The Impact of Short-Time Work in Times of the Covid 19 Pandemic: The Case of Germany in 2021

John Teppler

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Professor Joana Silva

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Abstract

The Covid 19 pandemic affected humanity worldwide in all areas of daily life to an extent comparable to no previous crisis. From today's point of view, it is possible to formulate a retrospective analysis of the impact and scope of the economic consequences for society. In this context, the Government of Germany introduced the short-time work (STW) program to mitigate the economic consequences. This paper examines the impact of this program. In particular, it assesses whether the program had a significant effect in strengthening the labor and domestic markets in 2021. The analyses focus on the contact-intensive sectors of retail and hospitality. The exogenous effect of the associated labor demand shock on unemployment and employment rates is measured using shift-share metrics. This work extends the research of Aiyar and Dao (2021) and confirms that the support program continued to be a significant tool for saving jobs and stabilizing the domestic market in 2021.

Keywords: short-time work, Germany, unemployment, labor market, Covid-19

Author: John Axel Teppler

Resumo

A pandemia de Covid-19 afectou a humanidade em todo o mundo, em todos os domínios da vida quotidiana, numa medida comparável a nenhuma crise anterior. Do ponto de vista atual, é possível formular uma análise retrospetiva do impacto e do alcance das consequências económicas para a sociedade. Neste contexto, o Governo da Alemanha introduziu o programa de trabalho a tempo reduzido (STW) para atenuar as consequências económicas. O presente documento analisa o impacto deste programa. Em particular, avalia se o programa teve um efeito significativo no reforço dos mercados de trabalho e doméstico em 2021. As análises centram-se nos sectores intensivos em contactos do comércio a retalho e da hotelaria. O efeito exógeno do choque de procura de mão de obra associado às taxas de desemprego e emprego é medido utilizando métricas de partilha de turnos. Este trabalho amplia a pesquisa de Aiyar e Dao (2021) e confirma que o programa de apoio continuou a ser uma ferramenta significativa para salvar empregos e estabilizar o mercado interno em 2021.

Palavras-chave: short-time work, Germany, unemployment, labor market, Covid-19

Autor: John Teppler

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List of Abbreviation

Short-time Work	STW
Gross Domestic Product	GDP
Ordinary Least Squares	OLS
Two Stage Least Squares	2SLS

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1 Introduction

The year 2021 was the second year of the Covid 19 pandemic and, with it, continued uncertainty regarding everyday life and the evolution of national and global markets. The pandemic has caused unpredictable fluctuations in costs, demand, and other economic indicators. National governments responded to this exogenous shock through economic policy instruments. In this context, the German government introduced the short-time work (STW) program in 2020 to mitigate the negative impact of the pandemic on the labor market.

Based on the research approach of Aiyar and Dao (2021), who examined the implications of these programs for 2020, this paper sets out and will address the effects in 2021 using cross-state variability. The focus of this study is on the labor demand shock generated in the retail and hospitality sectors. The labor demand shock in these two contact-intensive sectors is applied to the unemployment rate and employment growth and then interpreted.

In the past 50 years, there has been a significant increase in research that thematically focused on saving jobs during crisis periods and addressed the STW program. In this context, Azariadis (1975) posited a model of a simple industry in which risk-neutral firms can play both the role of worker and insurer in an uncertain economy vis-à-vis risk-averse workers. In particular, in an uncertain economy, the role of the insurer vis-à-vis a risk-averse worker is key, as it contributes to the stability of the labor market and the security of the worker. The optimal contract, the paper argues, involves the distribution of risk, with firms insuring workers against income fluctuations in return for a lower average wage.

Although the economic policy instrument of STW has been used in various recessions, few econometric analyses exist that evaluate the effectiveness of this instrument. Abraham and Houseman (1994), who took an aggregate approach to studying STW, compared aggregate adjustment patterns in employment and hours worked across different states and time intervals. The authors showed that the adjustment in aggregate hours worked had been quite similar in the countries studied, Belgium, France, Germany, and the United States, although employment adjustment had been much slower in the three European countries.

As a result of the financial crisis starting in 2007, in which STW was successfully used as an effective tool, academic interest in labor market research also increased. Hijzen and Venn (2021) conducted a comprehensive assessment of the impact of STW programs during the financial crisis, which covered 19 OECD countries. STW programs had an economically significant impact on job retention during the 2007 economic downturn, although this was

limited to workers with permanent contracts. This had led to an increased segmentation of the labor market between workers in regular jobs and workers in temporary and part-time jobs (Hijzen & Venn, 2011).

This thesis builds on the theoretical foundations and existing literature on research of STW programs and follows Aiyar and Dao's (2021) concept of not focusing on multiple states, but rather examining individual sectors within a state. Thus, the objective of this paper is to econometrically examine the German STW program during the Covid 19 pandemic in 2021, focusing on the contact-intensive sectors of retail and hospitality. Figure 1 visualizes the frequency of use of STW, which continued to be heavily used across all months in the second year of the pandemic (Statistik der Bundesagentur für Arbeit, 2023). The increasing numbers of cases at the beginning and end of 2021 were related to the covid-19 incidences in Figure 2, where incidence indicates the number of new covid-19 virus infections per 100000 population within seven days (Robert Koch-Institut, 2023). The clearly evident common trend was that as incidence increased, the number of short-course claims also increased. Based on Figures 1 and 2, it can be seen that in 2021, the use of reduced hours was a relevant issue, especially in conjunction with increasing incidences. Thus, there is scientific interest to extend the study of Aiyar and Dao (2021) for the year 2021 and to explore the impact of the STW program on the German labor and domestic market.

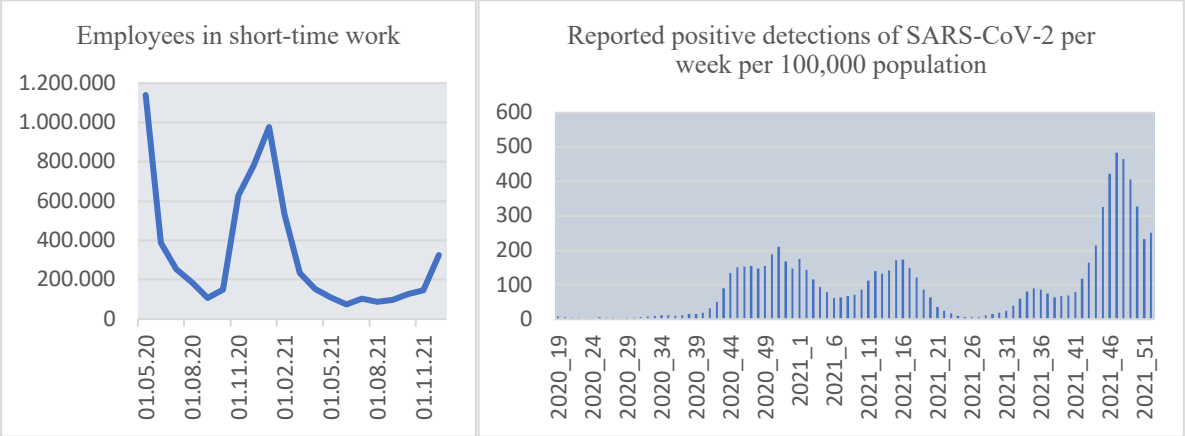

Figure 1 Employees in short-time work

Figure 2 Reported positive detections of SARS-CoV-2 per week per 100,000 population

To place the research question in an institutional framework, empirical strategies and econometric models are applied to obtain insights of STW program on the labor market.

Starting with a linear regression analysis, an instrumental variable is created to predict the variation in the use of STW in each state without being correlated with the impact of the pandemic. In this context, two shift-share metrics are created, one measuring the labor demand shock in the retail sector, based on mobility levels, and the other measuring the labor demand shock in the hospitality sector, based on sales changes, in 2021. Building on the Ordinary Least Squares (OLS) regression, a Two Stage Least Squares (2SLS) estimation is constructed to account for potential endogeneity issues and to include additional control variables. The regressions are used to examine the impact on the labor market and then on domestic demand. In this further step, under the creation of a proxy variable, we measure how the volume sales index for retail trade changed for the year 2021. Here, the volume turnover index for retail trade acts as a proxy indicator for the general level of consumption. In a final step, the robustness test that follows in this paper examines whether the results shown remain reliable even if the initial situation has changed. After explaining the results, the discussion section critically discusses the obtained findings with the analyses of Aiyar and Dao (2021), provides a research outlook and derives implications for action. The paper closes with a conclusion.

2 Background / Theory and Literature Review

The following section discusses some theoretical foundations and existing literature relevant to this paper, which are related to the topic of STW. First, Aiyar and Dao's (2021) models and concepts of reduced working hours and job security are mentioned. Based on the work of Aiyar and Dao (2021), the effects and implications of STW programs are then extended and analyzed to 2021.

A limited degree of predictability and forecasting is a pervasive phenomenon in any economy. In particular, during the Covid 19 pandemic, most of humanity was exposed to an extraordinary level of uncertainty that was difficult to assess. This impacted businesses and employees as they had to constantly deal with unpredictable fluctuations in demand, costs, and other economic components. In this context, companies assumed a crucial role as employers and insurers vis-à-vis its employees. Azariadis (1975) found in a model of a simple industry that risk-neutral firms could assume both the role of employer and insurer in an uncertain economy vis-à-vis risk-averse workers. In particular, he said, it is essential in an uncertain economy because it contributes to the stability of the labor market and the security of the worker. The optimal contract involves such risk-sharing that firms insure workers against income fluctuations in return for a lower average wage.

Economic programs to reduce private work hours and provide job security are limited by financial constraints and liquidity problems on the corporate side. However, when firms face credit constraints and inadequate contract enforcement, a simple cost minimization model predicts that firms will choose the opposite adjustment strategy in response to fluctuations in demand. This is headcount adjustment (or scope adjustment). The simplified result of this cost minimization in the absence of perfect markets is presented below.

Like authors Aiyar and Dao (2021), this paper uses a production function that is multiplicatively separable and allows for diminishing marginal returns for both hours (longer hours reduce marginal productivity) and workers (due to limited office space or managerial attention):

$$y = n^{\alpha} h^{\beta}$$

Here, the firm chooses the combination of hours per worker (h) and number of workers (n) to minimize the cost function for a given production level $\bar{y}$, variable labor cost w(h), and fixed costs (Aiyar & Dao, 2021):

$$min_{n,h}\Lambda = n(F + \omega(h)h)\ s.t.\ \bar{y} = n^{\alpha}h^{\beta}$$

The minimization of the present objective function expresses those changes in the production level $\bar{y}$ lead to adjustments in the number of employees, but the hours worked per employee remain constant. Since the company is unable to hedge against fluctuations in demand $\bar{y}$, disproportionate layoffs will occur during downturns compared to the optimal outcome under ideal contract conditions. Additional inefficiencies due to excessive job losses result from the negative impact on the unemployment insurance system and the loss of human capital, which reduces overall economic productivity. Young people, but also working people in general, are affected under initially poor labor market conditions, which can have a long-term impact on career and income development (von Walter, 2020). Since this endangers the values of the welfare state, the state can intervene with the help of economic policy measures. Thus, either reductions in working hours can be subsidized instead of layoffs (short-time allowance) or companies can be taxed for laying off workers (employment protection measures). In their 2011 article, Cahuc and Carcillo (2011) emphasize that STW programs stabilize permanent employment and reduce unemployment during downturns. However, STW programs can also lead to inefficient reductions in working hours. In practice, many countries combine these two complementary measures (Cahuc & Carcillo, 2011).

Although the economic policy tool of STW has been used in various recessions, few econometric evaluations have been conducted on the effectiveness of STW programs. Abraham and Houseman (1994), taking an aggregate approach to the study of STW, compared aggregate adjustment patterns in employment and hours worked across countries and time periods. The authors showed that the adjustment in aggregate hours worked was comparable in the countries studied, Belgium, France, Germany, and the United States, although employment adjustment was much slower in the three European countries. Authors Burdett and Wright (1989) provided a different focus by placing the STW program in the context of unemployment insurance and analyzing how these two instruments influenced labor market decisions.

Scholars discovered partly different trends at the beginning of this millennium. For example, analyses by Calavrezo, Duhautois, and Walkowiak (2010) provide evidence that STW programs in France were associated with more layoffs and a higher rate of firm insolvency between 2000 and 2005. In contrast, researchers such as Hijzen and Venn (2011) used country-level data to find that the use of STW saved jobs during recessions. Boeri and Bruecker (2011) extended the research to the OECD country level and analyzed the increased demand for STW based on firm shocks before and during the Great Recession using, among other things, human capital characteristics of the workforce and structural characteristics of a firm. In this context, companies with high research and development activities, a high share of exports, large company size and a high share of employees with work experience correlate positively with a STW take-up rate. In contrast, companies that work with state-of-the-art technology are negatively correlated.

In a historical context, the economic policy instrument of STW has also been popular in Germany, as Germany is a country with strong labor market regulations, high job security regulations and high hiring and firing costs (Gehrke & Hochmuth, 2021). During the Great Recession in 2007, the use of STW had been most common in Germany, compared to other EU member states. Consequently, more than four percent of all employees were affected by this regulation. In particular, Germany had coped very well with the 2007 recession in international comparison thanks to this economic policy instrument, also referred to at the time as the "labor market miracle" (Burda & Hunt, 2011). Drawing on the accumulated experience with STW programs in the Federal Republic of Germany during the 2007 financial crisis, Gehrke and Hochmuth (2021) noted that STW had been most widely used in Germany during recessions. In this context, the authors analyzed that the unemployment rate during the Great Recession would have been about 0.2 percentage points higher if there had been no discretionary STW. Their reasoning was that STW was an effective measure in terms of both automatic stabilization (Balleer et al., 2016) and discretion when it was successfully implemented during recessions. Thus, implementing discretionary STW policies had safeguarded an average of 100,000 jobs per quarter during the Great Recession in Germany. Without any STW, the number of employees would have fallen by an average of 140,000 per quarter, which would correspond to an average of 0.4 jobs saved per short-time worker during this period. Overall, the STW model thus saved about 540,000 jobs during the Great Recession in 2007 (Gehrke & Hochmuth, 2021).

In response to the Covid 19 pandemic and the subsequent global recession, STW programs were also used in the European region as a popular tool to combat job losses. In this context,

the German government managed to reduce unemployment by 2.9 percentage points to 6.2% in the second quarter of 2020 with the help of STW. Thus, the program helped to significantly contain the unemployment response to the labor demand shock by one-third through STW In some states, such as Hamburg, unemployment would have been as much as four percentage points higher without the s STW program. The authors also examined in their study that the STW program had contributed to this. This had stabilized domestic demand and dampened the 15% decline in retail sales in the second quarter of 2020 (Aiyar & Dao, 2021).

The instrument of STW has also been successfully applied in other European member states. During the Covid 19 pandemic in 2020, up to 8.4 million French citizens benefited from the government support program and were thus spared the threat of unemployment (Albertini, Fairise, Poirier, & Terriau, 2022). France was thus able to optimize the instrument of STW, allowing 40% of workers to benefit from the program during the Covid 19 pandemic, while only four percent benefited from STW at the time of the financial crisis in 2007 (Cahuc, Nevoux, & Kramarz, 2021). In France, the STW program helped stabilize employment and consumption, similar to Germany 2020. In addition to the positive effects, windfall effects were also recorded in France. Companies were able to make additional profit by overusing the program, which was not in economic proportion (Albertini, Fairise, Poirier, & Terriau, 2022).

The Danish government also used a similar model in response to the Covid 19 pandemic by taking over up to a 75% salary cap of the wages of temporarily exempt workers. This not only preserved jobs, but also helped companies facing a significant drop in demand and potentially imminent layoffs. As a result, the Danish government was able to safeguard up to 200,000 jobs over the pandemic period. As a result, Denmark recorded an unemployment rate of only five percent in 2020, compared to an average of 8.4 percent across OECD countries (Ornston, 2021).

3 Institutional Setup

The regulation of STW in Germany in 2021 was characterized by the short-time allowance paid by the Federal Employment Agency. The measure was introduced to safeguard jobs and avoid redundancies. The short-time allowance replaces employees for the part of their income that was lost due to reduced working hours during the pandemic.

To be eligible to apply for short-time allowance, there had to be a significant loss of work with loss of pay that was temporary and unavoidable. The requirements on the part of the company included the employment of at least one employee who was in an employment relationship subject to compulsory insurance and who could not have been laid off. The amount of the short-time allowance was generally 60% of the lost net pay for employees without children and 67% for employees with children. In connection with STW, the costs for the employer consisted mainly of social security contributions. However, these were fully reimbursed by the Federal Employment Agency in 2021. In the context of STW, the private division of labor related to the distribution of working hours. The introduction of STW reduced working hours and made them more flexible, allowing for a more efficient use of labor (Bundesagentur für Arbeit, 2023).

Between the years 2020 and 2021, some changes were adopted in Germany within the regulations of STW. These changes included the reimbursement of social security contributions, access to short-time allowance, and the amount of contributions. As of July 1, 2021, only 50% of social security contributions were reimbursed by the Federal Employment Agency. Full reimbursement up to December 31, 2021, only took place if qualification measures were carried out by the companies during the short-time working period. In addition, access to short-time allowance was made more difficult in 2021 compared with the previous year. Whereas in 2020 at least 10% of a company's employees had to be affected by work loss in order to apply for short-time allowance, this threshold was increased to 30% from January 1, 2021. The amount of short-time allowance was gradually adjusted in 2021 to up to 80% or 87% of the net pay lost for longer periods. This regulation was extended until December 31, 2021 (Federal Ministry of Labor and Social Affairs, 2023).

4 Empirical Strategy & Data

The author Aiyar and Dao 2021 addressed the central question of the extent to which the German STW program contributed to reducing unemployment during the COVID-19 crisis. The STW program explicitly aimed to preserve jobs during difficult economic times. However, the question of whether the German STW program contributed to reducing unemployment during the COVID-19 crisis cannot be answered in a one-dimensional way. This is because there could well be scenarios in which, even without the STW program, employers resorted to measures that were not directly related to the program. For this reason, it is not possible to identify a clear chain of causality and identify direct effects of the policy measure of the STW program on job retention based on employees on STW vs employees not on STW. In their paper, the authors emphasized the complexity of this issue and, with the help of a careful empirical analysis, elicited the actual effects of the STW program on the German labor market during the crisis. This analysis is taken as the basis for the present work and the following calculations are based on it.

This paper extends Aiyars and Daos' (2021) research and examines the impact of the German STW program on unemployment during the Covid 19 pandemic in 2021. To answer this question and to draw a comparison to Aiyars and Daos' (2021) study, the following also places the labor market outcome z as a function of the regional labor demand shock y_{st}, other factors X_{st}, and a fixed effect of the state γ_s. This market outcome represents the change in the unemployment rate or employment growth in each state s and time period t. Another dependence of the labor market outcome z is the time- and state-dependent elasticity of employment/unemployment with respect to labor demand $\eta_{z,st} = \frac{\partial z_{st}}{\partial y_{st}}$. The empirical relationships break down as follows:

$$z_{st} = \alpha_z + \eta_{z,st} y_{st} + \alpha_3' X_{st} + \gamma_s + \epsilon_{st} \qquad (1)$$

In response to business cycle shocks, the use of reduced hours with proper work should reduce employment turnover if the outcome variable z measures employment growth:

$$\eta_{z,st} = \alpha_1 + \alpha_2 KA_{st}, \text{where } \alpha_1 > 0, \alpha_2 < 0$$

This auxiliary function inserted in (1) gives the following objective function:

$$z_{st} = \alpha_z + \alpha_1 y_{st} + \alpha_2 y_{st} \times KA_{st} + \alpha_3' X_{st} + \gamma_s + \epsilon_{st} \qquad (2)$$

In this paper, we examine the hypothesis of whether the implementation of STW stabilized the labor market in response to the demand shock caused by the pandemic by estimating this equation:

$$\alpha_1 > 0, \alpha_2 < 0 \text{ if } z = employment\ growth$$

$$\alpha_1 < 0, \alpha_2 > 0 \text{ if } z = change\ in\ unemployment$$

The primary challenges with respect to estimating the parameters of the model are twofold. First, it requires the identification of an exogenous labor demand shock variable y that varies across the different German states and is orthogonal to the state-specific labor supply. Often, gross domestic product (GDP) growth is used for this purpose, as outlined for example in the paper by Hijzen and Venn (2011). However, the problem noted by Aiyar and Dao (2021) is that labor market outcomes (z) and GDP endogenously interact with each other and thus can bias estimates of $\alpha 1$ and $\alpha 2$.

In addition to an identification problem, a correlation exists in that firms put their employees on STW under economically poor conditions. Analogously, the share of employees on STW decreases when the economic situation improves. This leads to the conclusion that the use of STW depends endogenously on labor market conditions.

Since unobserved economic conditions are part of the residual and negatively correlated with the STW variable, such procyclical behavior strongly biases the estimate of the α2 variable toward zero. Assessing the empirical impact of STW programs is often challenging due to this fundamental identification problem that exists in both aggregate and firm-level data (Aiyar & Dao, 2021; Cahuc & Carcillo, 2011).

In order to draw a comparison between the study of Aiyar and Dao (2021) on the one hand, and to extend the analysis for the year 2021 on the other hand, this paper uses state-level data with a monthly frequency to solve both identification problems. To construct the dependent variables, monthly unemployment and employment data as well as the monthly retail sales index at the federal state level are used. These come from the Federal Employment Agency and the Federal Statistical Office. Also focused on in this analysis are the monthly fluctuations in labor market indicators and the use of STW in 2021. Figure 3 depicts the significant increase in STW applications in January, February, and December. In this context, the increase in applications for STW coincides with a significant increase in incidence per 100,000 inhabitants in Germany. The incidence indicates the number of new infections with the Covid 19 virus per 100000 inhabitants within seven days. In this context, the incidences in January and February 2021 reflected the last cycles of the third Covid-19 wave and in December 2021 the beginning of a fourth Covid-19 wave. Thus, in December 2021, there were significant constraints in Germany that affected the labor market, particularly in the food service and retail sectors (Tagesschau, 2023).

To solve the identification problem, two shift-share metrics in baseline are established in this paper. The objective is to analyze the growth performance and impact of shocks in two sectors over a defined period of 2021. For this identification problem, two labor demand shocks are created, one related to the mobility degree in the retail sector, and the other examining the turnover changes in the hospitality sector.

The first variable measures the labor demand shock, which refers to the degree of mobility in the retail sector:

$$y_{st}^{RE} = \Delta Retail\&Rec\ Mobility_t \times empshr_{s,t-1}^{CI}$$

First, the share of retail employees subject to social insurance contributions is calculated from the total number of employees subject to social insurance contributions in the respective federal state and respective month. In addition, the Germany-wide change in retail and leisure mobility, based on the Google Community Report, is multiplied by the previously calculated employment share.

The second variable measures the labor demand shock, which relates to changes in turnover in the hospitality sector:

$$y_{st}^{HO} = \Delta lnTurnover\_HO_t \times empshr_{s,t-1}^{HO}$$

In this second shift-share variable, analogous to the first, the share of employees subject to social security contributions in the hospitality industry is also calculated from the total number of employees subject to social security contributions in the respective state and respective month. Since this variable measures changes in sales, the employment share is multiplied by the logarithmic sales change factor.

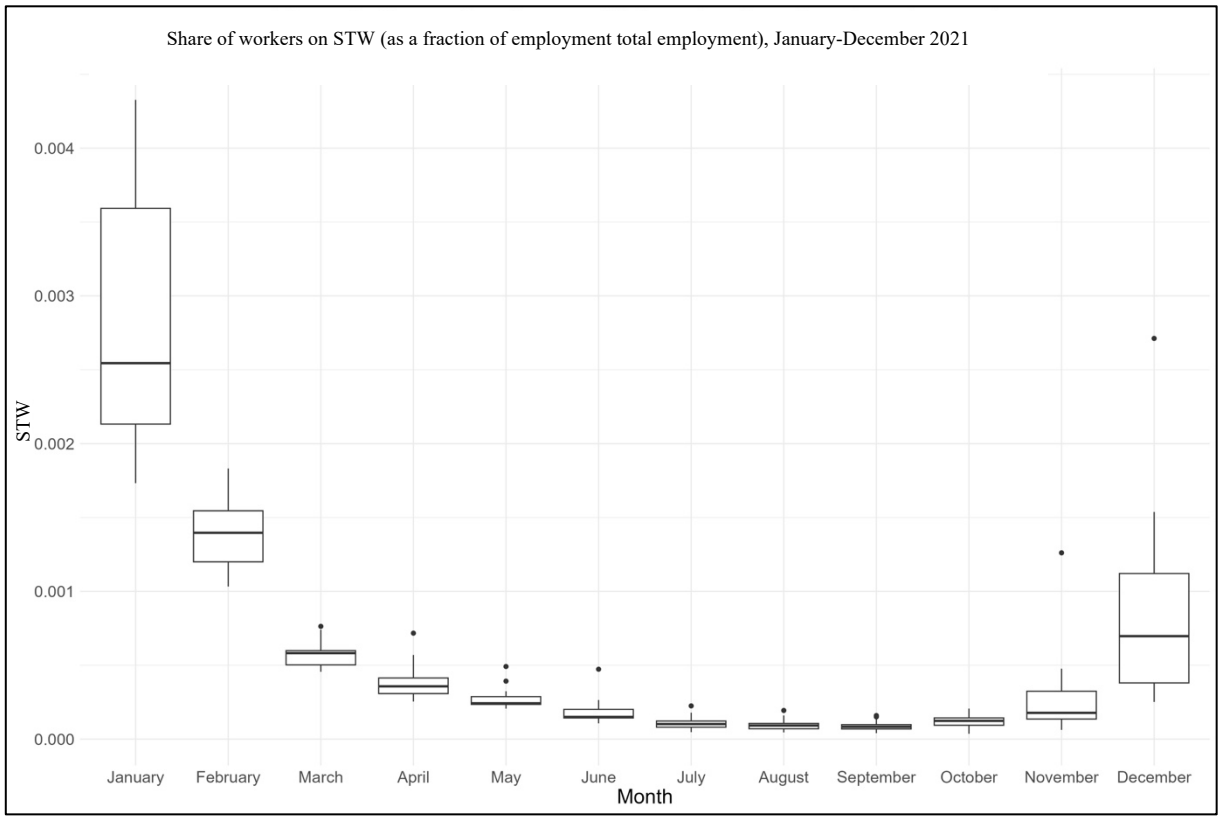

Figure 3 Share of workers on SWT (as a fraction of employment total employment), January-December 2021

Starting with the pandemic in 2020, the following year 2021 saw a continuation of the trend that fluctuations within business cycles occurred in parallel with the introduction of STW. This correlation highlights the identification problem described earlier. Ordinary least squares (OLS)

regression analysis tends to underestimate the potential mitigating effect of STW. The analysis is conducted in this study to examine the relationship between unemployment and STW claiming or their interaction according to equation (2). This underestimation leads to a bias in the coefficients that makes it tend to zero.

To counteract this bias, this paper uses an instrumental variable that can accurately predict the variation in the STW application rate across states while remaining unaffected by the impact of the pandemic. Thus, the rate of introduction of STW in each state and month of 2021 is measured. This is done by examining the share of workers who were subject to social security contributions in the corresponding month of the previous year (2020). Only employees who pay social security contributions are eligible for STW benefits. Therefore, one might infer that the proportional size of the pre-existing pool of eligible individuals in each state in 2020 can serve as a predictor of state-specific adoption of STW in response to the labor demand shock. However, this predictor is not expected to be significantly related to the magnitude of the pandemic shock in regional labor markets in 2020. Since the analysis controls for country-specific exposure to contact-intensive sectors, it is critical to ensure that the exclusion condition remains valid.

5 Results

5.1 Analysis of the initial situation in 2020

This paper examines the question of whether the STW program had an impact on the labor market and the domestic market in 2021. In order to analyze these effects, the focus of the study by Aiyar and Dao (2021) is placed on the contact-intensive sectors and the hospitality industry. This is where this paper differs, as the focus of this study is not generally on the contact-intensive sector, but within that, the retail sector is examined. Retail was also examined in the previous study, but this sector was only a part of the contact-intensive. In order to regress and interpret meaningful analyses, a regression for the year 2020 must first be created. The goal here is not to provide a detailed analysis, but to identify a consistent trend so that, based on this finding, we can begin the following analyses for 2021. As table 1 visualizes, the OLS estimation results are first obtained, reflecting the impact of two shocks on unemployment and employment growth in 2020 in all 16 German states. The two shocks will be labor demand extending from exposure to the retail sector ("CI_demandshock") and labor demand in the hospitality sector ("AF_demandshock"). The results show that there was a statistically significant decrease in the unemployment rate in 2020 due to a labor demand shock in the retail sector. In addition, it is identified that there was a significant increase in the employment rate due to the retail labor demand shock. These results are consistent with those of Aiyar and Dao for 2020 for the contact-intensive sector as a whole. Differences in the analysis can also be seen, but they do not show statistical significance in this paper. Thus, it can see as an indication that retail was also a suitable substitute for the entire contact-intensive sector for the year 2021.

5.2 Effects on the labor market

In the following, the results on the effects on the labor market are analyzed and interpreted. The hypothesis is examined whether the implementation of STW in 2021 also stabilized the labor market in response to the demand shock caused by the pandemic. Therefore, in the first step of this paper, an OLS regression is constructed based on the previously defined equation (2). In a second step, a two-stage small squares (2SLS) estimation is regressed based on equation (2). The 2SLS estimate is combined with the interaction term, with the state-specific share of workers, and an interaction of this share with each instrumented labor demand shock.

The results from Table 2 indicate that a decrease in labor demand due to the retail mobility constraint in 2021 caused a statistically significant increase in the monthly unemployment rate

(column 1). In addition, a negative labor demand shock produced a positive and significant effect on employment growth, although the increase is small (column 3). A shock in terms of establishment closures in the hospitality industry had a weakly negative but significant effect on employment growth. In addition, the interaction of these shocks includes another variable, the use of STW. In this context, the OLS estimation results indicate that take-up had no statistical significance in changing the monthly unemployment rate in 2021 but did have a strong negative significant effect on employment growth and thus a mitigating effect on the labor market. In addition, the use of STW amplified the positive effect on employment from labor demand in the hospitality industry. To account for possible endogeneity issues and to include additional control variables, the next step in this paper is to regress a 2SLS estimate on equation (2) to ensure the robustness of these results.

The 2SLS results in Table 3 provide valuable insights into the causal impact of labor demand shocks in the retail and hospitality sectors on labor market dynamics in Germany during the COVID-19 pandemic. In contrast to the OLS results, the analysis of the labor market shock in relation to the change in mobility of the retail sector shows no significant correlations between the shocks and labor market outcomes.

With respect to a labor demand shock in the hospitality industry, the 2SLS results confirm the previous OLS estimation results that the impact of a negative shock had a significant negative effect on employment growth. However, with endogeneity issues taken into account, no significant effect of a shock on the unemployment rate was found for column 1. In the economic context, however, this could be due to a change in consumer behavior, as despite decreased Covid-19 cases, consumer behavior in the hospitality industry changed between March and November 2021. Consumers preferred social distancing despite relaxations in restrictions.

The 2SLS estimation results show mixed conclusions with respect to STW. While the use of reduced hours had a significant positive effect on the unemployment rate, it had a significant negative effect on employment growth. The combination of the interaction variable and the labor demand shocks does not yield significant results when estimated.

To frame these results in an economic context and also to elaborate on the differences across states, the counterfactual increase in the unemployment rate is calculated for all states in the remainder of the paper.

Figure 4 below shows the counterfactual increase in the unemployment rate (UR) for the year 2021 in the respective German states. Following the study by Aiyar and Dao (2021), the same

comparison month is also taken as a kind of "baseline" in this paper. Due to the fact that there was no month before the Covid-19 pandemic in 2021, it is much more difficult to find an adequate comparison month for 2021 than it was for 2020. Therefore, the month of February 2020 was also taken for this analysis, as it represents the last month before the Covid-19 pandemic. This makes it the same month that Aiyar and Dao (2021) used previously. Thus, a direct comparison can be made.

The observations of the individual states provide information that in all states the unemployment rate would have increased on average in 2021 if the economic policy instrument of STW had not been adopted. Although the increase in the counterfactual unemployment rate is small, it must be considered in context. While the comparison month of February 2020 was not itself affected by the pandemic, the comparison month is at the beginning of the previous year. This must be kept in mind in the following analysis. Differences in the magnitude of the counterfactual decline in the unemployment rate between the federal states can be seen in the fact that more urban federal states recorded a smaller counterfactual increase.

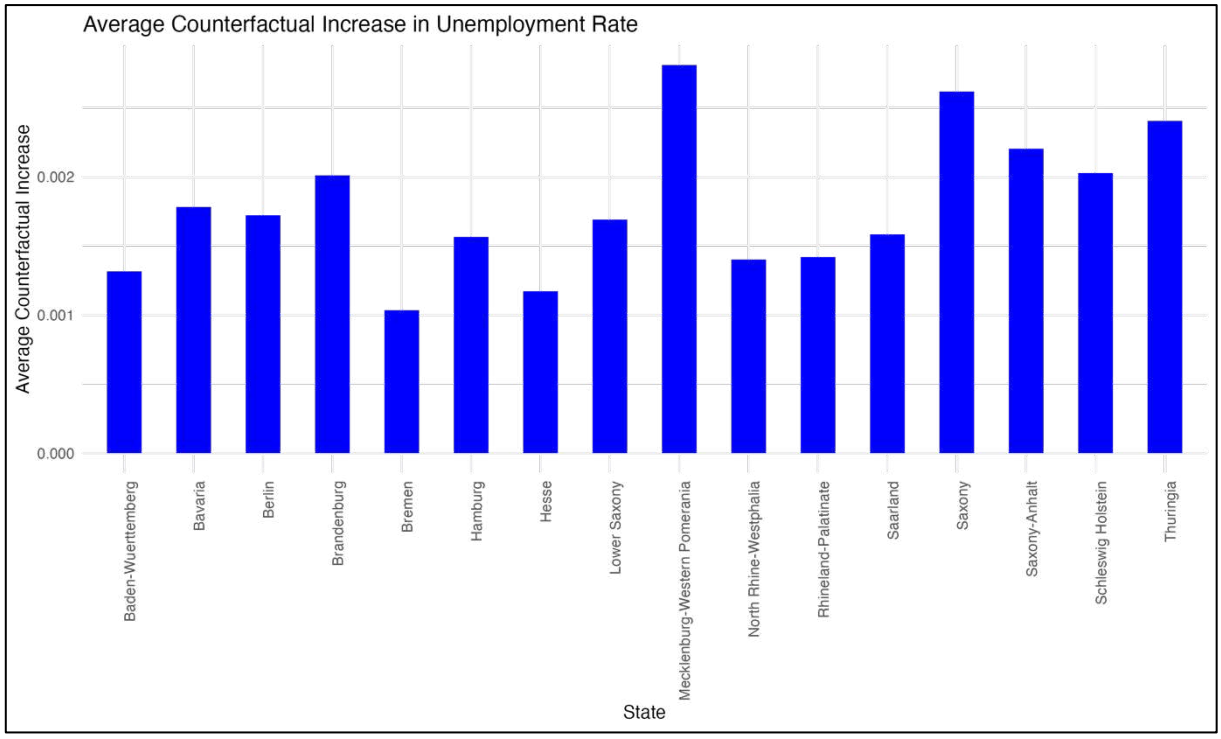

Figure 4 Additional counterfactual increase in UR with constant KA take-up (2021 Q3+Q4)

5.3 Effects on domestic demand

With the economic policy instrument of STW, the Federal Republic of Germany not only pursued the goal of mitigating the effects of the labor market, but also of stabilizing domestic demand for consumer goods through the increased purchasing power of the population. By securing a labor force through the use of STW and the resulting government-subsidized increase in the purchasing power of private households, Germany's economy as a whole was bolstered. This thesis of the German government at the time applied to both 2020 and 2021, which is why the STW program was extended until December 31, 2021.

A comparison between the monthly growth in retail sales in each state in 2021 and the labor demand shock in the same year support the aforementioned thesis of the federal government at the time. Figure 5 visualizes that a positive slope of the correlation between the negative labor demand shock and retail sales had a significant impact on private consumption.

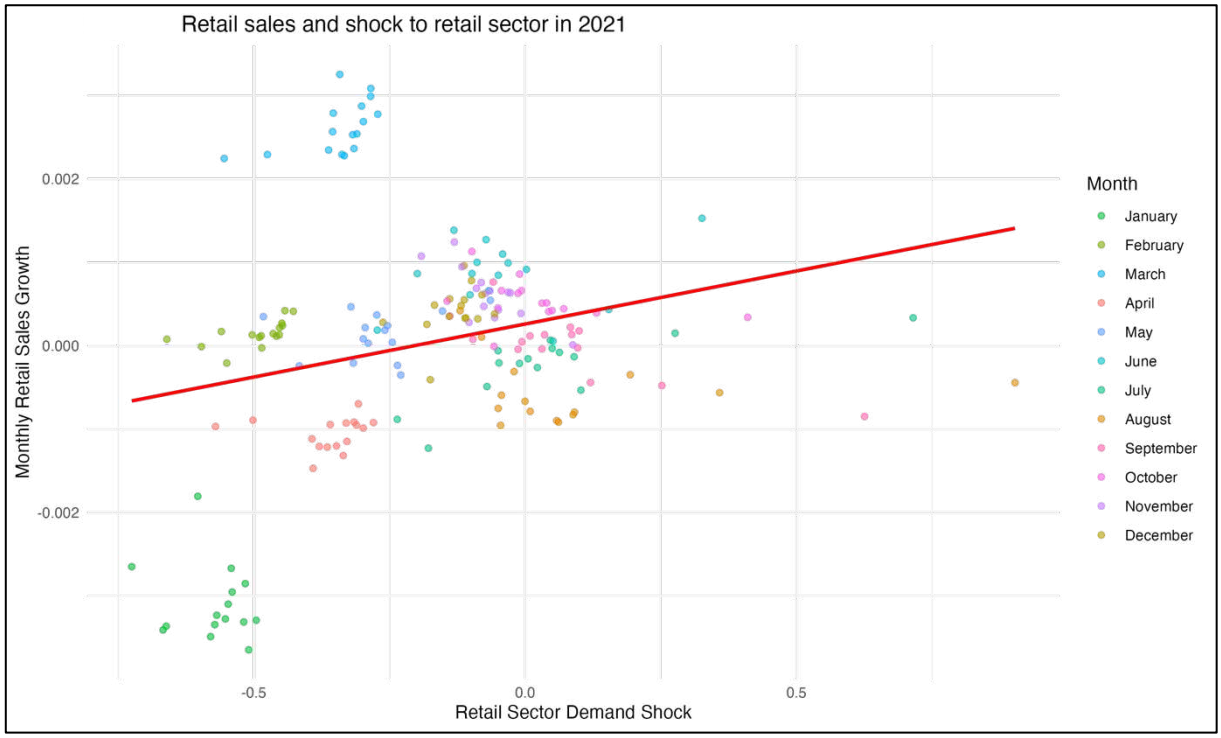

Figure 5 Retail sales and shock to retail sector in 2021

Already in the 2021 study, the analysis was based on the empirical question of whether the STW program reduced the negative demand effects during the pandemic (Aiyar & Dao, 2021). Since the extension of the STW economic policy instrument was adjusted in 2021 and the

program was extended until December 31, 2021, the empirical question posed retains its validity in two respects. On the one hand, a direct comparison with 2020 can be drawn below and, on the other hand, the political legitimacy for the extension of the instrument can be assessed. Therefore, a panel regression at the state level from equation (2) is also chosen in the following and the previous dependent variables of unemployment rate and employment growth are replaced with a proxy. Here, the new dependent proxy variable measures the retail volume sales index for 2021 under the assumption that the retail volume sales index is a proxy indicator for the overall level of consumption.

Table 4 reports the OLS estimation results for 2021. States with higher use of STW were significantly less affected by a negative effect of the demand shock on the retail volume sales index. From the results of the linear regression model, it can be concluded that the economic policy instrument of short STW mitigated the negative effect of the demand shock due to the pandemic in 2021. These assumptions are confirmed by the subsequent results from the 2SLS estimation, which were also calculated using the proxy of the volume index for retail trade. In particular, the interaction between the retail labor demand shock and the use of the STW work program was able to confirm the assumption that the STW program significantly mitigated the negative labor demand shock on retail sales. With respect to the effect of the labor demand shock in the hospitality industry, neither the OLS nor the 2SLS estimation could yield significant results.

This insight can also be drawn from Figure 6 below, which plots the difference between counterfactual retail sales growth and actual retail sales growth for 2021. The counterfactual distribution of retail sales growth without the use of STW is calculated using the estimated coefficients from the 2SLS regression. The month of February 2020 was taken as the comparison month for 2021. The month of February was selected using the same considerations as in the previous counterfactual calculation. The results of the attached figure 6 here support the assumption that the use of STW had a mild effect on the impact on domestic demand. On average, over the entire year 2021, actual retail sales growth was about 4.23 percentage points higher than the counterfactual retail sales growth. Thus, the instrument of STW during the pandemic in 2021 had the effect of stabilizing both the labor market and domestic demand in Germany.

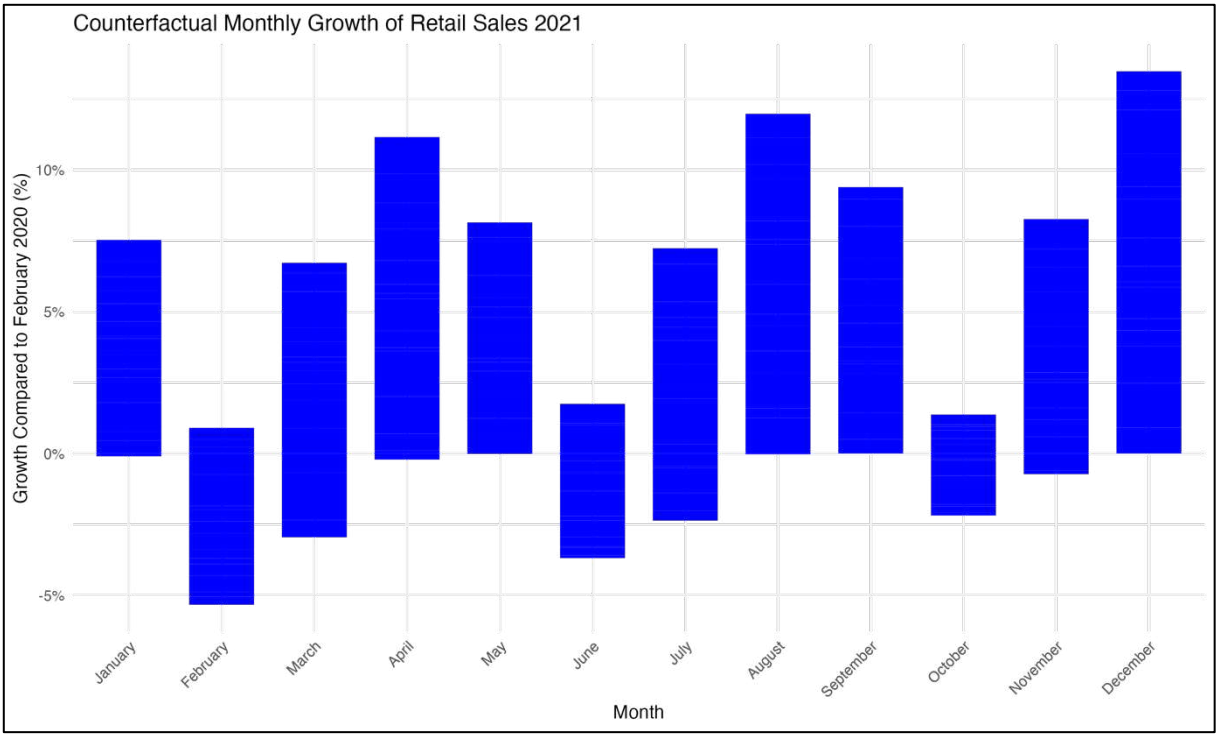

Figure 6 Difference between Counterfactual and Actual retail Sales Growth in 2021

6 Robustness test

The Covid 19 pandemic, which made headlines around the world in the spring of 2020, continued to spread at a rapid pace in 2021 and fundamentally changed our lives. The Covid 19 virus not only affected us on a health level, but also forced us to make adjustments on an economic level. In terms of the global value chain, the pandemic not only caused more difficult supply chains, but also caused a global decline in demand. The resulting recessionary economic development led to a sharp decline in exports worldwide. In this context, the Federal Republic of Germany recorded a year-on-year decline in goods exports of 9.1% in 2020. This decline was improved by 14.3% in 2021 compared to 2020 due to global adjustments and a renewed increase in global demand ((bpb), 2023).

With regard to the present work, the economic point of view of the export development in Germany, during the Covid-19 pandemic, provides a suitable alternative measure of the demand shock at the state level. Therefore, based on the work of Aiyar and Dao (2021), the next step is to develop an additional shift-share metric and examine how German export developments affected unemployment and employment in 2021. The following equation reflects the exposure to cross-border exports, which results from the interaction of nationwide export growth with the existing export share of each state, as measured by GDP:

$$y_{st}^{Ex} = \Delta lnexp_t \times expshr_{s,t-1}$$

The results of this regression are visualized in table 5 and indicate that the use of STW led to a 2.7 percent increase in the unemployment rate and a 2.5 percent moderation in employment growth. These results, unexpected at first glance, are reflected in the change in the lagged export ratio. An increase in the lagged export rate caused the unemployment rate to rise by one percent and employment growth to fall by 3.1 percent. However, the results of the 2SLS estimation show signs of collinearity, so an exact interpretation is not possible. Moreover, the results need to be put into the economic context that in 2021, export growth in Germany was 14.3% year-on-year, well above the average of 5.2% ((bpb), 2023). Due to the sharp decline in export growth in 2020 of 9.1%, it is possible that a "base effect" resulted from the resulting lower starting points for 2021.

7 Critical discussion

7.1 Critical classification in an economic context

It is of central importance that the previously analyzed results are placed in a societal and economic context. With respect to labor market effects, the results from the OLS regression also provide a meaningful contribution from an economic perspective. A negative labor demand shock in the retail sector may have led to a decline in demand for goods and services, which in turn affected employment. A negative shock in the hospitality sector could have led to a decline in demand for services in that sector, which would also reduce employment. The interaction with STW in the regression shows how labor market policies modified the effects of demand shocks. STW may have helped preserve jobs by allowing firms to temporarily reduce their workforces without laying them off. However, this was not true for the retail sector in 2021. Analysis of the OLS estimation results shows that the relationships between economic shocks in the retail and hospitality sectors with the use of STW and labor market outcomes are complex. This complexity is also reflected across states, as some states, such as Bavaria or Baden-Württemberg, were more resistant to demand shocks, while Mecklenburg-Western Pomerania or Saxony-Anhalt were more sensitive.

To account for possible endogeneity problems and to include additional control variables, this paper next regresses a 2SLS estimation based on equation (2) to ensure the robustness of these results. In the economic context, the results show that many companies in the retail sector were able to learn from the experience of the first Covid-19 year and better adapt through alternative business models. In addition, the deadlines for government support were extended to Dec. 31, 2021, during the year. However, from the previous analysis, it can also be deduced that companies in the retail and hospitality sectors found themselves in difficult economic situations despite the government support program. Due to uncertainties in many areas of social life, entrepreneurs may have found themselves in the situation of cutting jobs or not hiring new employees despite continued government support for employees.

7.2 Critical comparison of the results

This paper examines the effect that the STW program in Germany had on the labor market in 2021. In this context, the study by Aiyar and Dao (2021) was taken as a basis, which examined the effect for the year 2020 on the hospitality and contact-intensive sectors. In this work, this is also done, but the contact-intensive sectors are substituted with the specific sector of retail.

However, since retail is part of the contact-intensive sector, the explanatory power is still there and thus comparisons can be made to the results from the previous year by Aiyar and Dao (2021). In this section of the paper, the results are compared with the results of Aiyar and Dao and put into an economic context.

The econometric model of this paper and those of Aiyar and Dao (2021) are in agreement, allowing for a meaningful interpretation. The results on labor market impacts from the OLS and 2SLS regressions for 2020 and 2021 show a consistent picture. The results of the analysis in 2021 indicate that a negative labor demand shock had a significant negative impact on employment growth in Germany. This is confirmed by the 2SLS and the preceding OLS estimation results. Aiyar and Dao (2021) obtained the same results in their analysis for 2020, although the effect was stronger on the labor market in 2020 compared to 2021. Regarding the rates of change in unemployment due to a labor demand shock, no significant results was found in 2021. However, these results should be put into an economic context. Many companies in the retail sector were able to learn from the experience of the first Covid-19 year and better adapt through alternative business models. In addition, the STW program in 2021 was extended through the end of the year, reducing the need to adjust employment levels from a business perspective.

When including the results for the counterfactual increase in the unemployment rate for all federal states in 2021, a clear picture of results emerges. In all federal states, the counterfactual increase in the unemployment rate would have been higher if the economic policy instrument of STW had not been continued. This finding is also taken from the study by Aiyar and Dao (2021), which, however, predicted a much stronger increase in the unemployment rate. It must be taken into account that it was not possible to select an optimal comparison month in 2021 and that the month of February of the previous year was therefore used. However, as the month of February 2020 is further away in time and did not correspond to the current starting position for 2021, it can be interpreted that the actual mitigating effect on the unemployment rate would have been significantly higher.

The results related to the impact on domestic demand in 2021 also confirm the trends from the study "The Effectiveness of Job-Retention Schemes: Covid-19 Evidence from the German States" by Aiyar and Dao. When comparing monthly sales growth to a labor demand shock in the retail sector, the results show a positive slope on private consumption. This significant positive correlation is also seen in 2020. The positive correlation is confirmed in both studies and shows that states with a higher use of STW were significantly less affected by a negative

effect of the demand shock in terms of the volume sales index for retail trade. This indicates that in the absence of the program, income would have been lower and so would consumption. Thus, the results of the linear regression model provide evidence that the economic policy instrument of STW may have mitigated the negative effect of the demand shock due to the pandemic in 2021. These assumptions are confirmed by the subsequent results from the 2SLS estimation, which were also calculated using the retail volume index proxy.

The resulting economic implications and the question of whether the instrument of STW also provided a stabilizing labor and domestic market in 2021 can also be answered unambiguously. On average, over the entire year 2021, actual retail sales growth was about 4.23 percentage points higher than counterfactual retail sales growth. These results are also confirmed by Aiyar and Dao (2021). The actual retail sales growth of 2021 was 1.33 percentage points higher than that of 2020 from the study of Aiyar and Dao (2021). These results can be justified by the fact that in 2021, retail sales were less affected by restrictions and sales increased compared to the previous year. Due to the ongoing support program, the increased money supply was able to boost sales even more than it did in 2020.

With regard to the impact on domestic demand, this paper proves that the economic policy support program made a relevant contribution to economic stabilization in Germany across the labor market. Due to the increased money supply and the resulting greater incentive for private households to make purchases, the STW program was able to make a significant contribution to stabilizing the domestic market.

7.3 Limitations and need for further research

This empirical work has limitations that can be related to the research question at hand. Based on the data sets and the resulting findings, this work provides evidence that the effect of the STW program in Germany in 2021 could show the same economic trends as in the year before. This finding takeaway is of elementary importance. However, it can be seen in this paper that many effects and trends were much weaker than in 2020. This fact can be explained in many different economic and social ways. First, as explained above, for the analysis on counterfactual growth for the year 2021, an optimal reference month, as was the case in 2020, is not available. In addition, this work points to limitations arising from the failure to account for the effect of adjustment for pandemic consequences. With the knowledge and experience from the first pandemic year, the German population and economy were able to adapt and thus react to the

negative pandemic consequences. This effect may have meant that, across almost all analyses, the impact on the labor and domestic markets was significantly smaller than in the previous year. Conversely, this could be a rationale for why the initial effects from 2020, particularly from the first quarter, were the strongest. At the same time, the size of the effect that resulted from the adjustment measures is not known. This paper could therefore lay the groundwork for further research on what effects adaptation to the pandemic had at the societal and economic levels.

7.4 Theoretical and practical implications

This paper contributes with its results to the existing literature by providing an answer to how the STW program affected the labor and domestic market in Germany in 2021.

This paper confirms that the implementation of STW in Germany had a positive impact on the German labor and domestic market. These results were collected in the context of the contact-intensive sectors of retail and hospitality. Based on theory, this paper not only extends Aiyar and Dao (2021) and provides new knowledge to the theoretical literature. Since in the past the issue of STW has often been studied at the international level, this thesis follows a different approach and examines the national impact by using country-level differences in exposure to the pandemic shock and the use of STW (Hijzen & Venn, 2011; Boeri and Bruecker, 2011).

In answering the research question, practical implications for incumbent governments are also highlighted. This study provides reason to continue using the economic policy tool of STW as a valuable and effective means to provide a quick and effective response to the labor and domestic markets in times of economic crisis. The STW program was discovered and researched decades ago (cf. Hall & Lazear, 1984), gained prominence especially during the financial crisis of 2007, and provided decisive impetus also during the Covid 19 pandemic. Both previous studies and the current thesis do not assess potential distortions that this program introduced in the economy and any mismatches that might appear. Assessing these types of effects should be the subject of future research.

8 Conclusion

Since the outbreak began in 2020, the Covid 19 pandemic not only caused great suffering and health disasters, but also posed enormous economic challenges to humanity. Every state government was forced to respond to this exogenous shock within a very short time. Past crises, especially the 2007 financial crisis, indicated that the instrument of STW is an effective measure to provide a response to the economic challenges during the pandemic. In this context, this thesis answers the question of how the use of STW affected the labor and domestic markets in 2021 in Germany.

This work extends the research of Aiyar and Dao (2021) and confirms the claim that the STW program both saved jobs and that the increased funds cushioned the decline in consumption and stabilized domestic demand. By specifically analyzing labor demand shocks in the retail and hospitality sectors and instrumenting STW take-up by workers subject to social security contributions, individual effects on the unemployment rate and employment growth could be calculated. However, differences can be identified at the state level, as not all states responded to the labor demand shocks to the same extent. For example, some German federal states, such as Mecklenburg-Western Pomerania and Saxony-Anhalt, reacted more sensitively to the labor demand shocks. Counterfactual analyses confirm the findings of this paper that the STW program led to a stabilization of domestic demand. The assistance program not only stabilized domestic demand in 2021, but also improved it by 1.33 percentage points over the previous year. Thus, this paper contributes to previous research on STW and provides discussion points for future research directions.

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10 Appendix

Table 1:

Table 1. OLS Results in 2020

	Dependent variable:			
	(1)	(2)	(3)	(4)
CI_demandshock	-0.013***		0.0132**	
	(0.0035)		(0.006)	
AF_demandshock		0.001		0.0063
		(0.0037)		(0.0043)
CI_demandshock:KA	-0.0618		-0.058	
	(0.0386)		(0.0647)	
AF_demandshock:KA		-0.299*		0.4381
		(0.149)		(0.2655)
No. Observation	192	160	192	160
R-squared	0.4746	0.4153	0.2928	0.2429
Note:				*p**p***p<0.01
	Robust standard errors clustered at state level in parentheses			

Table 2:

Table 2. OLS Results in 2021

	Dependent variable:			
	(1)	(2)	(3)	(4)
CI_demandshock	-0.0053***		0.0084***	
	(0.0020)		(0.0029)	
AF_demandshock		-0.0039		0.0127***
		(0.0028)		(0.0044)
CI_demandshock:KA	-1.0849		-7.7405***	
	(0.8610)		(2.9284)	
AF_demandshock:KA		-3.6407		9.9036*
		(4.0431)		(5.7520)
No. Observation	192	160	192	160
R-squared	0.7034	0.7388	0.3931	0.4144
Note:				*p**p***p<0.01

Robust standard errors clustered at state level in parentheses

Table 3:

	twoSLS1.1	twoSLS1.2	twoSLS2.1	twoSLS2.2	twoSLS3.1
IV stages	First	Second	First	Second	First
Dependent Var.:	CI_demandshock:KA	ch_UR	AF_demandshock:KA	ch_UR	CI_demandshock:KA
lag1_CI_share	-0.4277 (0.4555)		-0.0335 (0.1200)		-0.4277 (0.4555)
lag1_CI_share x CI_demandshock	-0.1796 (0.3544)		0.0104 (0.0073)		-0.1796 (0.3544)
CI_demandshock	0.0481 (0.0837)	-0.0058 (0.0072)			0.0481 (0.0837)
KA	-0.5566*** (0.0237)	-0.5819 (0.5501)	0.0052 (0.0042)	0.0486 (0.0476)	-0.5566*** (0.0237)
allE_CI_share	-0.8777 (0.6173)	-0.4383 (1.275)			-0.8777 (0.6173)
mobility_monthlychange	-0.0182 (0.0432)	0.0085 (0.0117)			-0.0182 (0.0432)
CI_demandshock:KA		-1.056 (1.003)			
AF_demandshock			-0.0142** (0.0044)	-0.1123 (0.0957)	
allE_AF_share			-0.1823 (0.2036)	-0.1057 (0.4833)	
chLog_TurnoverAF_constant			0.0090** (0.0024)	0.0702 (0.0579)	
AF_demandshock:KA				-7.852 (5.692)	
Fixed-Effects:	----------	----------	----------	----------	----------
as.factor(state)	Yes	Yes	Yes	Yes	Yes
S.E.: Clustered	by: state)	by: state)	by: state)	by: state)	by: state)
Observations	192	192	160	160	192
R2	0.94985	-1.5068	0.51122	-14.823	0.94985
Within R2	0.93419	-1.5193	0.47199	-15.195	0.93419

	twoSLS3.2	twoSLS4.1	twoSLS4.2
IV stages	Second	First	Second
Dependent Var.:	EmpGrowth	AF_demandshock:KA	EmpGrowth
lag1_CI_share		-0.0335 (0.1200)	
lag1_CI_share x CI_demandshock		0.0104 (0.0073)	
CI_demandshock	0.0140* (0.0061)		
KA	-0.0865 (0.5528)	0.0052 (0.0042)	-0.0737 (0.0787)
allE_CI_share	-1.596 (1.412)		
mobility_monthlychange	0.0016 (0.0069)		
CI_demandshock:KA	-0.1743 (1.007)		
AF_demandshock		-0.0142** (0.0044)	0.1881 (0.1474)
allE_AF_share		-0.1823 (0.2036)	0.6475 (0.8804)
chLog_TurnoverAF_constant		0.0090** (0.0024)	-0.1171 (0.0901)
AF_demandshock:KA			12.56 (8.965)
Fixed-Effects:	----------	----------	----------
as.factor(state)	Yes	Yes	Yes
S.E.: Clustered	by: state)	by: state)	by: state)
Observations	192	160	160
R2	0.28698	0.51122	-9.1946
Within R2	0.27488	0.47199	-9.4169

---Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Table 4:

Column 1: OLS regression with unemployment rate as dependent variable

```
t test of coefficients:

                                          Estimate  Std. Error t value  Pr(>|t|)
(Intercept)                             0.01161317  0.00931303  1.2470   0.21420
CI_demandshock                          0.00027130  0.00219497  0.1236   0.90178
KA                                      0.06326442  0.00961393  6.5805 6.191e-10 ***
as.factor(state)Bavaria                 0.00180482  0.00122416  1.4743   0.14233
as.factor(state)Berlin                  0.00642626  0.00342974  1.8737   0.06277 .
as.factor(state)Brandenburg             0.00437284  0.00226471  1.9309   0.05525 .
as.factor(state)Bremen                  0.00099734  0.00045851  2.1751   0.03107 *
as.factor(state)Hamburg                 0.00303618  0.00179917  1.6875   0.09342 .
as.factor(state)Hesse                   0.00206701  0.00046079  4.4858 1.371e-05 ***
as.factor(state)Lower Saxony            0.00180375  0.00147476  1.2231   0.22308
as.factor(state)Mecklenburg-Western Pomerania  0.00809222  0.00497439  1.6268   0.10573
as.factor(state)North Rhine-Westphalia  0.00216470  0.00035846  6.0389 1.026e-08 ***
as.factor(state)Rhineland-Palatinate    0.00319268  0.00133651  2.3888   0.01805 *
as.factor(state)Saarland                0.00206960  0.00138347  1.4960   0.13661
as.factor(state)Saxony                  0.00296960  0.00135720  2.1880   0.03010 *
as.factor(state)Saxony-Anhalt           0.00456321  0.00238542  1.9130   0.05752 .
as.factor(state)Schleswig Holstein      0.00663956  0.00380765  1.7437   0.08310 .
as.factor(state)Thuringia               0.00149583  0.00129928  1.1513   0.25131
allE_CI_share                          -0.15843335  0.11372042 -1.3932   0.16547
mobility_monthlychange                  0.00094325  0.00246541  0.3826   0.70252
CI_demandshock:KA                       0.11904224  0.02341554  5.0839 1.011e-06 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

Column 3: 2SLS regression on the dependent variable of unemployment rate.

```
TSLS estimation, Dep. Var.: chLog_RSales_constant, Endo.: CI_demandshock:KA, Instr.: lag1_CI_share, lag1_CI_share:CI_demandshock
Second stage: Dep. Var.: chLog_RSales_constant
Observations: 183
Fixed-effects: as.factor(state): 16
Standard-errors: Clustered (as.factor(state))
                      Estimate Std. Error   t value Pr(>|t|)
fit_CI_demandshock:KA  0.732670   0.538232  1.361255  0.19353
CI_demandshock        -0.004287   0.005734 -0.747698  0.46620
KA                     0.405049   0.297248  1.362665  0.19310
allE_CI_share          0.790416   0.675301  1.170464  0.26007
mobility_monthlychange -0.000857   0.008095 -0.105812  0.91713
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
RMSE: 0.00222     Adj. R2: -2.17986
                 Within R2: -1.84465
F-test (1st stage), CI_demandshock:KA: stat = 0.863882, p = 0.423302, on 2 and 176 DoF.
                           Wu-Hausman: stat = 4.25072 , p = 0.040841, on 1 and 161 DoF.
                               Sargan: stat = 1.53834 , p = 0.214864, on 1 DoF.
```

Column 2: OLS regression on the dependent variable of employment growth.

```
t test of coefficients:

                                          Estimate  Std. Error t value  Pr(>|t|)
(Intercept)                             1.7645e-03  1.1643e-03  1.5155  0.131911
AF_demandshock                         -2.9436e-03  2.2767e-03 -1.2929  0.198176
KA                                     -1.9667e-02  6.2941e-03 -3.1247  0.002164 **
as.factor(state)Bavaria                 7.7287e-04  4.2461e-04  1.8202  0.070868 .
as.factor(state)Berlin                  2.4936e-04  6.0104e-04  0.4149  0.678870
as.factor(state)Brandenburg            -2.2175e-04  2.4656e-04 -0.8994  0.369991
as.factor(state)Bremen                 -4.6185e-04  1.9650e-04 -2.3504  0.020147 *
as.factor(state)Hamburg                 7.8283e-04  4.7184e-04  1.6591  0.099331 .
as.factor(state)Hesse                  -4.4001e-04  1.8564e-04 -2.3702  0.019141 *
as.factor(state)Lower Saxony            1.1324e-04  5.4611e-05  2.0735  0.039959 *
as.factor(state)Mecklenburg-Western Pomerania  1.0685e-03  1.2410e-03  0.8610  0.390727
as.factor(state)Rhineland-Palatinate    -6.7934e-04  1.6635e-04 -4.0838 7.418e-05 ***
as.factor(state)Saarland                -1.0088e-04  6.9742e-05 -1.4464  0.150296
as.factor(state)Saxony                  -7.0188e-05  2.4059e-04 -0.2917  0.770926
as.factor(state)Saxony-Anhalt           -6.5565e-04  2.0919e-04 -3.1342  0.002100 **
as.factor(state)Schleswig Holstein      -2.9257e-05  4.2225e-04 -0.0693  0.944859
as.factor(state)Thuringia               1.6000e-04  8.3863e-05  1.9079  0.058452 .
allE_AF_share                          -4.9719e-02  4.3468e-02 -1.1438  0.254657
chLog_TurnoverAF_constant               2.1861e-03  1.2857e-03  1.7003  0.091287 .
AF_demandshock:KA                       1.8940e-01  9.6837e-02  1.9559  0.052473 .
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

Column 4: 2SLS regression on the dependent variable of employment growth.

```
TSLS estimation, Dep. Var.: chLog_RSales_constant, Endo.: AF_demandshock:KA, Instr.: lag1_CI_share, lag1_CI_share:CI_demandshock
Second stage: Dep. Var.: chLog_RSales_constant
Observations: 160
Fixed-effects: as.factor(state): 15
Standard-errors: Clustered (as.factor(state))
                          Estimate Std. Error   t value Pr(>|t|)
fit_AF_demandshock:KA     2.609161   1.844549  1.414525  0.17906
AF_demandshock            0.033356   0.031060  1.073915  0.30102
KA                       -0.019935   0.018455 -1.080191  0.29832
allE_AF_share            -0.070573   0.169959 -0.415237  0.68426
chLog_TurnoverAF_constant -0.021305   0.018747 -1.136427  0.27486
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
RMSE: 0.003072     Adj. R2: -4.65471
                 Within R2: -3.99973
F-test (1st stage), AF_demandshock:KA: stat = 0.775082, p = 0.462466, on 2 and 153 DoF.
                          Wu-Hausman: stat = 8.09552 , p = 0.005109, on 1 and 139 DoF.
                              Sargan: stat = 0.199547, p = 0.655087, on 1 DoF.
```

Table 5:

Column 1: OLS regression on the dependent variable of the unemployment rate.

```
t test of coefficients:

                                          Estimate  Std. Error t value  Pr(>|t|)
(Intercept)                             -7.4880e-02  1.2894e-02 -5.8071 3.027e-08 ***
lag_export_ratio                         1.1187e+01  2.7040e+00  4.1370 5.509e-05 ***
KA                                       5.5817e-02  3.5334e-02  1.5797  0.116028
as.factor(state)Bavaria                 -8.3905e-03  1.7310e-03 -4.8472 2.796e-06 ***
as.factor(state)Berlin                  -2.4424e-02  5.3622e-03 -4.5549 9.929e-06 ***
as.factor(state)Brandenburg             -1.5114e-02  3.6656e-03 -4.1232 5.819e-05 ***
as.factor(state)Bremen                   1.0797e-04  6.4178e-04  0.1682  0.866595
as.factor(state)Hamburg                 -1.3339e-02  2.4466e-03 -5.4522 1.717e-07 ***
as.factor(state)Hesse                   -2.9626e-03  1.0870e-03 -2.7253  0.007092 **
as.factor(state)Lower Saxony            -9.8226e-03  2.0701e-03 -4.7451 4.380e-06 ***
as.factor(state)Mecklenburg-Western Pomerania -3.5352e-02  7.6076e-03 -4.6469 6.702e-06 ***
as.factor(state)North Rhine-Westphalia   -2.6819e-03  8.8124e-04 -3.0433  0.002709 **
as.factor(state)Rhineland-Palatinate     -1.0486e-02  2.2109e-03 -4.7427 4.425e-06 ***
as.factor(state)Saarland                 -1.0247e-02  2.0167e-03 -5.0810 9.761e-07 ***
as.factor(state)Saxony                   -1.0197e-02  2.1502e-03 -4.7422 4.435e-06 ***
as.factor(state)Saxony-Anhalt            -1.7430e-02  3.6911e-03 -4.7221 4.842e-06 ***
as.factor(state)Schleswig Holstein       -2.7146e-02  5.8474e-03 -4.6425 6.831e-06 ***
as.factor(state)Thuringia                -8.6871e-03  1.8383e-03 -4.7258 4.765e-06 ***
allE_CI_share                            8.5499e-01  1.6482e-01  5.1874 5.979e-07 ***
mobility_monthlychange                  -7.3977e-03  8.3999e-04 -8.8069 1.393e-15 ***
lag_export_ratio:KA                     -1.7558e+02  9.2518e+01 -1.8978  0.059406 .
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

Column 2: OLS regression on the dependent variable of employment growth.

```
t test of coefficients:

                                           Estimate  Std. Error t value  Pr(>|t|)
(Intercept)                              0.0987210   0.0158946  6.2110 3.875e-09 ***
lag_export_ratio                       -33.9481519  13.3785058 -2.5375 0.0120581 *
KA                                      -0.0615675   0.0428266 -1.4376 0.1523758
as.factor(state)Bavaria                  0.0077916   0.0020261  3.8455 0.0001695 ***
as.factor(state)Berlin                   0.0249494   0.0063479  3.9304 0.0001230 ***
as.factor(state)Brandenburg              0.0133918   0.0044224  3.0282 0.0028414 **
as.factor(state)Bremen                   0.0015114   0.0013702  1.1031 0.2715345
as.factor(state)Hamburg                  0.0146120   0.0026017  5.6164 7.756e-08 ***
as.factor(state)Hesse                    0.0005717   0.0022028  0.2595 0.7955316
as.factor(state)Lower Saxony             0.0089629   0.0023752  3.7735 0.0002217 ***
as.factor(state)Mecklenburg-Western Pomerania  0.0364261   0.0080824  4.5069 1.216e-05 ***
as.factor(state)North Rhine-Westphalia   0.0012268   0.0016877  0.7269 0.4682796
as.factor(state)Rhineland-Palatinate     0.0114152   0.0026762  4.2655 3.295e-05 ***
as.factor(state)Saarland                 0.0118953   0.0021740  5.4716 1.564e-07 ***
as.factor(state)Saxony                   0.0102644   0.0025622  4.0061 9.194e-05 ***
as.factor(state)Saxony-Anhalt            0.0175820   0.0041731  4.2132 4.067e-05 ***
as.factor(state)Schleswig Holstein       0.0284935   0.0063565  4.4825 1.347e-05 ***
as.factor(state)Thuringia                0.0062396   0.0022308  2.7970 0.0057487 **
allE_CI_share                           -1.0196037   0.1773066 -5.7505 4.010e-08 ***
mobility_monthlychange                   0.0131893   0.0016559  7.9649 2.217e-13 ***
lag_export_ratio:KA                    218.1442921 122.8771584  1.7753 0.0776265 .
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

Column 3: 2SLS regression on the dependent variable of unemployment rate.

```
TSLS estimation, Dep. Var.: ch_UR, Endo.: lag_export_ratio:KA, Instr.: lag1_CI_share, lag1_CI_share:lag_export_ratio
Second stage: Dep. Var.: ch_UR
Observations: 192
Fixed-effects: as.factor(state): 16
Standard-errors: Clustered (as.factor(state))
                          Estimate Std. Error   t value   Pr(>|t|)
fit_lag_export_ratio:KA -493.947537 758.088363 -0.651570 5.2454e-01
lag_export_ratio          19.590325  20.307674  0.964676 3.5000e-01
KA                         0.157803   0.242131  0.651727 5.2444e-01
allE_CI_share              0.840493   0.190387  4.414645 5.0197e-04 ***
mobility_monthlychange    -0.007030   0.001044 -6.735691 6.6854e-06 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
RMSE: 0.001672     Adj. R2: 0.326426
                 Within R2: 0.393949
F-test (1st stage), lag_export_ratio:KA: stat = 3.29079 , p = 0.039415, on 2 and 185 DoF.
                            Wu-Hausman: stat = 0.708713, p = 0.401054, on 1 and 170 DoF.
                                Sargan: stat = 8.65132 , p = 0.003268, on 1 DoF.
```

Column 4: 2SLS regression on the dependent variable of employment growth.

```
TSLS estimation, Dep. Var.: EmpGrowth, Endo.: lag_export_ratio:KA, Instr.: lag1_CI_share, lag1_CI_share:lag_export_ratio
Second stage: Dep. Var.: EmpGrowth
Observations: 192
Fixed-effects: as.factor(state): 16
Standard-errors: Clustered (as.factor(state))
                          Estimate  Std. Error   t value   Pr(>|t|)
fit_lag_export_ratio:KA -147.693186 1378.680607 -0.107126 9.1611e-01
lag_export_ratio         -24.291369   37.016270 -0.656235 5.2161e-01
KA                         0.055626    0.438388  0.126888 9.0071e-01
allE_CI_share             -1.036268    0.173217 -5.982499 2.5108e-05 ***
mobility_monthlychange     0.013611    0.001455  9.354534 1.1933e-07 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
RMSE: 0.003837     Adj. R2: 0.243834
                 Within R2: 0.311526
F-test (1st stage), lag_export_ratio:KA: stat = 3.29079 , p = 0.039415, on 2 and 185 DoF.
                            Wu-Hausman: stat = 0.162839, p = 0.687063, on 1 and 170 DoF.
                                Sargan: stat = 0.001326, p = 0.970957, on 1 DoF.
```