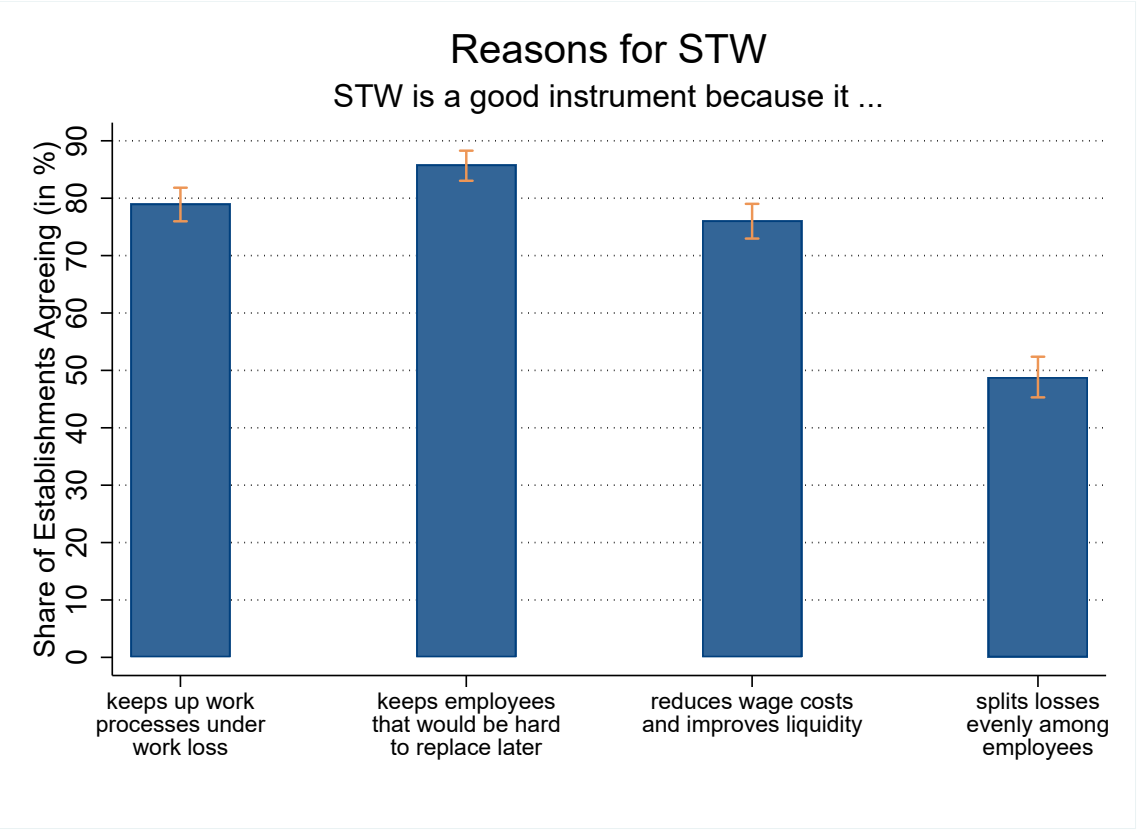
Figure 2 attests that, in general, establishments respond positively to the statements about the usefulness of STW. The statement on equally splitting losses among employees receives the lowest support, with just under half of all establishments agreeing. Agreement rates for the three other statements, however, are between 75% and 85%.

An interesting finding is that the canonical main argument that STW eases liquidity constraints only comes in third with 75% agreeing. A share that is significantly lower than the 85% agreeing that STW allows firms to keep employees that would be hard to replace later. Hence, it seems that the motive of labor hoarding plays a bigger role for firms when

[6] In Kuhn et al. (2021), some of the results in this subsection 4.1 have been reported in German for a policy audience.

[7] Establishments could respond on a scale of one to five, where one corresponds to ‘do not agree at all’ and five to ‘agree completely’. I measure ‘agreeing’ as responding with four or five.

Figure 2: What Firms Value about STW



Notes: The figure shows the share of establishments that agree with each of the four statements about why STW is a good policy instrument plus their respective 95% confidence intervals. Establishments could respond on a scale of one to five, where one corresponds to 'do not agree at all' and five to 'agree completely'. Depicted are the shares of establishments that responded with four or five. The data are from the twelfth wave of the BeCovid-survey which took place in April 2021. Survey weights are applied to make the sample representative of the population of establishments with at least one employee subject to social security contributions. $N = 2,000$ establishments.
Source: own calculations. ©IAB

thinking about the benefits of STW than does improved liquidity. This could reflect that Germany's labor market has been tight for some time and filling vacancies poses a considerable challenge for many firms (Bossler/Popp, 2024). Section 4.2 below also shows how expected worker shortages can help predict which establishments utilize STW.

The flexibility that the German STW scheme offers for adjusting work processes is also prized highly, by four out of five establishments. In firms with a high level of coordination in the production process, shocks can present a bigger challenge when workers are missing, a setting where the flexibility of STW is valuable (Kuhn et al., 2023).

4.2 Selection Into Short-Time Work

One crucial question regarding selection into STW is whether the quality of establishments before a recession is a strong predictor of STW take-up during it or not. The answer to this question has implications for the effects the program might generate. Determining selection on establishment quality requires eliminating observable differences between establishments that are correlated with establishment quality or productivity, most notably e.g. the industry in which a firm is active, how big it is and in which region it is located. To more carefully assess the issue of possible adverse selection into STW, I therefore estimate models based on the following selection equation:

$$STW_e = \alpha + \beta Quality_e + \sum_{occ=1}^{Occ} \gamma_o OccShare_{eo} + \delta_i + \psi_s + \phi_r + \varepsilon_e \qquad (1)$$

Establishments are denoted by the subscript e. STW is a measure for the usage of STW by the establishment. On the extensive margin, for instance a dummy taking the value one if the establishment has any STW spell in a given year. On the intensive margin, for example an establishment's share of employees in STW averaged across a given year. Shares of occupations within an establishment are denoted o and consist of twelve occupational categories based on the Blossfeld classification (for details, see Ganzer et al., 2023). δ_i are 5-digit industry fixed effects (838 categories), ψ_s denote size class fixed effects[8] and ϕ_r are regional fixed effects on the level of the 401 German counties. ε is an error term. The coefficient of interest here is β, indicating the relationship between establishment quality and STW take-up in a given year, conditional on the set of fixed effects and the occupational structure. I use two quality indicators, both being computed from prior years' data to avoid contamination: First, the AKM-FE of an establishment – available for a majority (≈60%) of all establishments, but for more than 90% of establishments with 50 or more employees[9]. Second, log revenue per worker ('labor productivity') – available for establishments answering the revenue question in the establishment panel. To do so, I construct quintiles of labor productivity for establishments surveyed in the Establishment Panel. I focus on establishments that consist of a single plant and are not part of a multi-establishment firm, due to two reasons. First, different establishments in a network that are part of the same firm can in theory report STW for each other and Kagerl/Schierholz/Fitzenberger (2022) find

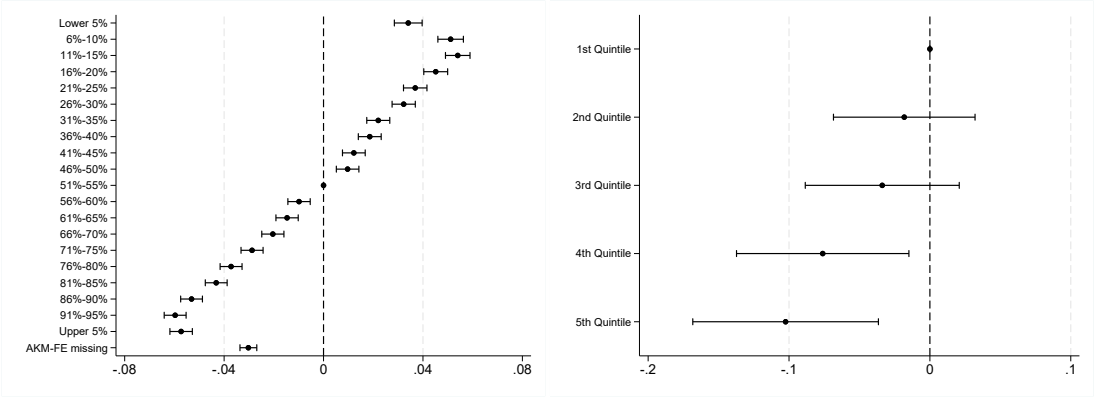
[8] Size classes are: 1 to 4 employees, 5 to 9, 10 to 49, 50 to 99, 100 to 499, 500+

[9] Establishments without an AKM-FE are coded as having a missing AKM-FE and are included as a separate category in (1). Essentially, there are two big reasons why the AKM-FE might be missing. First, as the AKM-FE is computed over the time period 2010 to 2017, younger establishments have not existed (long enough) yet and hence have no wage premium. Second, establishments are not part of the connected set because of limited mobility of employees that is the requisite for estimating AKM-FE. This disproportionately applies to very small establishments which make up the overwhelming mass of all establishments, explaining the 60% figure in the main text.

that some headquarters report STW for establishments that are subordinate to them. Second, and more importantly, the revenue amount surveyed might not reflect the establishment's revenue for multi-plant firms if it is not determined in the firms' accounting procedures. Thus, the restriction to single-plant establishments insures that the calculated revenue per worker is truly specific to the establishment in question. Moreover, all regressions with labor productivity use survey weights to be representative of the population of establishments with at least one employee subject to social security contributions.

Figure 3 shows results from equation (1) for the extensive margin. Coefficients from 20 five-percent-intervals (ventiles) of the AKM-FE distribution and an indicator for a missing AKM-FE are depicted in Panel (a), serving as the first measure of establishment quality which uses the universe of establishments. The eleventh ventile of the distribution (51%-55%) is the reference category (also shown). In Panel (b), quintiles of log labor productivity as computed from the Establishment Panel proxy firm quality.

Figure 3: Selection: Firm Quality and the Extensive Margin of STW in 2020



(a) AKM-FE **(b) Labor Productivity**

Notes: The figure shows coefficients for establishment quality based on specification (1) with the full set of fixed effects and occupational controls: panel (a) for the year 2020 using the position in the distribution of the AKM-FE which were calculated from the period 2010 to 2017, panel (b) using the position in the distribution of labor productivity which was calculated for 2019. The dependent variable is a dummy taking the value one if an establishment has at least one STW spell in the given year, and zero otherwise. The reference category is the eleventh of the twenty ventiles, i.e. between the 51st and the 55th percentile for panel (a). The reference category in panel (b) is the first quintile and survey weights are applied. $N_{2020}^{AKM} = 2,097,889$ establishments and $N_{2020}^{LP} = 6,913$ establishments.
Source: own calculations. ©IAB

Figure 3 reveals a strong adverse selection based on the AKM-FE measure: Establishments in the lower part of the distribution are considerably more likely to have experienced STW than those in the upper part. Comparing the highest to the lowest decile of the AKM-FE distribution when adjusting for occupational structure and for the set of fixed effects,

establishments in the uppermost decile are roughly ten percentage points less likely to be in STW than in the lowest decile. Relative to the baseline share of about one third in 2020, this is a sizeable difference. Figure A2 in the Appendix shows that this result of selection in the pandemic also holds when additionally adjusting for the ventiles of the median wage distribution across establishments in specification (1). Hence, the observed patterns are not driven by differing wage levels, but by the wage premia. The other panel of Appendix Figure A2 further shows the results' robustness when only considering single-plant establishments.

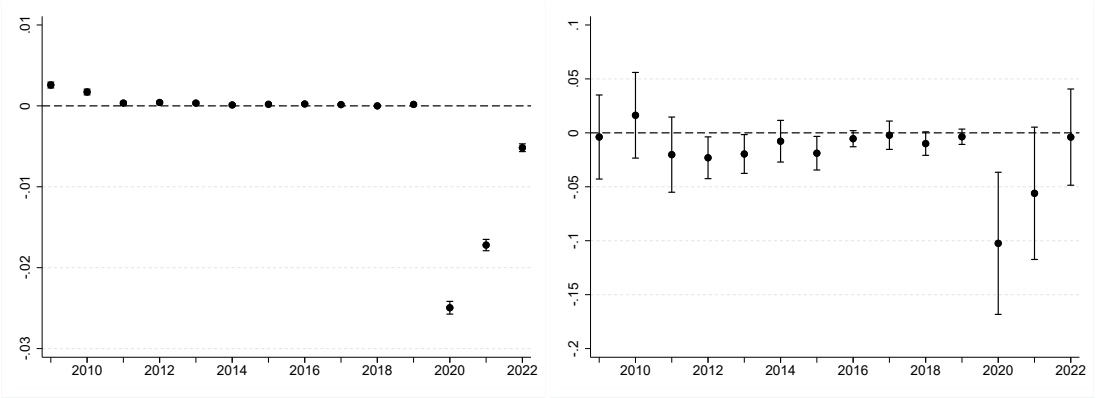
Results for the intensive margin of STW are shown in Figure A3 in the Appendix, only considering establishments with at least one STW month in the respective year. The measure I use is the average work loss in STW across the entire year (months without STW thus have value zero). For the intensive margin, 2020 again exhibits the strong pattern of adverse selection.

Panel (b) of Figure 3 affirms the selection result when using the labor productivity measure. Compared to the first quintile, establishments in the fifth quintile are ten percentage points less likely to have an STW spell in 2020. Because of the much-reduced sample size and the application of survey weights, the estimates are less precise, but the just-mentioned point estimate is very similar to the interpretation of Panel (a), see above. Yet, the two measures are not fully congruent with a correlation coefficient of 0.45 between the position in the AKM distribution and the position in the labor productivity distribution. The partial correlation coefficient between the two measures is 0.2. when holding the other factors from specification (1) constant. This provides evidence that, while being somewhat different, both measures capture underlying establishment quality.

So far, the selection analysis has been confined to the initial pandemic recession in 2020. The German STW scheme, however, is always active and can be utilized by firms, even during a business cycle's boom phase. Therefore, I now consider all years with STW data availability, which comprise the time period 2009 through 2022. Figure 4 plots the results for both proxies of firm quality. To summarize the establishment quality measures in one coefficient for every year, I show the difference between the fifth and the first quintile for labor productivity. For the AKM fixed effects, I show the estimated value for increasing the AKM-FE by one standard deviation within a 5-digit industry. Both of these quality proxies are always computed in the year prior, except for crisis years: 2019 is also used for 2021/2022 and 2008 is also used for 2010/2011.

There are two key takeaways from Figure 4. First, that in the financial crisis in 2009 and 2010 – in contrast to the pandemic recession – there is no apparent pattern of adverse selection into STW; the AKM measure in Panel (a) even suggests a slight positive selection. However, the labor productivity measure does not confirm this pattern, rather it seems that there is

Figure 4: Selection Over Time: The Extensive Margin of STW



(a) AKM-FE: One SD Increase **(b) Labor Prod.: 5th vs. 1st Quintile**

Notes: The figure shows coefficients for establishment quality based on specification (1) with the full set of fixed effects and occupational controls. The dependent variable is a dummy taking the value one if an establishment has at least one STW spell in the given year, and zero otherwise. In panel (a) the coefficient values represent increasing the SD of the AKM-FE (within a 5-digit-industry) by one. Panel (b) shows the difference obtained between the fifth and first quintile of labor productivity while applying survey weights. Both of these quality proxies are computed in the year prior, except 2021 and 2022 where 2019 is used and 2010 and 2011 where 2008 is used.
Source: own calculations. ©IAB

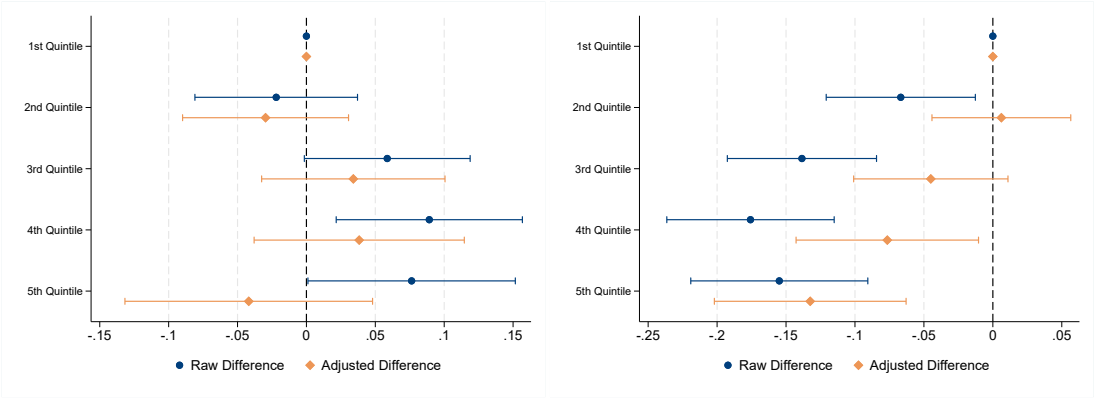
no selection on establishment productivity in the Great Recession. Second, there is no pronounced positive or negative selection on establishment quality into STW in the intervening non-crisis years[10]. Figure A4 in the Appendix documents the robustness of this pattern: First, to including median wages as a control, and, second, to only looking at establishments in manufacturing (since manufacturing constituted the vast majority of STW establishments in the financial crisis). Figure A5 in the Appendix shows, that, at the intensive margin, there also only is adverse selection in the years of the pandemic. Additionally, Figure 4 suggests that selection returns to the pre-pandemic pattern when considering the labor productivity measure.

Reviewing the results on selection into STW so far, it appears that a negative selection on establishment quality into STW – when conditioning on sector, size and other factors – is evident for the pandemic, but not for the prior big recession, the financial crisis. Such a pattern hints at the fact that the two crises affected firms along the quality distribution differently. I affirm this by looking at the relationship between labor productivity and reported crisis effects in the Establishment Panel, drawing on similar questions in 2010 and

[10] The baseline rates of STW are obviously starkly diverging between the years, so the coefficient sizes are not directly comparable. However, the shown general selection patterns are independent of any coefficient scaling. In addition, the coefficients for the non-crisis years from 2011 to 2019 have to treated with caution, because of very low baseline STW rates with little variation to explain.

2020 on whether the respective crisis negatively affected establishments[11]. Figure 5 plots differences in the fractions of establishments self-reporting negative crisis effects, relative to the first labor productivity quintile. The raw differences show the unadjusted differences, only applying survey weights, while adjusted differences are obtained from running the selection equation (1) and taking a dummy of reported negative crisis ramifications as the dependent variable. The baseline fraction of negatively affected establishments amounts to 0.35 in the financial crisis and to 0.74 in the Covid-19 pandemic's initial phase. Reporting negative crisis effects is, naturally, a very strong predictor of STW take-up, even conditionally: Including the indicator in specification (1) with STW as the dependent variable yields that crisis-hit establishments are 10 percentage points more likely to be in STW in 2010 (overall STW share 7%) and 33 percentage points more likely in 2020 (overall STW share 40%).

Figure 5: Labor Productivity and Reported Negative Crisis Effects



(a) Financial Crisis (2010) **(b) Covid-19 Pandemic (2020)**

Notes: The figure shows coefficients and 95%-CIs for labor productivity on the probability of reporting negative crisis effects taken from the Establishment Panel; panel (a) for the financial crisis in 2010, panel (b) for the pandemic in 2020. The raw difference is the difference in means for the negative effects dummy relative to the first labor productivity quintile, the adjusted difference is based on specification (1) with the full set of fixed effects and occupational controls. The dependent variable is a dummy taking the value one if an establishment reports negative effects of a respective crisis, and zero otherwise. The reference category in both panels is the first quintile and survey weights are applied. The baseline fractions of reported negative crisis effects for the first quintile are 0.35 in 2010 and 0.74 in 2020. Labor productivity is measured before the respective crisis. $N^{LP}_{2010} = 5,728$ establishments and $N^{LP}_{2020} = 6,900$ establishments.
Source: own calculations. ©IAB

Panel (a) of Figure 5 shows differences obtained for 2010, where establishments were surveyed about whether the financial crisis had any negative effects on them in 2009/2010. Raw differences show the upper two quintiles being about 8 percentage points *more* likely to report negative effects. Conditionally, however, there is no discernible relationship

[11] Revenue changes could be an alternative, less subjective, measure. However, available data only measure year-on-year changes, where it is unclear whether and how much of a potential decrease is due to the crisis itself or due to being in STW. Hence, I rely on establishments' assessments of the crisis effects.

between labor productivity and reported crisis ramifications, just as the right-hand side panel of Figure 4 indicates for STW. One possible explanation for this result, even when only considering manufacturing, could be in the fact that the crisis strongly decreased global demand. German exports decreased by more than 18% in 2009 relative to the year before, but the corresponding decrease in 2020 amounted to only 9%. This means that firms with more export exposure suffered greater consequences and were more likely to go into STW. As exporters are typically positively selected on size and productivity (Melitz, 2003), this could constitute one explanation for the STW selection pattern in 2009 and 2010. In fact, the data from the Establishment Panel support this mechanism. First, as expected, exporters – defined as establishments where a non-zero share of revenue originates from outside of Germany – are positively selected on labor productivity. Second, conditional on the controls and fixed effects of equation (1), exporters are indeed more likely to be in STW and to report negative crisis effects.

Panel (b) of Figure 5 shows differences obtained for 2020, where establishments were surveyed about whether the pandemic had any negative effects on them in the first half of 2020. There is a negative relationship between quality and reported crisis effects. For instance, the highest quintile is more than 10 percentage points less likely to be affected than the lowest, in raw as well as in adjusted differences. Therefore, even conditioning on narrow industries and other factors, lower-productivity establishments seem to be more adversely impacted by the pandemic.

The survey questions in 2020 – in contrast to the financial crisis – allow for further analyzing some specific types of negative effects. Establishments reporting negative pandemic effects were further asked about several types of negative ramifications and whether the establishment experienced them. Specifically, those are decreasing demand, (temporarily) shutting down, supply chain problems, pandemic-induced staff shortages[12] and liquidity shortages. Table 2 investigates the relationship between STW, negative pandemic ramifications and labor productivity.

Panel A of Table 2 considers whether the reported pandemic effects can explain the adverse selection into STW. Column (1) reproduces the conditional difference between the fifth and first labor productivity quintile, shown for instance in the right panel of Figure 4. In column (2), the sample is restricted to the set of establishments for which data on all types of negative pandemic effects is available, which yields a very similar coefficient. Column (3) adds a dummy variable if an establishment indicates that it is negatively affected by the pandemic in 2020. Unsurprisingly, the indicator is strongly tied to STW. Interestingly, adding the pandemic effects also halves the firm quality coefficient and turns it insignificant. This suggests that a big portion of the observed adverse selection of less productive establishments can be explained by those establishments being hit harder by the pandemic

[12] This comprises shortages due to, e.g., sickness, quarantine and care obligations.

Table 2: Explaining Adverse Selection into STW during the Pandemic

	Panel A: STW and Negative Pandemic Effects				
	(1)	(2)	(3)	(4)	(5)
	Dependent Variable: STW Indicator for 2020				
Labor Productivity	-0.102***	-0.096***	-0.050	-0.048	-0.049
5th vs. 1st quintile	(0.034)	(0.034)	(0.032)	(0.032)	(0.032)
Negative Pandemic Effects			0.334***		
			(0.018)		
Decreasing Demand				0.273***	0.273***
				(0.021)	(0.021)
Shutting Down				0.087***	0.086***
(temporarily)				(0.031)	(0.031)
Supply Chain Problems				-0.003	-0.002
				(0.022)	(0.022)
Staff Shortages				0.018	0.014
(pandemic-induced)				(0.022)	(0.022)
Liquidity Shortages				0.108***	0.106***
				(0.022)	(0.022)
Worker Shortages					0.049*
Expected (in 2018)					(0.025)
Full Set of Controls/FE	✓	✓	✓	✓	✓
Establishments	6913	6525	6525	6525	6525
	Panel B: Specific Negative Effects and Firm Quality				
	(6)	(7)	(8)	(9)	(10)
Dependent Variable	*Decreasing Demand*	*Shutting Down*	*Supply Chain Problems*	*Staff Shortages*	*Liquidity Shortages*
Labor Productivity	-0.103***	-0.041**	-0.025	-0.067**	-0.145***
5th vs. 1st quintile	(0.036)	(0.020)	(0.033)	(0.029)	(0.035)
Mean Y	0.55	0.16	0.24	0.17	0.29
Full Set of Controls/FE	✓	✓	✓	✓	✓
Establishments	6525	6525	6525	6525	6525

Notes: The table shows regression coefficients, where the full set of controls/FE refers to the variables and fixed effects from equation (1). The dependent variable in Panel A is an indicator whether an establishment was in STW in 2020 or not. The dependent variables in Panel B are indicators whether an establishment reports the specific negative effect of the pandemic or not. Mean Y in Panel B denotes the overall share of establishments reporting the respective negative effect type. Labor productivity is measured in 2019. Survey weights are applied. Standard errors are clustered at the establishment level and reported in parentheses. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.
Source: own calculations. ©IAB

downturn (also see Figure 5). Column (4) replaces the general crisis-effects indicator with the five specific types of negative ramifications to delineate which effects drive the result from column (3). Decreasing demand, shutting down and liquidity shortages are the only three factors that are positively associated with STW. Being up to three times larger than the other two estimates, the coefficient on decreasing demand is the most important one.

Column (5) further adds a variable whether the establishment indicated (in the 2018 survey wave of the Establishment Panel) that it expected worker shortages in the coming two years, serving as a proxy for the labor hoarding motive. While the other coefficients are not moved by its inclusion, the expected worker shortages in 2018 show a positive association with STW take-up in 2020, albeit one that is only marginally significant. This corroborates that labor hoarding is a noteworthy reason for establishments using STW, as shown in Section 4.1.

Panel B of Table 2 takes the five different indicators as dependent variables and shows how they are correlated with labor productivity. Higher labor productivity is negatively associated with all five, but supply chain problems and pandemic-induced staff shortages are not predictive of STW. In absolute terms – and especially relative to the fraction of all establishments reporting each type of negative effect (denoted 'Mean Y' in Table 2) – the firm quality association is most pronounced for liquidity shortages (15 percentage points less likely), followed by decreasing demand (10 percentage points less likely). Lower quality establishments probably already had worse business models and worse liquidity when the pandemic unexpectedly hit and therefore had less room for maneuvering and fewer reserves to cushion the shock. With improving liquidity being one of the main reasons for STW (see Section 4.1), they took up more STW. Correspondingly, low-productivity establishments in 2020 are also significantly more likely to have taken up any type of governmental financial support other than STW.

Taken together, the finding that there is adverse selection into STW during the pandemic, but not during the financial crisis, can be attributed to establishments along the productivity distribution being affected differently by the two crises. Interestingly, this is almost the inverse of the conclusion drawn for the Italian case: "[...] the nature of the pandemic suggests that, contrary to the financial crisis of 2008, the COVID-19 shock may have been quite orthogonal to firms' productivity prior to the crisis" (Giupponi/Landais, 2023: p. 2003). One possible reason for the opposite selection patterns between Germany and Italy during the financial crisis could be that the crisis manifested itself differently in the two countries. Another reason could lie in the institutional differences between the implementations of the two STW schemes.

In Germany, the financial crisis disproportionately struck high-quality firms, primarily in manufacturing, but shows no clear selection pattern when adjusting for difference by narrow industries, occupations, regions and firm size. By contrast, the pandemic hit the economy more broadly and exhibits adverse selection even when conditioning on these other factors. This manifests itself in less productive establishments being more likely to report decreasing demand, temporarily shutting down and liquidity shortages. Facilitated by a presumably worse business standing and less financial reserves before the crisis, this could push low-quality establishments towards using STW. Alternatively, since productivity is strongly positively correlated with better management practices, different reactions to

the crisis could explain the selection pattern. For instance: Gathmann et al. (2024) show for Germany that investing in digital technologies at the beginning of the pandemic led to firms having higher employment levels and less STW during the crisis. At the same time, higher-quality firms were also more likely to invest.

5 Employment Effects

5.1 Estimation

I estimate the effects of STW in the pandemic, utilizing data from 2016 until the end of 2022. In general, when trying to identify the employment effects of a STW scheme with establishment-level panel data, estimation takes place via some version of the following specification (see e.g. Cahuc/Kramarz/Nevoux, 2021):

$$Y_{et} = (\beta STW_e \times Post_t) + \psi_e + \tau_t + \varepsilon_{et} \tag{2}$$

Y_{et} denotes (contributory) employment at time t (e.g., years), ψ_e are establishment fixed effects which eliminate time-invariant establishment heterogeneity, τ_t stand in for time fixed effects that adjust for general economic trends, and ε_{et} denotes the error term. A matrix X_{et} could be added to (2) as an optional vector of time-varying control variables. β represents the parameter of interest in (2), capturing STW's effect on employment after the shock ($Post_t$) has hit (e.g., by taking STW_e to be a dummy when there was STW in the establishment in 2020). This specification can be extended into an event-study:

$$Y_{et} = \sum_{m \neq 2019} \beta_m (STW_e \times \mathbb{1}\{t = m\}) + \psi_e + \tau_t + \varepsilon_{et} \tag{3}$$

This extension as spelled out in (3) has two appealing qualities. First, it allows to check for the existence of differential trends between firms using and not using STW before the event of going into STW takes place. Second, it allows for tracing the dynamics of STW by disentangling the short-, medium- and (possibly) long-run effects on employment during STW and after exiting the scheme.

Yet, to identify an employment effect, the assignment into STW needs to be as good as random, conditional on controls and the set of fixed effects. The evidence I present in Section 4.2 above, however, strongly suggests that establishment quality might be an important confounding variable that could taint employment effect estimates. This means that the firm quality dimension needs to be taken into consideration for estimating (and comparing) the employment ramifications of STW in the pandemic.

Because *Kurzarbeit* is principally available as an insurance program to every establishment, my approach to estimate the employment effects of STW is a matched event-study specification as in (3) which explicitly factors in the firm quality dimension when matching establishments. These employment effects would then, assuming parallel trends and under the relatively strong assumption of selection on observables, constitute an average treatment effect on the treated (ATT). Concretely, to ensure comparability of establishments with and without STW, I use coarsened exact matching (CEM) on a range of characteristics. I match exactly on the narrow 5-digit-level industry codes (more than 800), 20 ventiles of the AKM-FE distribution prior to the pandemic, the degree of urbanity in the establishment's county of residence (four categories; taken from the German Federal Office for Building and Regional Planning), six establishment size classes[13] measured in 2019, three establishment age categories measured in 2019 (less than 10 years, 10-25 years, 25+ years) and how STW-eligible employment developed from 2017 to 2018 and from 2018 to 2019 (increase, unchanged or decrease are the three categories, respectively).

For the baseline model estimates, I exclude establishments that had STW in the years before the pandemic and include only those STW-using establishments in the pandemic that received support at any time in 2020 (for a maximum of a total annual work loss of 10%), but not in 2021 and 2022. I impose this restriction to be able to estimate what happens to employment after STW stops, answering the question whether any effects are of a lasting nature. While this restriction could also be seen as possibly introducing a bias through conditioning on future outcomes, I later show that relaxing it does not alter my results.

Note that the matching categories combine for more than a million possible combinations ('strata'), of which roughly 440,000 exist in the sample. Out of about 850,000 establishments[14] that fulfill the data requirements, I can successfully match 216,619 establishments from 43,353 different strata. 67,100 of these firms are establishments with a STW spell in 2020[15]. From this results a CEM weight distribution having a standard deviation

[13] The same as for the selection equation (1): 1-4, 5-9, 10-49, 50-99, 100-499, 500+

[14] The loss in establishments from the overall population is mainly due to the restrictions explained above, due to a range of 5-digit-industries not or only having STW establishments and due to the availability of the AKM fixed effects.

[15] These establishments comprise about 10% of the total STW volume in 2020. On average, each STW establishment has more than four matched controls, albeit that the distribution of matched controls is right-skewed: On third of STW establishments have exactly one matched control, the median is two, the 75th percentile equals five, the 90th percentile 10, the 95th percentile 16, and the 99th percentile 34.

of 1.84 with a mean of one. The maximum weight is 85 (the 99th percentile is at nine), implying that – given the total number of establishments in the analysis – no unduly high weights arise.

The CEM event-study approach relies on the assumption that the treatment group of STW establishments would have experienced a similar employment development as the matched control group of establishments without STW in the absence of the German short-time work scheme, also conditional on the establishment and time fixed effects. It is important to emphasize that I match establishments exactly on the narrow-most fifth-digit industry level and on 20 ventiles of the AKM-FE distribution to ensure that establishments are affected similarly by the pandemic shock and by the measures taken to contain it (e.g., lockdowns were based on the type of economic activity). Additionally, performing the matching in conjunction with the event-study approach laid out in (3) allows me to examine whether there are differential employment trends between STW and matched non-STW establishments before the pandemic hit. Reassuringly, I find no evidence for the existence of differential pre-trends, lending support to the approach's conditional parallel trends assumption.

Further possibly confounding influences are ruled out by the variables in the matching procedure. Including establishment age is motivated by the observation that younger firms are more likely to face liquidity crunches and have worse access to financial markets compared to otherwise similar establishments and this could thus impact the decision for STW. Size classes provide a further measure (albeit rough) of firm quality as well as a proxy for access to financial markets and for management practices (which often markedly differ between bigger and smaller firms), factors which could impact the decision whether to go into STW or not. Because better firms and industries tend to cluster around themselves in more urban areas, I consider how urban the establishment's county of residence is. Moreover, the regional information also proxies for differences in labor market tightness since cities usually have thicker labor markets. To capture not just a static snapshot of establishments in 2019, but also of their histories, employment changes in the two years up to 2019 are part of the matching to facilitate only comparisons between establishments that are on the same (employment) trajectory.

In the following, I summarize the key takeaways from my robustness checks, which I discuss in more detail after the main results. The outlined approach requires that all relevant variables are captured in the matching or by the set of fixed effects. One set of factors that could conceivably be threatening relates to the structure of the workforce. To address this concern, I perform – on top of CEM – entropy balancing (Hainmueller, 2012; Zhao/Percival, 2016) on the matched sample in a robustness check, balancing on a broad set of workforce characteristics in 2019, including skill, age, nationality and gender. Applying this procedure,

the results remain unchanged, demonstrating that workforce characteristics cannot explain the observed employment differential between STW and non-STW establishments.

To further ensure comparability of establishments, I restrict the sample of STW establishments to ones that have a total work loss in 2020 of 10% or less (recall that this factors in the intensive STW margin of employees as well). This entails keeping more than half of the original STW establishments and makes establishments with and without STW more comparable as it can be assumed that it is more likely that establishments with very high usage of STW experienced stronger a higher Covid shock intensity due to unobserved factors that could predispose them to be vulnerable to shocks. I show that dropping the threshold leads to somewhat attenuated effects, a fact which supports this assumption, but still exhibits the same pattern of employment differences.

While CEM makes sure that like is compared with like, a loss of information comes with it as a significant portion of the sample (see above) cannot be matched on the strict criteria. To alleviate concerns arising from loss of information I check the robustness of my results against an alternative inverse probability weighting (IPW) approach that utilizes the full sample and takes into account a broad set of establishment as well as workforce characteristics. The IPW specification yields the same pattern of findings. I report all robustness checks after presenting the main results.

5.2 Results

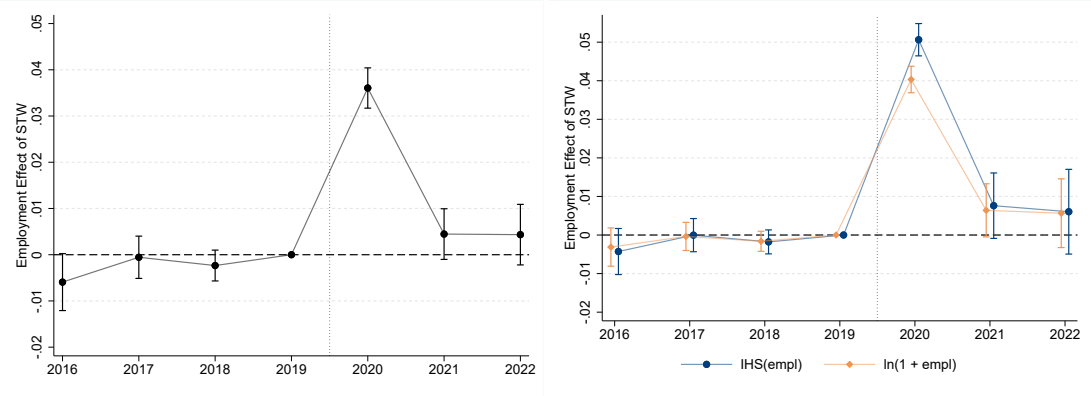
I present (graphical) results based on the event study specification (3) while applying weights obtained from the outlined CEM approach. I consider the period from 2016 until 2022, the current maximum year of data availability. 2019 is the year of reference.

I start with the baseline specification based on equation (3). The left panel (a) of Figure 6 plots estimates and 95% confidence intervals for the (dynamic) employment ramifications of being in STW. Prior to the pandemic, estimates hover around zero, showing no discernible pre-trend for log employment. For 2020, the coefficient indicates a strongly significant higher employment level for STW establishments compared to their matched non-STW counterparts, on the order of about 3.5%. In the two subsequent years after STW has ended for the establishments[16], the point estimates fall back to about 0.5%, estimates that are however insignificant. Thus, it seems that the employment effects of being in STW are short-lived and dissipate very rapidly after an establishment exits the scheme. Figure A6 in the Appendix compares this set of baseline results to a specification where STW establishments with STW in 2020 *and* 2021 are matched to non-STW controls. In this case,

[16] Recall that the STW establishments for this graph were chosen such that they do not have STW in 2021 or 2022, to measure what happens after the scheme is exited.

2022 is the only post-STW period. However, the same pattern emerges in Appendix Figure A6 with the coefficient for 2022 being close to zero and insignificant. For 2021, this approach yields an employment estimate of around 2%, somewhat lower than for the pandemic's initial year, likely because of the reduced crisis severity and accompanying reduced STW usage (see Figure 1). A similar picture arises when defining STW establishments as those with STW in 2020 *and/or* 2021, as depicted in Figure A7 in the Appendix.

Figure 6: Employment Effects of STW



(a) Log Employment **(b) Employment (including zeros)**

Notes: The figure shows estimates and 95% confidence intervals based on (3), applying CEM weights. Standard errors are clustered on the establishment level. 2019 is the base year. The dependent variable is log regular employment in panel (a). In panel (b) the inverse hyperbolic sine of regular employment and the log of 1 plus regular employment are the dependent variables to capture zeros in employment (for instance, caused by establishment closure).
Source: own calculations. ©IAB

The absence of differential pre-trends is encouraging with respect to the matching procedure. In fact, Figure A8 in the Appendix compares the event study from the left panel of Figure 6 with a specification that uses the same sample, but without the matching weights. There, a clear positive pre-trend in terms of employment can be seen with STW establishments having negative employment coefficients before the pandemic that are rising with time, providing a result which underscores once more the negative selection into the German STW scheme during the pandemic recession.

One shortcoming of using logged employment as the dependent variable is the existence of zeros in employment levels that would be caused by an establishment closing down. To avoid looking solely at surviving establishments, panel (b) of Figure 6 plots results for two transformations that do not drop zero employment observations, the inverse hyperbolic sine and the log of employment plus one. Although the interpretation of the point estimates themselves is no longer straightforward, the general pattern of estimates across time is the same, suggesting that there is little happening in terms of differential establishment deaths between STW and non-STW establishments. This, however, is not surprising as the German

government radically eased bankruptcy regulations at the start of 2020, which led to firm closures in the pandemic actually being *lower* than before the pandemic (Müller, 2021). Hence, in this context with the current end of the observation period in 2022, the 'extensive margin' of establishment employment plays no significant role.

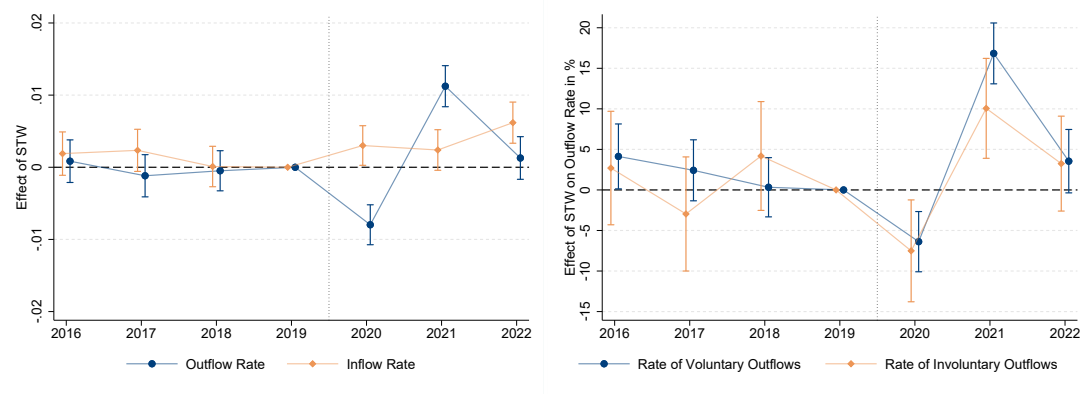
The swift dissipation of the positive employment relationship after the end of STW begets the question what this is driven by. Based on the theoretical considerations, one would expect STW establishments initially being able to hold on to their workforce while their non-STW competitors shed employees. Afterwards, the re-convergence of employment could be due to non-STW firms rehiring to their previous employment level or due to STW establishments also shedding workers after the end of their STW usage. To investigate, I study employment changes as well as inflows and outflows.

Appendix Figure A9 contrasts log employment changes between STW and non-STW establishments. In the years before the recession's onset, both types of establishment have (after matching) very similar growth rates, but STW establishments have a 3-4 log points higher employment change in 2020 than establishments without STW. This does not necessarily imply that they are growing, it is merely the difference to non-STW establishments, which – as a matter of fact – do experience employment declines in 2020. Yet, after STW ends, the estimated difference in employment change sharply turns into the opposite the following year, to about negative 3 log points, a coefficient that is in the same ballpark range in absolute terms as the previous year's coefficient. In 2022, there is again no difference in employment growth between the two groups, the adjustment taking place directly the year after exiting STW. This produces the pattern observed in Figure 6.

Disentangling inflows and outflows, Figure 7 provides the results for employment flows. Panel (a) expands the analysis by separately looking at establishments' inflow and outflow rates, which are both roughly 0.13 at the mean. The event study for inflows suggests that STW-using establishments consistently have marginally higher inflow rates after the pandemic strikes, being able to keep up hiring at a higher clip in the downturn. Even more crucial is the time line of coefficients for the outflow rate. As expected, in 2020, STW establishments have comparatively decreased outflows consistent with STW saving jobs. However, 2021 exhibits an estimate which is the roughly same-sized inversion of 2020, i.e., STW establishments have increased outflow rates relative to their matched peer establishments that have not utilized the scheme. Outflow rates show no difference for 2022. This indicates that many employment relationships at risk are not lastingly saved by the German STW program, as it merely postpones the severance of the worker-firm-match.

While the employment adjustments between STW and non-STW establishments originate mainly from dynamic differences in outflows, the interpretation of this result also hinges on

Figure 7: Effects of STW: Employment Flows and Types of Outflows



(a) Employment Flows **(b) In(Voluntary) Outflows**

Notes: The figure shows estimates and 95% confidence intervals based on (3), applying CEM weights. Standard errors are clustered on the establishment level. 2019 is the base year. In panel (a) the outcome variables are inflow and outflow rates. These are, respectively, defined as the number of flows between two time periods divided by the average employment across the two time periods. The top 1% of rates are, further, trimmed to limit the impact of outlier values. Both inflows and outflows have a mean value of about 0.13. The dependent variables in panel (b) are voluntary and involuntary outflow rates. These rates are defined as the number of (in)voluntary flows between two time periods divided by the average employment across the two time periods and are trimmed analogously to limit the impact of outlier values. Because the two types of outflows have different baseline means, the coefficients are rescaled such that they show the effect relative to the mean in percent. An outflow is classified as 'voluntary' when the person leaving an establishment has an employment-to-employment transition, otherwise it is classified as 'involuntary'.
Source: own calculations. ©IAB

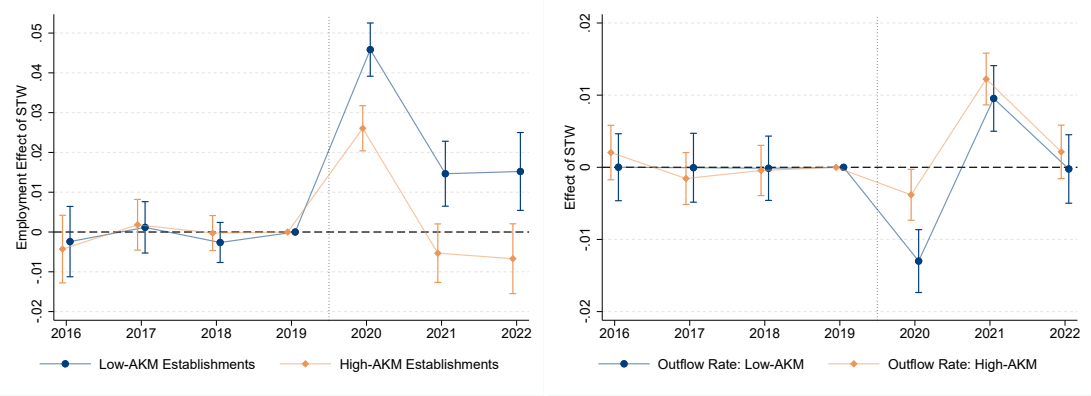
whether these outflow differences derive mainly from involuntary outflows (i.e., firing) or voluntary outflows (i.e., quits). On the one hand, if a majority of outflows (in STW establishments in 2021) are layoffs, this would suggest that STW saves jobs only temporarily and firms have to lay off some of their affected workers after exiting the scheme. If, on the other hand, a majority of those outflows is voluntary, STW saves jobs more lastingly but employees leave of their own volition. This could be the case, for instance, if employees perceive STW as a strong signal of low firm quality and they leave because they doubt the firm's future viability. Given the data at hand, disentangling voluntary from involuntary outflows is not trivial. Using an approximation for the outflow reason, panel (b) of Figure 7 reports results where an outflow is classified as 'voluntary' if a person leaving an establishment has an employment-to-employment transition with no break in between, and as 'involuntary' otherwise[17]. The graph reveals slight differences between the two outflow types. For both types, 2020 shows a 7-8% reduction in outflows in 2020 (relative to the mean) and 2021 an increase of 10-15%. The 2021 estimate for voluntary outflows is higher, with the difference being statistically significant at a threshold p-value of 6.6%.

[17] The results remain the same when, e.g., drawing the boundary between voluntary and involuntary outflows such that up to a month of unemployment or non-employment is allowed for a 'voluntary' outflow.

While the available data indicate that the employment changes are driven by both voluntary and involuntary separations, the change in voluntary outflows is somewhat higher for STW establishments after exiting the scheme. In combination with the fact that the majority of outflows can be classified as voluntary, the analysis suggests that the non-lasting employment effects are not primarily a sign of delayed layoffs, but rather that the post-STW employment dynamics can mostly be ascribed to voluntary outflows. For instance, this might be the case because workers perceive STW as a signal of the firm having a structural weakness.

Section 4.2 above illustrates how there is negative selection into STW based on measures of establishments quality/productivity. Therefore, it is relevant to consider whether there are any differences in the employment effects for more and less productive establishments. Figure 8 compares the employment effects of receiving STW benefits between low-AKM and high-AKM establishments, where the delineation into low and high takes place via a split at the median of the AKM-FE distribution. Because the 20 ventiles of the AKM fixed effect distribution are part of the CEM procedure, this simply splits the sample without changing any of CEM strata.

Figure 8: STW Employment Effects: Low-AKM and High-AKM Establishments



(a) Log Employment **(b) Outflow Rates**

Notes: The figure shows estimates and 95% confidence intervals based on (3), applying CEM weights. Standard errors are clustered on the establishment level. 2019 is the base year. Low-AKM establishments are those who are in the bottom half of the wage premia distribution as estimated from 2010 to 2017. Conversely, high-AKM establishments are in the distribution's top half. Panel (a) takes log employment stocks as the outcome, panel (b) takes outflow rates (top 1% are trimmed) as the outcome.
Source: own calculations. ©IAB

Figure 8 reveals differences by firm quality. While there are, for both groups, again no observable pre-trends, their estimated coefficients differ in the pandemic years. In panel (a), both groups have a positive effect in 2020, but the low-AKM establishments' point estimate at 4.5% is nearly twice as large as the 2.5% for high-AKM establishments. Even more interesting is the divergence in 2021 and 2022, where the results for more productive

establishments indicate slightly negative, but insignificant, employment effects compared to high-quality non-STW establishments. In contrast, the comparison within establishments that have low wage premia implies significant positive employment effects of about 1.5% persisting up to two years after the STW scheme was exited. When estimating the total effect of STW over the time period 2016 to 2022 by comparing the time until 2019 with that from 2020 onwards (i.e., when estimating equation (2) instead of the event-study), the estimate for low-AKM establishments is 2.7% (S.E. 0.4) and 0.6% (S.E. 0.3) for high-AKM establishments[18]. Correspondingly, the ability of Germany's *Kurzarbeit* to save jobs in a lasting manner seems stronger for lower-quality establishments. Panel (b) of Figure 8 shows that, when considering outflow rates by AKM category as the outcome, this impact of STW is mostly driven by the reduction in outflows in 2020 being more pronounced for low-AKM establishments.

Taken together, the findings suggest a positive employment effect of the German STW scheme in the pandemic on establishments, albeit that almost all of the effect dissipates quickly when an establishment no longer is in STW. This relationship is driven by STW establishments having decreased outflows (both voluntary and involuntary ones) relative to non-STW establishments during their time in STW, but having relatively increased outflows afterwards that roughly cancel each other out dynamically. Employment effects during STW are more pronounced for low-AKM establishments, a group which, in contrast to high-AKM establishments, also has slight positive employment impacts even after exiting the scheme, courtesy of a stronger reduction in outflows while in STW.

5.3 Robustness

One possible threat to the econometric strategy could come from the assumption that all the relevant variables are captured in the matching step (or by the set of fixed effects). In particular, workforce characteristics are mostly absent in the matching and could pose an issue. While there is strong evidence of assortative matching between workers and firms (e.g. Card/Heining/Kline, 2013), this assortative matching is not perfect and workforce characteristics (like how skilled the workforce is) could differ within matched strata by STW status. This might conceivably affect STW take-up and also employment after STW ends (for instance, higher-skilled workers being more likely to leave afterwards).

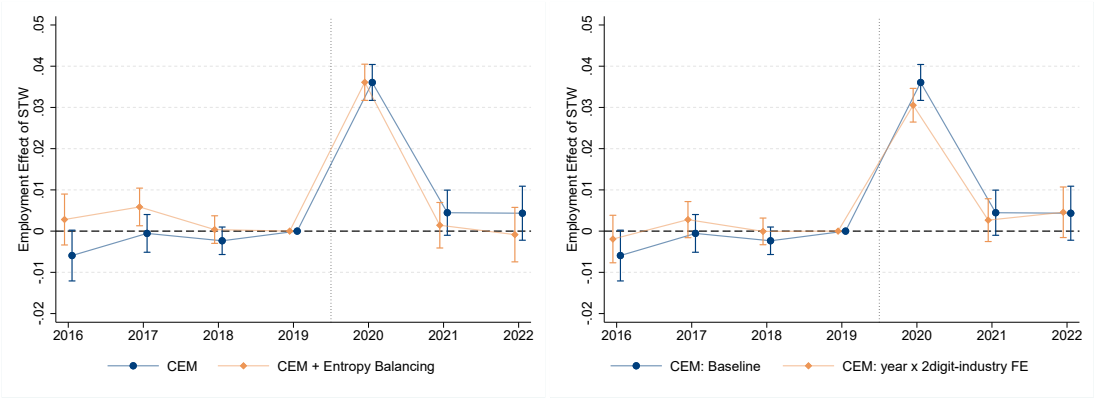
Additionally including employee characteristics is infeasible due to the fact that the number of matching strata would grow immensely and, henceforth, the curse of dimensionality would bite. Nevertheless, I consider an extension of my approach that explicitly brings in workforce characteristics by further applying entropy balancing (Hainmueller, 2012;

[18] For reference, the STW estimate based on (2) amounts to 1.8% (S.E. 0.3) for the full CEM sample.

Zhao/Percival, 2016) to the matched sample. I adjust the matching weights in such a way that the first moments on a range of workforce variables are identical between the group of STW establishments and the group of non-STW establishments. Employee shares of German nationality, women, full-time workers and three skill levels as well as the mean age comprise the set of workforce characteristics.

I compare the baseline event study with the one obtained from adding entropy balancing as a second step on top of CEM in panel (a) of Figure 9. Reassuringly, this extra balancing step does little to the estimates, showing that differences in worker characteristics cannot explain the employment ramifications of STW which I find.

Figure 9: Robustness: Worker Characteristics and Time-by-Industry FE



(a) Adjusting for Worker Characteristics **(b) Including Year-by-Industry FE**

Notes: The figure shows estimates and 95% confidence intervals based on (3), applying CEM weights. Panel (a) compares the baseline – from the left panel of Figure 6 – to a specification that additionally balances the obtained CEM-weights with respect to worker characteristics (age, nationality, gender, skill; see text for more details). Panel (b) compares the baseline with a specification where year-by-industry fixed effects are included instead of year fixed effects (industries are measured on the 2-digit level in this context, implying 90 different industries).
Source: own calculations. ©IAB

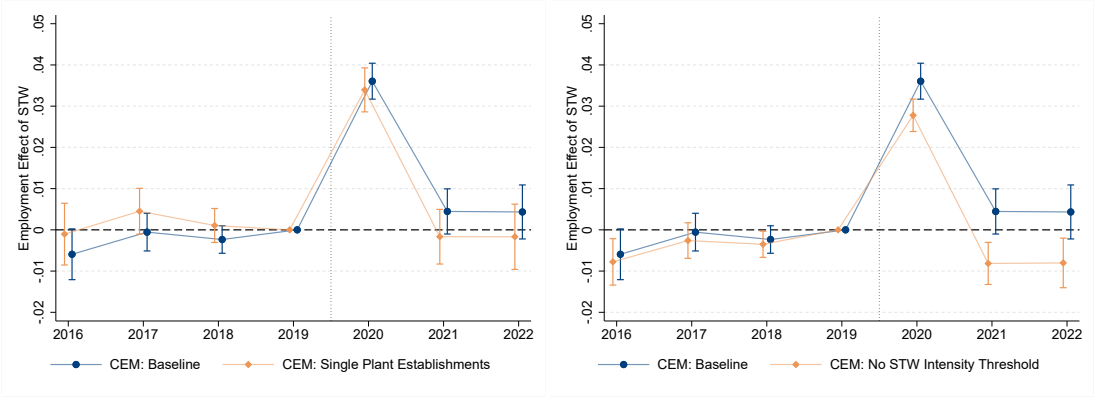
Another concern could be that the employment development seen in the aggregate event study might be an artefact of a misspecified regression equation, for instance if the year fixed effects are insufficient for absorbing non-STW-related differences in time. To rule out this possibility, panel (b) of Figure 9 overlays my baseline specification with a specification which includes year-by-industry fixed effects for 90 2-digit industries (instead of just year fixed effects). However, the results remain unchanged. Similarly, I get quantitatively nearly identical coefficients in Appendix Figure A10, where I include year-by-federal-state fixed effects in the estimation.

One peculiarity of the German STW scheme and how it is administered has to do with the distinction between establishments and companies and the possibility that, for instance,

headquarters within a company could report STW for other establishments within the company structure (see Section 3). This possibility cannot be accounted for explicitly by the administrative data, although it happens occasionally (Kagerl/Schierholz/Fitzenberger, 2022). To get a better grasp on company networks and how they relate to establishments, I merge the administrative data on establishments to an indicator of which establishments are single-plant establishments, and hence not part of a larger company structure. This indicator originates from the data of the Mannheim Enterprise Panel which covers nearly all active firms in Germany (for more details see Bersch et al., 2014). It should be noted that there is a sizeable portion of establishments whose status as single-plant or multi-plant cannot be determined. Nevertheless, as it is the only available data source at this big a scale, I use this data for a robustness analysis.

Panel (a) of Figure 10 shows the baseline result and the result obtained by only considering establishments that are ascertained to be single-plant establishments. Due to the data constraints, this implies a reduction in sample size of about 40%, to roughly 130,000 establishments. Correspondingly, the estimates exhibit a lower degree of precision. Yet, focusing on single-plant establishments yields the same pattern of dissipating positive STW employment effects.

Figure 10: Robustness: Single-Plant Establishments and STW Intensity



(a) Only Single-Plant Establishments **(b) No STW Intensity Threshold**

Notes: The figure shows estimates and 95% confidence intervals based on (3), applying CEM weights. Panel (a) compares the baseline – from the left panel of Figure 6 – to a specification that only considers single-plant establishments ($N = 130,952$ establishments; see text for more details). Panel (b) compares the baseline with a specification where the STW intensity threshold of a maximum 10% total work loss in 2020 for STW establishments is dropped ($N = 257,667$ establishments; see text for more details).
Source: own calculations. ©IAB

One restriction to ensure comparability that I make is the imposition of a maximum total work loss in 2020 of 10% for STW establishments (see Section 5.1). In panel (b) of Figure 10, I drop this restriction. Still, there is an employment effect in 2020 on the order of ca. 3% and no strong discernible pre-trend. Merely the estimates for 2021 and 2022 show a marginally

statistically significant negative employment effect of half a percent. Because dropping the restriction increases the relative share of low-AKM establishments (also see the selection results in Section 4.2), the differences between top and bottom half AKM firms in Figure 8 cannot explain this; in fact, this pattern actually affects the coefficients for the post-STW years positively. Therefore, it seems likely that the STW group without the intensity restriction is affected more strongly by the crisis shock relative to non-STW firms. This might then be reflected by the pre-Covid coefficients, the very high STW intensity and by those firms shedding more workers after the STW spell than non-STW establishments do during the STW period.

5.4 An Alternative Approach

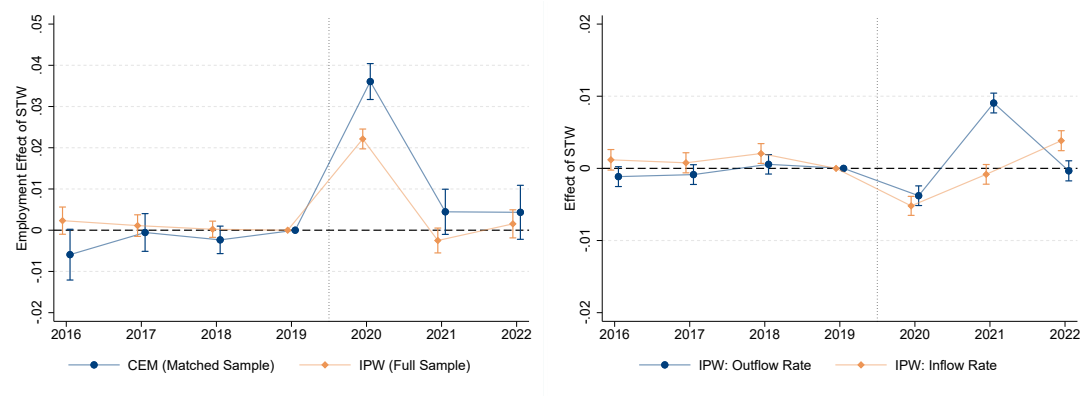
One disadvantage of relying on coarsened exact matching is the elimination of unmatched establishments from the analysis sample. As is evident from the numbers given in Section 5.1, the establishment sample shrinks by nearly 75%. For STW establishments, however, the decrease is relatively less severe at 45%. Still, to avoid this loss of (potentially useful) information, I consider an alternative approach to estimate the employment effects of STW that utilizes the full sample of (STW) establishments. To this end, I perform an inverse probability weighting (IPW) approach on the full sample. Because IPW does not punish nearly as much as CEM does for including more variables in the matching step (curse of dimensionality), I include a broad range of establishment variables and of workforce characteristics in the logit estimation of the underlying propensity score. Specifically, the propensity score estimation for the base year 2019 includes indicators for 5-digit industries, indicators for counties, log employment (plus three lags of it), the log median wage, establishment age, the value of the establishment AKM-FE as well as the mean age of the workforce and employee shares by gender, nationality, full-time, three skill levels and twelve occupations.

The standard deviation of the resulting IPW weights (enforcing common support) is smaller than the one for the CEM weights (1.37 versus 1.84). Similarly, a maximum value of roughly 61 indicates no outliers, given that the IPW sample of roughly 750,000 establishments is three and a half times bigger than the CEM sample. Panel (a) of Figure 11 juxtaposes the event study with the IPW sample and weights with the CEM baseline. Incorporating more establishments and more information (on occupations, among others) in the IPW approach yields the same pattern of rapidly vanishing employment effects after the absence of trends prior to Corona. Merely the size of the 2020 coefficient is subdued to slightly above 2% when using IPW.

Panel (b) of Figure 11 applies the IPW approach to the outcomes of inflow and outflow rates. As in the CEM case, outflows are subdued during STW and increased after STW ends (relative

to non-STW establishments). Regarding inflows, the IPW coefficients actually suggest lower inflows during STW in 2020, but slightly higher inflows for STW establishments in 2022 as well. The divergent patterns by establishment quality seen in Figure 8 for coarsened exact matching are replicated for IPW in Appendix Figure A11.

Figure 11: Inverse Probability Weighting as an Alternative Matching Approach



(a) Comparison CEM and IPW **(b) IPW: Inflows and Outflows**

Notes: The figure shows estimates and 95% confidence intervals based on (3). Panel (a) compares the baseline – from the left panel of Figure 6 – to the IPW specification (see text for more details). In panel (b), the outcome variables are inflow and outflow rates. These are, respectively, defined as the number of flows between two time periods divided by the average employment across the two time periods. The top 1% of rates are, further, trimmed to limit the impact of outlier values.
Source: own calculations. ©IAB

Summarizing the IPW results, it is reassuring that this alternative approach, which incorporates a bigger slate of characteristics at the expense of not directly matching establishments, still can deal with the selection into STW (also see Appendix Figure A12 for a comparison of the IPW-weighted event study with the unweighted one) and produces the same findings as does the CEM approach. Thus, my result of positive STW employment effects that quickly fade after STW proves econometrically robust.

6 Windfall Effects

Windfall effects (also: deadweight losses) of STW describe job matches which are supported through the STW scheme, but which would not be lost in the (counterfactual) absence of STW. In the context of the pandemic, the German government eased access to the job insurance. Alongside the fact that the Federal Employment Agency was straining to handle

the unprecedented level of STW applications in the spring of 2020, these two factors led to many applications being examined much faster and in a less detailed manner than usually. Correspondingly, it can be expected that more applications were granted due to the special circumstances of the pandemic and the eased access rules (see Section 2). Potentially, some firms factored this in and profited off the easy STW access despite there being little or no risk of job destruction.

One extreme version of windfall is the fraud-like abuse of STW allowances, for example by officially applying for hours reductions for employees but unofficially still requiring or expecting employees to achieve the full-time work load. This constitutes free riding in the sense that the STW benefits are abused to subsidize wages despite no decrease in work hours. The scope of such illicit behavior is obviously hard to gauge, the Federal Employment Agency only reports few cases where firms were required to repay their STW allowances after a later review. Based on experimental methods within an employee survey, Bossler et al. (2023) do find a sizeable incidence of actual working hours being longer than stated in the official notification.

Free riding in this narrow sense may, however, be only a part of windfall. Another, likely much more wide-spread, version of windfall is the support of jobs with hours reductions that would not have been lost without STW. For instance, a firm only has a modest decrease in revenue which it could have weathered even without government support. One anecdote widely reported in German media concerned the car company Mercedes-Benz in 2023, which put some of its employees in STW due to supply chain problems, despite earning billions of Euros in profit at the same time[19]. Mercedes-Benz in this case, it should also be stressed, conformed with the official rules around STW. While this might be one obvious case of windfall effects (as it stands to reason that Mercedes-Benz would not have fired those employees in the absence of STW, since layoffs are excluded under an agreement with the company's works council until 2029), the question is what the overall scale of the windfall effects is. In the following, I try to provide approximate numbers on the windfall of the German STW scheme based on different approaches.

One suggestive indicator can be the share of firms with low work loss during the pandemic. If the total work loss in STW is low, it becomes more likely that the firm could have held on to these workers if it wanted. For example, 7.5% of all STW firms had a total actual work loss between March and December 2020 of less than 2%. Of course, where to set the threshold is arbitrary, but the decision early in the pandemic to reduce the minimum threshold to 10% of workers (from one third) with at least 10% work loss in a STW month resulted in a higher ex-post share of establishments that have very little actual total work loss.

[19] E.g., from the German public broadcaster: https://www.tagesschau.de/wirtschaft/unternehmen/mercedes-kurzarbeit-mitarbeiter-101.html

A superior measure of windfall is the share establishments (and their employees) that experienced no or only small actual revenue decreases (also see Cahuc/Kramarz/Nevoux, 2021). This relates directly to the economic reasons that need to be fulfilled for STW allowances to be granted, e.g. supply chain problems, a lack of orders or – in the pandemic – governmental orders to restrict business activities. All these reasons should manifest themselves in noticeable decreases in establishment revenue. For evidence on revenue changes and economic consequences of the the pandemic, I again turn to data collected from establishments surveys (Establishment Panel and BeCovid) that can be linked to the administrative data.

I a first step, I analyze how wide-spread the utilization of STW is among (single-plant) establishments that report no revenue decrease from 2019 to 2020[20]. In the BeCovid survey, establishments were asked how their revenues in 2020 compared to those in 2019. Among those reporting revenue drops, about half have at least one STW spell in the pandemic. For those reporting that revenue stayed (roughly) the same or increased, the share of STW establishments is much lower, but still stands at 20%.

In another analysis, I use survey information on the pandemic's economic impact on establishments to delineate which establishments were in distress in 2020. I draw this information from the Establishment Panel where establishments were asked in 2020 whether the pandemic had negative economic impacts on the establishments or not. 55% of firms reporting such negative effects used STW in 2020, yet so did 10% of those without adverse impacts.

Taking together, the various indicators for windfall effects shown so far – very low work loss, no initial revenue decrease in the pandemic, no self-reported negative crisis effects – do indeed suggest that there is a sizeable amount of windfall. But, the numbers just presented merely constitute a lower bound on the windfall because of the coarseness of the indicators for the pandemic impact. Survey measurement error may be another concern. Moreover, establishments that were negatively affected or experienced revenue decreases are not counted even though they might not have laid off workers in the absence of STW.

An alternative way to arrive at a figure for windfall effects is to take the employment effect estimates from Section 5 at face value and do a *back-of-the-envelope* calculation to get an amount for the number of saved jobs. Setting this amount in relation to the total number of employees in STW then gives a rough approximation of the windfall. Figure 6 yields a 3.5% employment coefficient for 2020, albeit that this a mean effect over establishments. To get a more useful estimate in terms of employees, I run the CEM baseline regression but

[20] For establishments with low revenue decreases and STW, it is hard to disentangle whether the crisis itself led to the revenue decrease or if STW caused (parts of) it. Hence, I consider only establishments with no (or positive) revenue changes.

additionally incorporate employment weights for 2019. This yields a coefficient of about 4.1% for 2020 (95%-CI bounds: 2.5% and 5.6%). Extrapolating to the contributory employment in all STW establishments in 2020 – which stood at nearly 11 million workers – the estimated number of jobs saved by STW is therefore about 450,000 (95%-CI bounds: 275,000 and 615,000).

Average unemployment stood at 2.7 million in Germany in 2020, implying that the number of jobless would have been higher by one sixth were it nor for STW (using the point estimate). Mapped onto the unemployment rate, the estimate implies an unemployment rate in 2020 of 6.9% instead of 5.9%[21]. In total, 8.75 million unique people were in STW in 2020. Further taking into account an average work loss of 42% in 2020 during the pandemic would suggest a number of 3.7 million employment equivalents that were supported by STW. In relation to the estimated number of jobs saved, this indicates substantial windfall effects.

However, these are back-of-the-envelope numbers derive from a partial-equilibrium calculation and come with some fairly strong caveats. First, the point estimate is potentially inaccurately estimated because it is derived only from the STW sample of establishments with STW in 2020 (but not afterwards), excluding some heavy and long-time users of STW. Second, the calculation relies on extrapolating from the matched sample to the entirety of STW establishments. The estimates from IPW use the full sample and are only slightly lower, but both approaches incorporate information on AKM-FE, which are missing for a sizeable chunk of establishments. Third, the calculations are only for the initial shock year of 2020 and neglect any possible contribution of STW to stabilizing the economy as a whole. Such a stabilizing effect can for example derive from the mere existence of STW, which constitutes an ex-ante known safety net and thus reduces uncertainty for firms. Similarly, the big uptake of STW during the pandemic could lead to spillover effects on non-STW firms which would not be captured in my estimates. For 2021 and later, the dynamics of unemployment and labor market frictions start to be even more crucial for the policy's macroeconomic implications. Therefore, I restrict my back-of-the-envelope calculations to 2020. As stressed by Balleer et al. (2016), the interactions of labor market institutions matter greatly for the dynamic effectiveness and efficiency of STW.

To summarize, the evidence from multiple indicators – despite some caveats – suggests that there are significant windfall effects associated with the German STW scheme during the pandemic, as also found by Bossler et al. (2023). There were STW spells with very little work loss and many establishments were in STW despite no or limited impact of the pandemic on their operations or revenues. Moreover, while the employment ramifications translate to

[21] Implied unemployment changes at the lower bound of the 95%-CI in the absence of STW: One tenth more unemployed and a 6.5% unemployment rate. At the upper bound of the 95%-CI: 23% more unemployed and a 7.3% unemployment rate.

hundreds of thousands of saved jobs, millions were in STW. This suggests that a majority of the STW benefits were not targeted very well, leading to a great deal of windfall.

7 Conclusion

The pandemic has brought the labor market instrument short-time work into the spotlight again. Across 2020 and 2021, the costs of STW in Germany accrued to a total of 45 billion Euros, being comparable to the spending on unemployment insurance in this time frame. This paper surveys the scope of STW in Germany, considers the reasons why establishments go into STW, analyzes the selection into STW and investigates its employment and windfall effects.

For my analysis, I use novel administrative data on STW in Germany and further draw on survey information that is linked to the official data. I find that the unprecedented use of STW in the pandemic was motivated not only by firms' immediate financial concerns, but also by their desire to hold on to their workforce in a tight labor market. Still, I document a strong negative selection into STW based on measures of establishment quality and productivity. This selection pattern, however, is only apparent in the Covid recession, not during the financial crisis. The two crises having different ramifications along the firm productivity distribution provide an explanation. Firms with more exposure to international markets – who tend to be bigger and more productive – were hit disproportionately often during the financial crisis, while the Covid-19 downturn struck the economy very broadly. With low-quality firms presumably being in a worse position prior to the shock, the pandemic made them more likely to face decreasing demand, temporarily shutting down and liquidity crunches, which drive the selection into STW.

Regarding the core argument of saving jobs, I demonstrate that establishments in STW have higher employment levels compared to their matched non-STW counterparts when they are receiving the benefits. After exiting the scheme, employment effects quickly become insignificant and mostly vanish, a finding supported by a plethora of econometric specification checks and robustness exercises. This result is driven by outflows among STW establishments being initially lower, but then higher after the end of STW, a finding that holds for both voluntary and involuntary separations. Yet, the bigger driver of the outflow differences after STW ends are voluntary outflows, suggesting that employees perceive STW as a negative signal about the firm. In addition, I present evidence that the employment-saving property of STW is more pronounced and lasts longer for low-productivity establishments.

All in all, back-of-the-envelope calculations suggest up to half a million jobs were saved by STW in 2020. Yet, with 8.75 million jobs – translating to 3.7 million employment equivalents – that were supported by STW allowances overall in 2020, large windfall effects are also a feature of Germany's STW implementation. The existence of windfall is corroborated by some establishments receiving STW benefits despite experiencing no or little pandemic repercussions in terms of economic effects and revenue.

My results have implications for policy makers. The substantial amount of windfall effects implies that improving the targeting of the German STW scheme could make it more efficient. There should be a focus on making sure that establishments are having sizeable revenue decreases due to the shock in question before granting STW. Further, the special eased access rules during the pandemic – which in part ran until 2022, see Section 2 – could have been omitted or tied directly to the countermeasures against Covid-19, for instance to lockdown orders or social restrictions. Related, introducing an experience rating element to *Kurzarbeit* could be helpful, a mechanism working well in other settings (see OECD, 2021; Fitzenberger/Walwei, 2023) and suggested already by Burdett/Wright (1989). The partial paying back of STW costs at a later point through increased contributions by former STW firms provides a stronger incentive to firms to only take up STW if really necessary.

However, I stress that my analyses are reduced-form and thus in partial equilibrium. I do not include dynamic general equilibrium considerations, such as the possibility that STW has a stabilizing macroeconomic effect through it acting as safety net and preventing a crisis from further spiralling downwards. One limitation of my approach arising through this is the possibility of spillover effects of the broad usage of STW on non-STW firms. The case of spillovers would then violate the stable unit treatment value assumption (SUTVA). Similarly, my results do not reasonably lend themselves to an explicit cost-benefit calculation of short-time work versus unemployment and the scheme's overall welfare effects. STW and unemployment insurance are not one-to-one substitutes either way and, as forms of social insurance, exhibit strong complementarities (Giupponi/Landais/Lapeyre, 2022): For instance, unemployment insurance can deal with persistent structural changes while STW is better suited to cushioning temporary and acute shocks.

Worthy of further investigation are the reallocation implications of STW. On the one hand, the stronger employment results for less productive establishments could be read as foretelling negative reallocation effects. On the other hand, the existence of large windfall effects and the increased rate of voluntary outflows after STW ends could be read as indicating that any reallocation effects are quite limited. In the future, with more data available on the post-pandemic period and special regulations on STW and bankruptcy having run out, reallocation effects of STW could provide a fruitful avenue for research.

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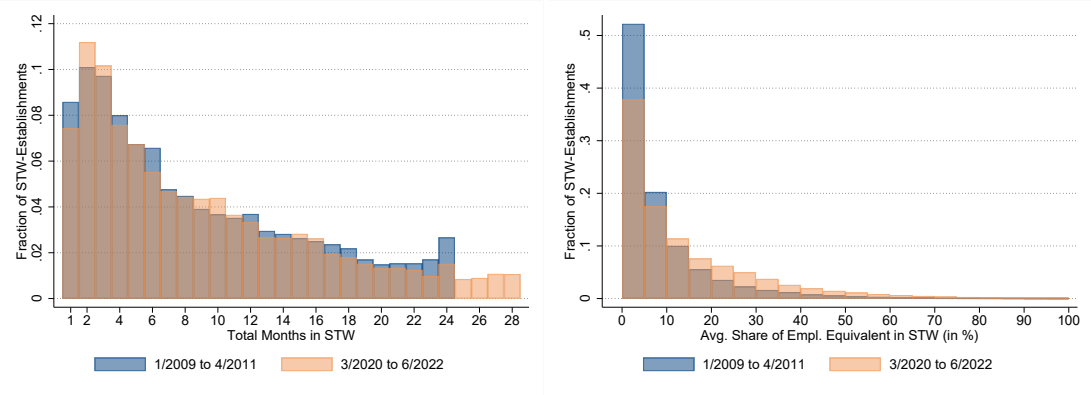
Appendix

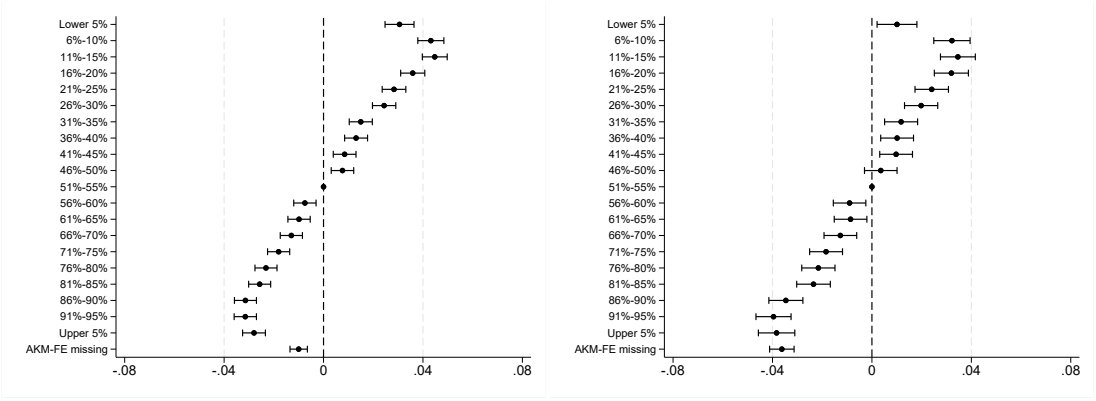
Figure A1: Establishment-Level Intensive Margin of STW



(a) Months in STW **(b) Work Loss in STW**

Notes: Panel (a): The graph shows histograms for the number of STW months in an establishment for 28-month-periods in the two crises (only including establishments that had at least one STW spell in the respective time period). 28 months was the maximum number of months in STW during the pandemic, the limit was 24 months in the financial crisis. Each bar represents one month; the population of STW-using establishments is used. Panel (b): The graph shows histograms for average share of employment equivalent in STW in an establishment for the two crises, for 24 months in the financial crisis and for 28 months in the pandemic (only including establishments that had at least one STW spell in the respective time period, where months without STW are counted as zeros in the computation). Each bar has a width of five percentage points; the population of STW-using establishments is used.
Source: own calculations. ©IAB

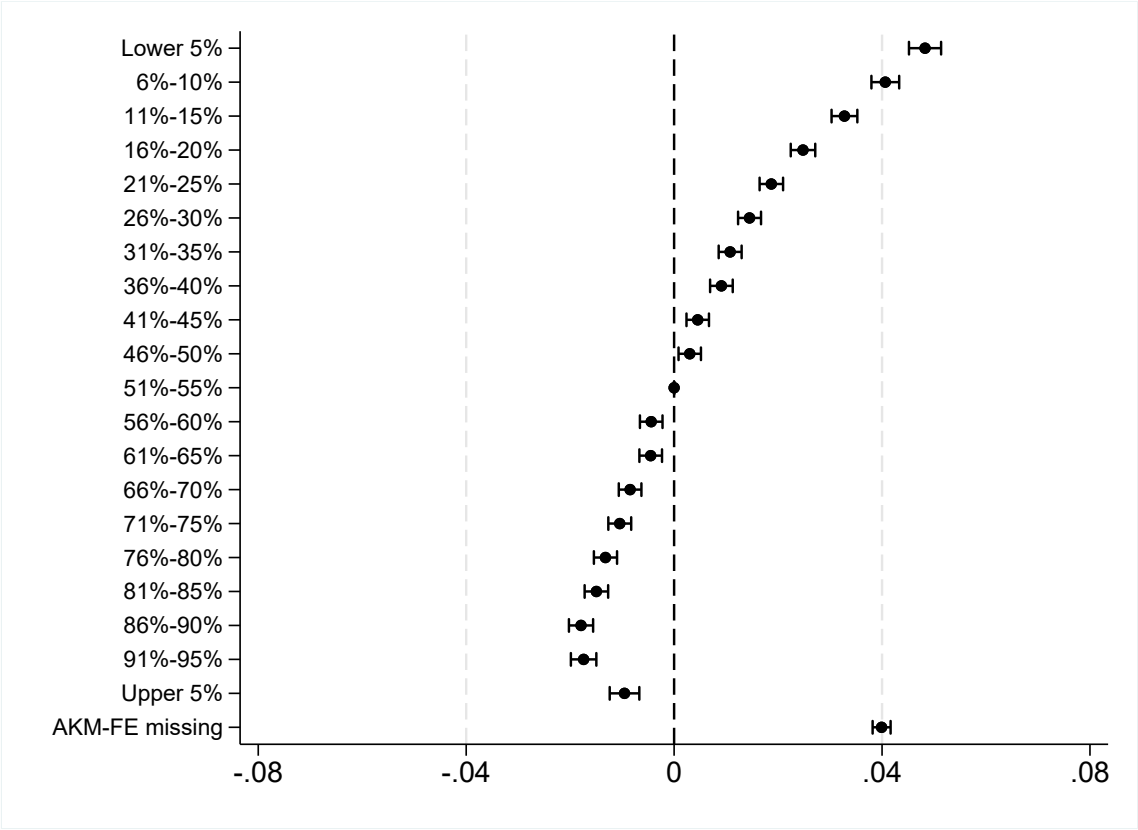
Figure A2: Selection on the Extensive Margin: Robustness (2020)



(a) Median Wage Controls **(b) Only Single-Plant Establishments**

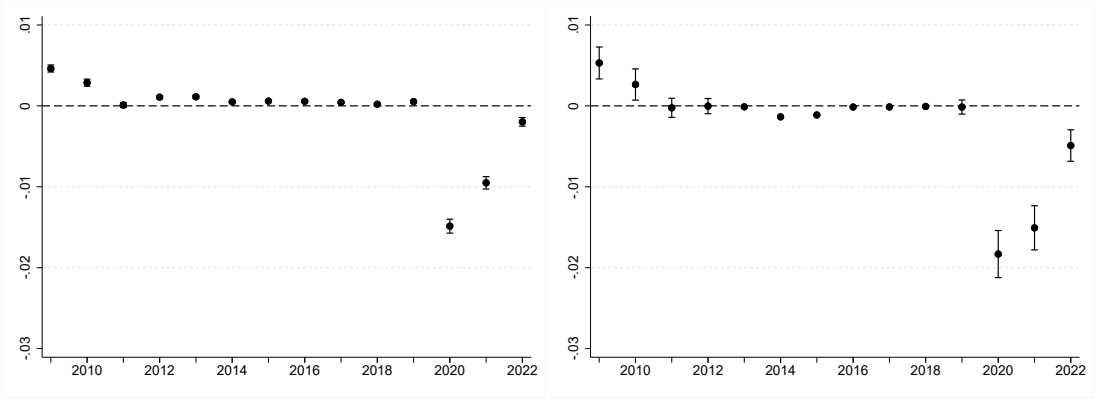
Notes: The figure shows coefficients for establishment quality based on specification (1) for 2020 with the full set of fixed effects, occupational controls. In panel (a), a full set of dummies for twenty ventiles for the median wage distribution is included additionally. In panel (b), only single-plant establishments are considered in the estimation. Used is the position in the distribution of the AKM-FE which were calculated from the period 2010 to 2017. The dependent variable is a dummy taking the value one if an establishment has at least one STW spell in the given year, and zero otherwise. The reference category is the eleventh of the twenty ventiles, i.e. between the 51st and the 55th percentile. $N_{(a)} = 2,097,889$ establishments and $N_{(b)} = 961,503$ establishments.
Source: own calculations. ©IAB

Figure A3: Selection: AKM-FE and the Intensive Margin of STW (2020)



Notes: The figure shows coefficients for establishment quality based on specification (1) for 2020 – conditioning on establishments with at least one spell in STW – with the full set of fixed effects and occupational controls. Used is the position in the distribution of the AKM-FE which were calculated from the period 2010 to 2017. The dependent variable is the average work loss in STW over the whole year for the establishment. In the computation, a month without STW is given the value zero. The baseline share for STW establishments for this work loss measure is 0.18 in 2020. The reference category is the eleventh of the twenty ventiles, i.e. between the 51st and the 55th percentile.
Source: own calculations. ©IAB

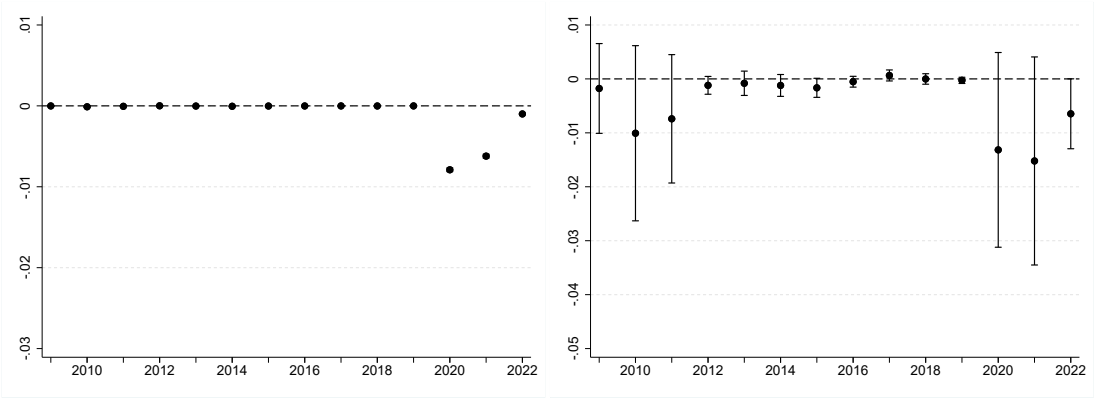
Figure A4: Selection Over Time: Extensive Margin Robustness



(a) AKM-FE: Including Wage Controls **(b) AKM-FE: Only Manufacturing**

Notes: The figure shows coefficients for establishment quality based on specification (1) with the full set of fixed effects and occupational controls. The dependent variable is a dummy taking the value one if an establishment has at least one STW spell in the given year, and zero otherwise. The coefficient values represent increasing the SD of the AKM-FE (within a 5-digit-industry) by one. Used is the position in the distribution of the AKM-FE which were calculated from the period 2010 to 2017. Specifications in panel (a) include a full set of dummies for twenty ventiles for the median wage distribution on top of the baseline specification. Panel (b) only consider establishments in the manufacturing sector.
Source: own calculations. ©IAB

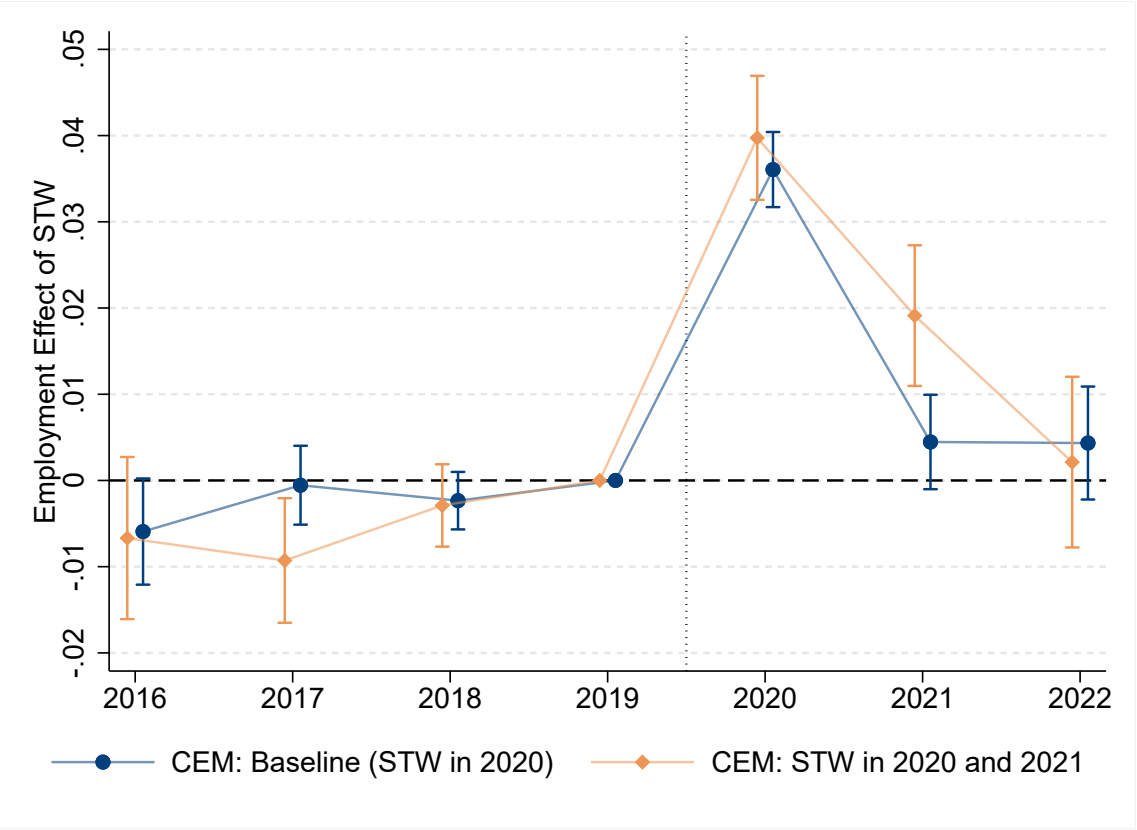
Figure A5: Selection Over Time: Intensive Margin



(a) AKM-FE: One SD Increase **(b) Labor Prod.: 5th vs. 1st Quintile**

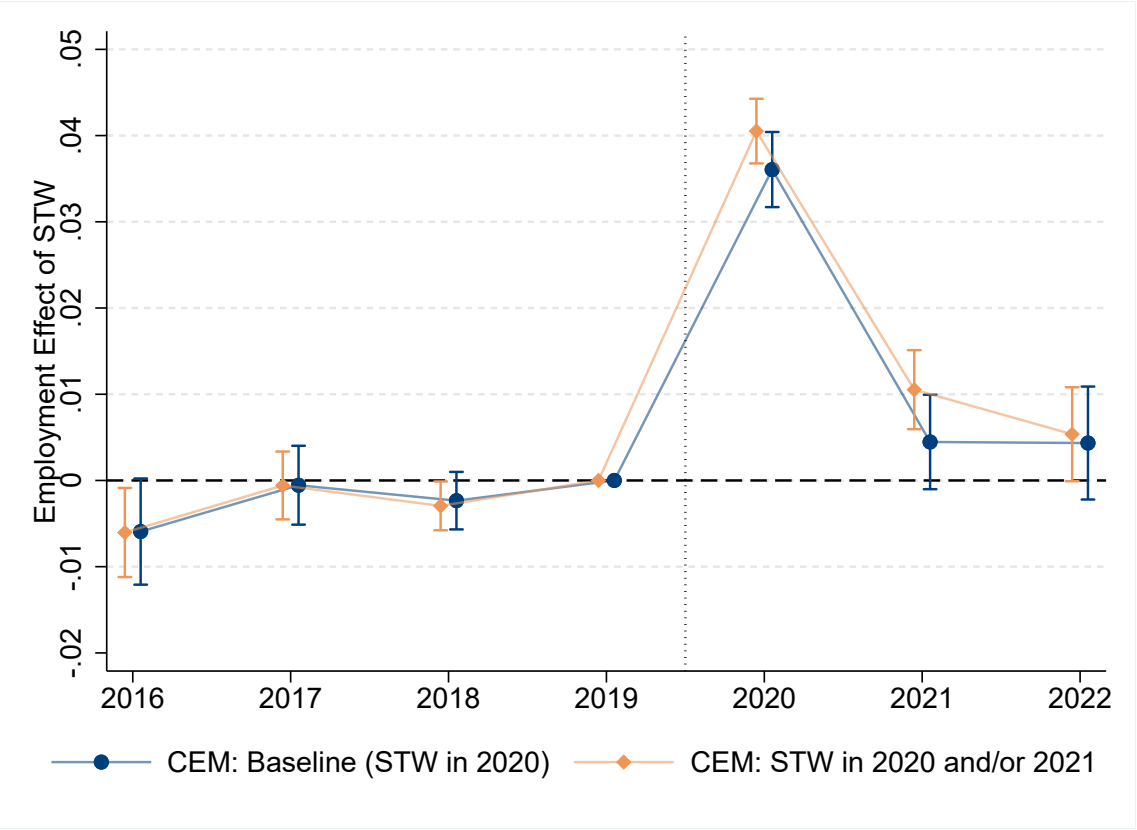
Notes: The figure shows coefficients for establishment quality based on specification (1) – conditioning on establishments with at least one spell in STW – with the full set of fixed effects and occupational controls. The dependent variable is the average work loss in STW over the whole year for the establishment. In the computation, a month without STW is assigned the value zero. In panel (a) the coefficient values represent increasing the SD of the AKM-FE (within a 5-digit-industry) by one. Panel (b) shows the difference obtained between the fifth and first quintile of labor productivity while applying survey weights. Both of these quality proxies are computed before the respective crises.
Source: own calculations. ©IAB

Figure A6: STW Employment Effects: Use of STW in 2020 *and* 2021



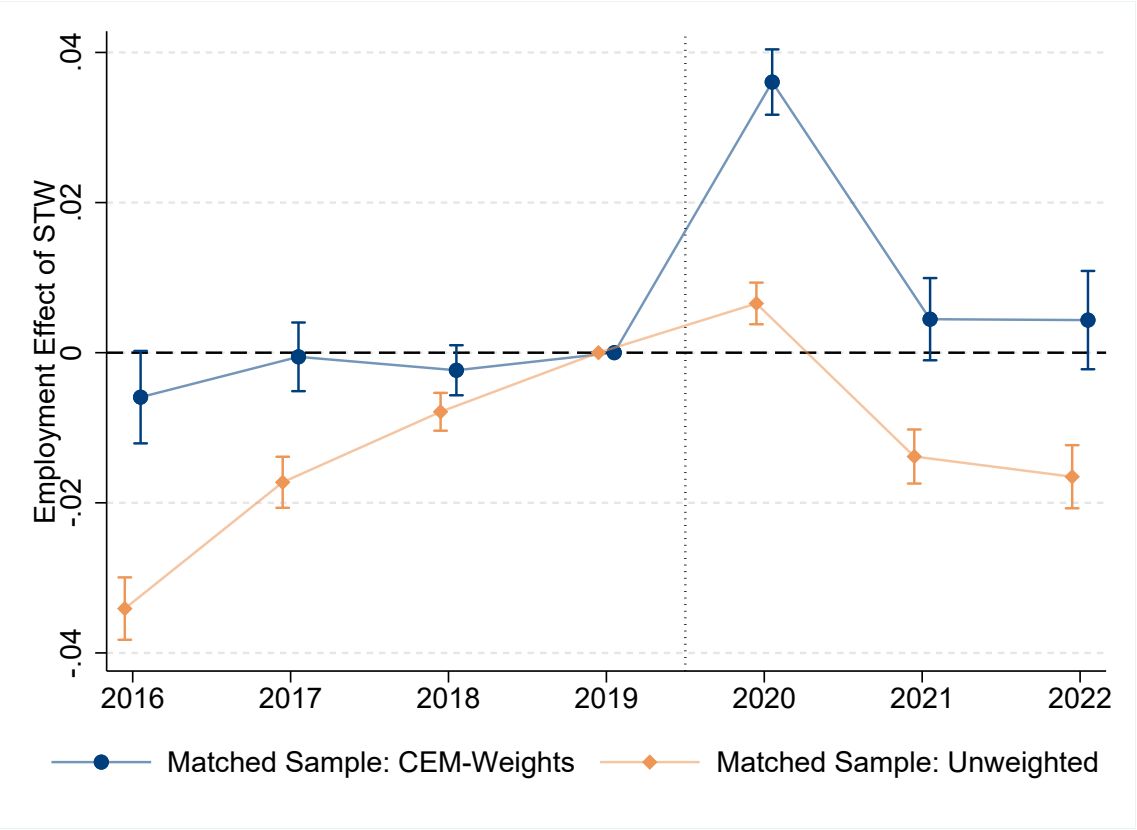
Notes: The figure shows estimates and 95% confidence intervals based on (3), applying CEM weights. Standard errors are clustered on the establishment level. 2019 is the base year. The baseline corresponds to panel (a) of Figure 6. The other event study performs the same matching procedure, but takes into account STW establishments that were in the scheme in 2020 *and* 2021. The baseline solely focuses on establishments that were in STW only in 2020. CEM abbreviates coarsened exact matching.
Source: own calculations. ©IAB

Figure A7: STW Employment Effects: Use of STW in 2020 *and/or* 2021



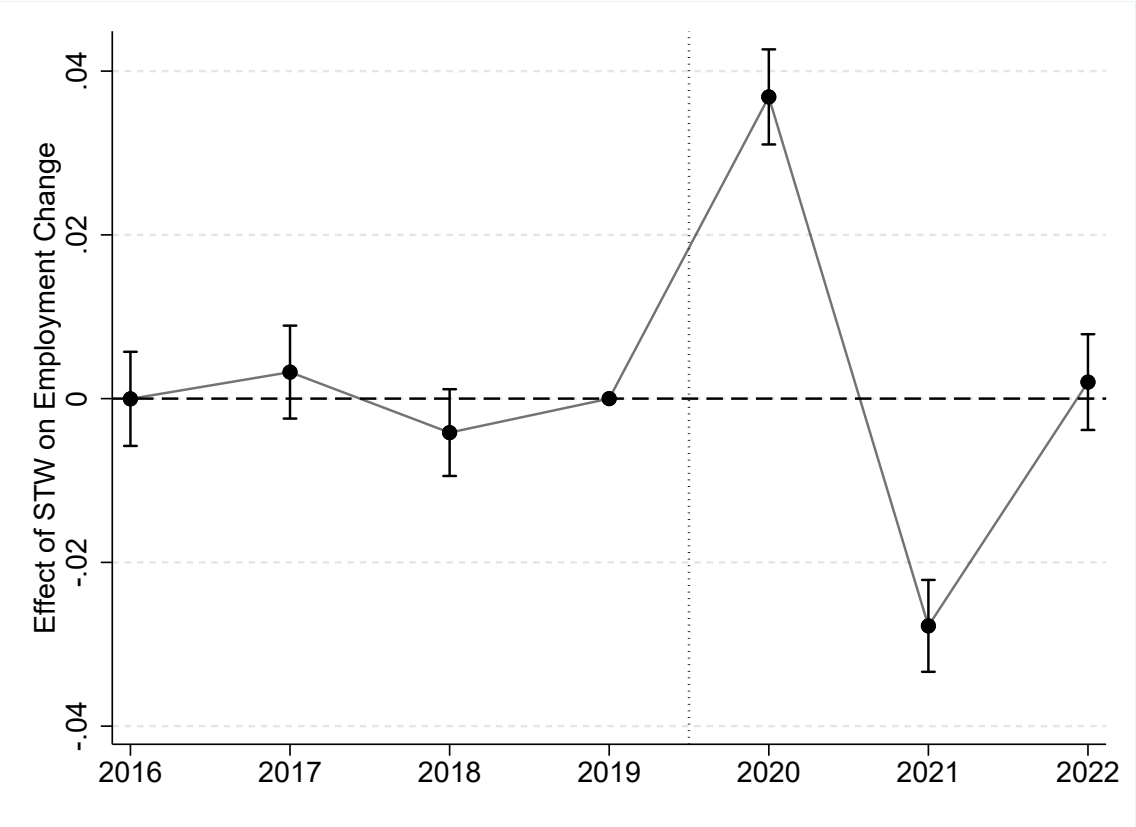
Notes: The figure shows estimates and 95% confidence intervals based on (3), applying CEM weights. Standard errors are clustered on the establishment level. 2019 is the base year. The baseline corresponds to panel (a) of Figure 6. The other event study performs the same matching procedure, but takes into account STW establishments that were in the scheme in 2020 *and/or* 2021. The baseline solely focuses on establishments that were in STW only in 2020. CEM abbreviates coarsened exact matching.
Source: own calculations. ©IAB

Figure A8: STW Employment Effects: Comparison of CEM to Unweighted Estimation



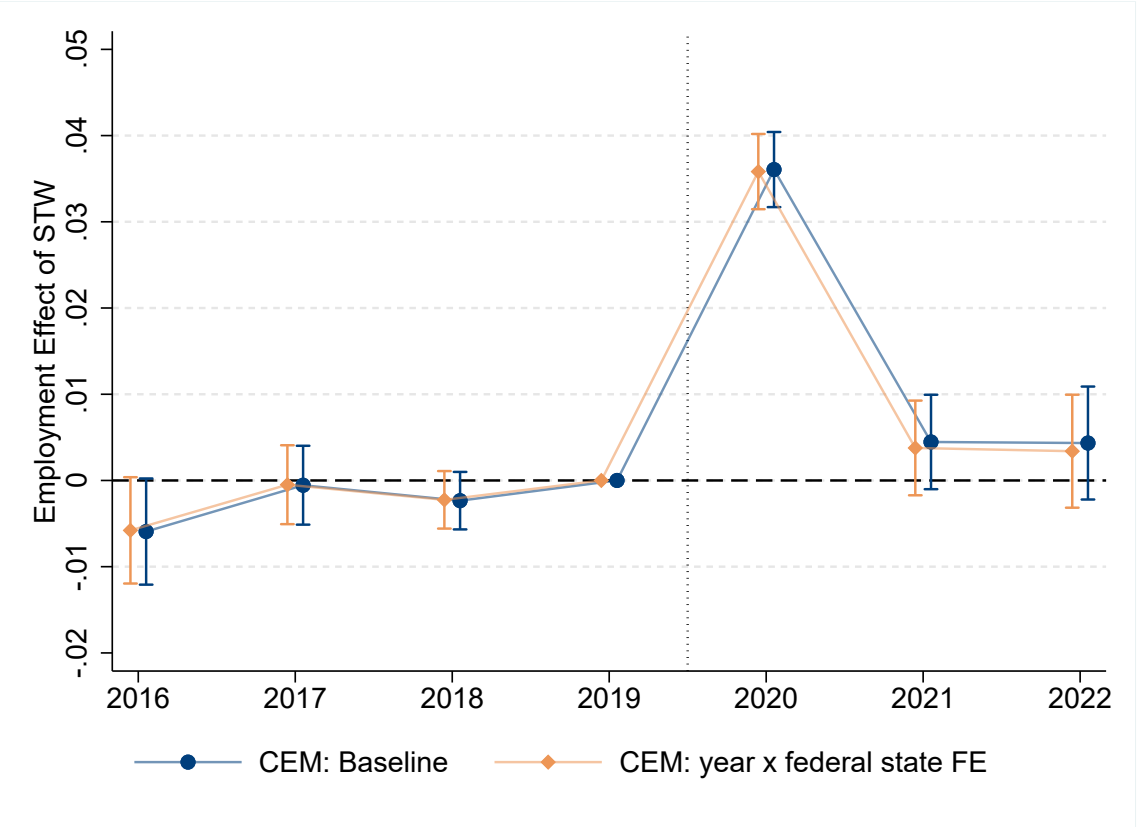
Notes: The figure shows estimates and 95% confidence intervals based on (3). Standard errors are clustered on the establishment level. 2019 is the base year. CEM abbreviates coarsened exact matching.
Source: own calculations. ©IAB

Figure A9: STW and Employment Change



Notes: The figure shows estimates and 95% confidence intervals based on (3) with CEM weights. The dependent variable is log employment change. Standard errors are clustered on the establishment level. 2019 is the base year. CEM abbreviates coarsened exact matching.
Source: own calculations. ©IAB

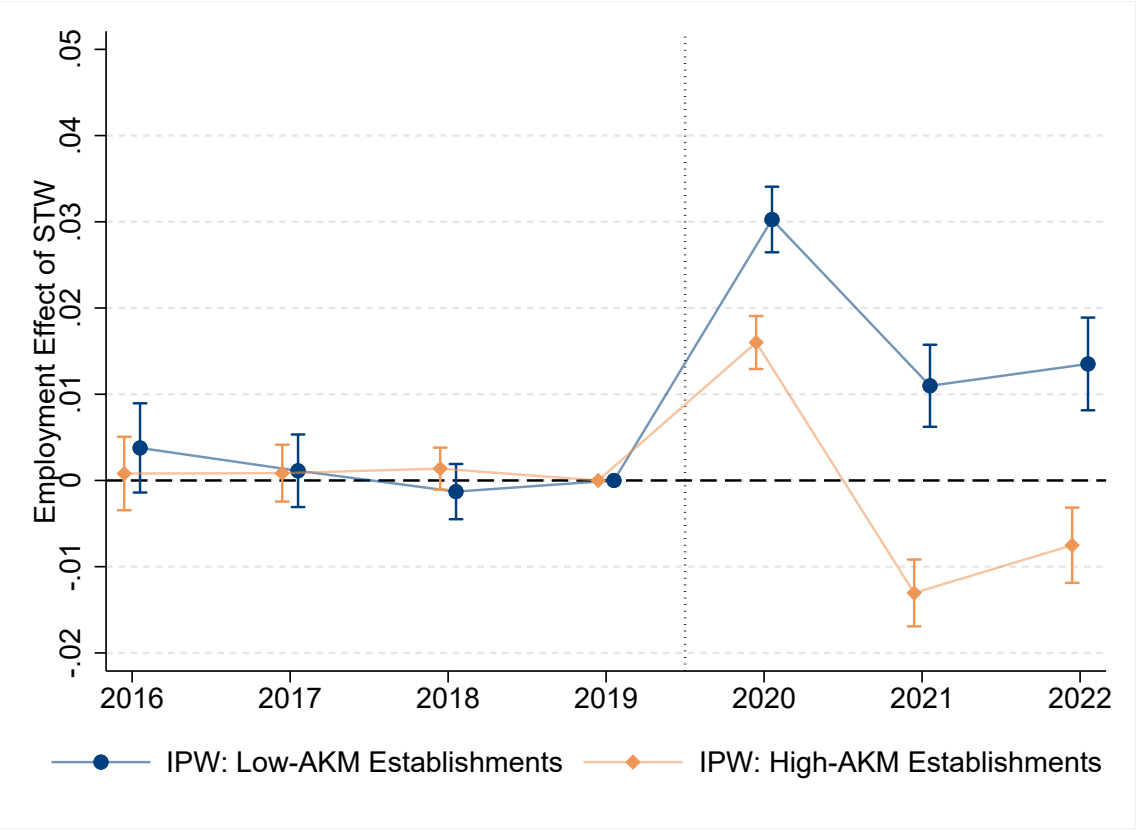
Figure A10: STW Employment Effects Robustness: Including Year-by-State FE



Notes: The figure shows estimates and 95% confidence intervals based on (3). Standard errors are clustered on the establishment level. 2019 is the base year. The figure compares the baseline with a specification where year-by-state fixed effects are included instead of year fixed effects (specifically, using the 16 federal states). CEM abbreviates coarsened exact matching.

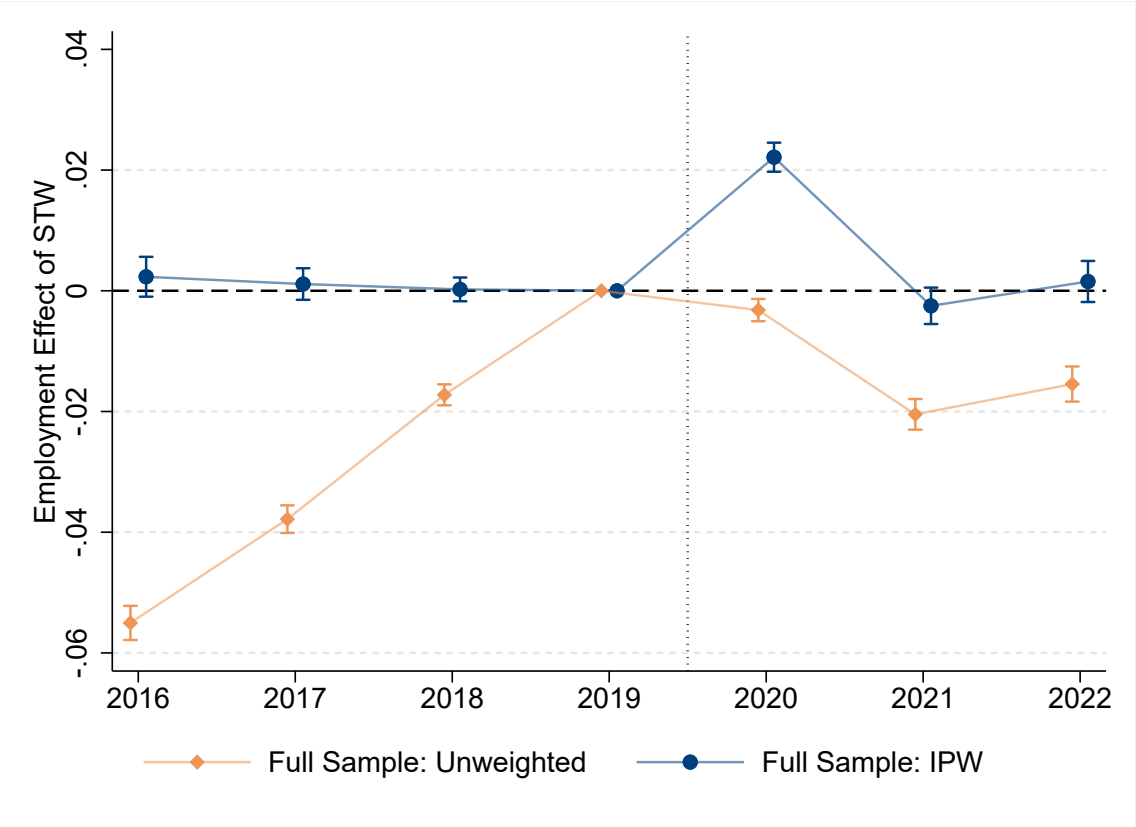
Source: own calculations. ©IAB

Figure A11: Effects of STW using IPW: Low-AKM and High-AKM Establishments



Notes: The figure shows estimates and 95% confidence intervals based on (3), applying IPW weights. Standard errors are clustered on the establishment level. 2019 is the base year. IPW denotes inverse probability weighting. The figure investigates differences between low- and high-AKM establishments using the IPW approach, the IPW counterpart to Figure 8. Low-AKM establishments are those who are in the bottom half of the wage premia distribution as estimated from 2010 to 2017. Conversely, high-AKM establishments are in the distribution's top half.
Source: own calculations. ©IAB

Figure A12: STW Employment Effects: Comparison of IPW to Unweighted Estimation



Notes: The figure shows estimates and 95% confidence intervals based on (3). Standard errors are clustered on the establishment level. 2019 is the base year. IPW denotes inverse probability weighting.
Source: own calculations. ©IAB

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