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A Comparative Evaluation of Fiscal Stabilization Strategies during the Covid-19 Pandemic with Germany as a Reference Point

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Abstract: We provide a comparative evaluation of fiscal stabilization strategies during the Covid-19 pandemic. For this purpose, we use Germany's temporary value-added tax (VAT) rate reduction as a reference point. We construct a credible counterfactual for Germany in a two-step procedure. First, we carry out a careful pre-selection of the donor pool countries to obtain a control group that is highly similar to Germany regarding important post-treatment characteristics. Second, we apply a reweighting scheme on the pre-selected donor countries. The synthetic control group only differs from Germany in the way that it did not implement the temporary VAT rate reduction. Our results indicate that the German VAT cut policy and partial VAT reductions in other countries were relatively ineffective in stimulating consumption with regards to their costs when compared to other measures such as (targeted) direct cash transfers (e.g. implemented in Canada, Denmark, Japan, and the United States). We attribute this to the fact that direct cash transfers are more comprehensible, salient, and actionable, in particular, in a dynamic environment with high uncertainty induced by unclear future economic prospects.

Keywords: consumption; Covid-19; synthetic control; temporary VAT cut; unconventional fiscal policy

JEL Classification: E21; E62; E65; H31

1 Introduction

As a unique health shock, the Covid-19 pandemic led to an unprecedented global recession that differed significantly from previous economic crises. In response,

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governments all over the world imposed restrictions on public life via non-pharmaceutical interventions in an effort to mitigate the spread of the virus. In particular sectors producing goods and services involving close physical contact and large gatherings of people were subject to vast restrictions, including prolonged shutdowns of whole industries. However, lockdowns did not only affect the supply side of the economy. Aggregate demand was also reduced since people were only allowed to leave their homes for necessary activities and many employees were either forced to work from home or were put on short-term work schemes, leaving them with lower salaries. Thus, the recession following the health shock was a unique major global economic crisis in which both supply and demand were severely affected. Moreover, the anxiety and uncertainty caused by the outbreak of the global health crisis reduced consumers' economic sentiment, further muting aggregate demand. As a result, governments faced the twofold challenge of slowing the spread of the virus and maintaining public life in light of a dynamically evolving public health crisis and of cushioning the economic impact of lockdowns and stay-at-home orders.

The following recession was also special in terms of limitations on the governments' policy responses. As interest rates in most advanced economies were close to or at the zero lower bound and many central banks were already engaging in large-scale asset purchases, there was a strong focus on fiscal policy to stimulate the economy. To dampen the negative effects on the economy, governments adopted sizable fiscal stimulus packages and many countries decided on measures specifically targeted at boosting household consumption. Germany opted for an unconventional fiscal policy measure by reducing its value-added tax (VAT) rate temporarily as part of its stimulus package announced on 3 June 2020. During 2020q3 and 2020q4, the standard VAT rate was lowered from 19 % to 16 % and the reduced rate from 7 % to 5 % with estimated costs of approximately 20 bn EUR.[1]

The *absolute* effectiveness of the temporary VAT rate reduction in Germany as the largest measure of the aforementioned fiscal package has already been evaluated. Bachmann et al. (2021) use survey and scanner data and find that the VAT cut increased household spending by 26 bn EUR in 2020. Using a survey design, Fuest et al. (2021a, 2021b) estimate an effect of 6.3 bn EUR. Other researchers calibrate DSGE models to obtain a treatment effect and find that the VAT rate reduction increased GDP in 2020 by 6.5 bn EUR (Wollmershäuser et al. 2020), by 0.3 % (i.e. roughly 10 bn EUR, Funke and Terasa 2022), or by 32 bn EUR (Clemens and Roeger 2022), respectively.

However, many other countries (e.g. Canada, Denmark, Japan, and the United States) adopted more standard policies, such as direct transfers to households, to

1 The reduced rate applies, for instance, to most basic food items, transportation, or printed matter, such as books and newspapers.

stimulate consumption. Accordingly, the question of the *relative* effectiveness of stabilization measures is an important issue for policymakers, as most policies will have positive effects on consumption. Yet, governments should carefully consider whether there are more cost-effective measures to reach a certain goal and choose measures that give taxpayers the greatest "bang for the buck." Against this background, we evaluate Germany's temporary VAT rate reduction as a tool to stimulate consumer spending from a different angle.[2] Our research design – which relies on a counterfactual analysis using different donor pool specifications and validation exercises – allows us to answer a set of interesting questions that were not thoroughly addressed in the existing literature about consumption stimuli during the Covid-19 pandemic.[3] First, which fiscal stabilization measures are the most cost-effective during a global health crisis when there are restrictions on supply and demand? Second, which (design) parameters influence the effectiveness of such policies?

Hence, we evaluate whether some policies targeted at boosting private consumption during a crisis are more suited than others to achieve this goal. This is of particular relevance as policy-induced constraints on aggregate supply and consumer spending potentially reduce the effectiveness of fiscal stimulus measures targeting household demand as these might dampen the absorption of the stimulus (Auerbach et al. 2022). Little is known about how supply-side constraints and rapidly evolving infection dynamics interfere with the mechanisms of policies that directly target private demand, and which policies may be most robust to those impediments.

To the best of our knowledge, we are the first to use a comparative case study approach to evaluate the German VAT rate reduction. Our paper allows us to analyze the relative performance of the fiscal policy response of several developed countries after controlling for various confounding factors. This potential is further exploited by pairing the data-driven matching approach with a qualitative analysis and comparison of the different policy responses of governments. We try to solve the identification problem by constructing a credible counterfactual of Germany in a two-step procedure. First, we carry out a careful pre-selection of the donor pool countries to obtain a control group that is highly similar with regards to important *post-treatment characteristics*, such as the expenditures for fiscal measures (as % of GDP), to counter to the consequences of the Covid-19 pandemic. Second, we apply a

2 Of course, all these fiscal policy measures also have a (re-)distributional motive. In this paper, however, we focus on evaluating their cost-effectiveness with respect to stimulating consumption.

3 Behringer, Dullien, and Gechert (2021) show that the stimulating potential of the VAT reduction is lower when compared to direct transfer measures such as the Kinderbonus (a lump-sum transfer to families of 300 EUR per child) using a survey design. However, they only compare the different policies within the German stimulus package.

reweighting scheme on the pre-selected donor countries so that systematic differences between Germany and the control units are removed and these are on virtually the same trajectory *before* the imposition of treatment. This synthetic control group should only differ from Germany in the way that it did not implement the temporary VAT rate reduction, which allows us to evaluate the relative cost-effectiveness of this specific (unconventional) fiscal policy measure.

Our results indicate an insignificant, yet slightly negative average treatment effect of the intervention in 2020q3 and a significantly negative estimate for 2020q4 that further increases in size when countries that used VAT rate reductions in some sectors are excluded from the donor pool. Hence, we conclude that the German VAT cut policy and partial VAT reductions in other countries were relatively ineffective with regards to their costs when compared to other measures such as (targeted) direct cash transfers. This holds despite the fact that the German fiscal package was even larger when compared to the counterfactual. Moreover, placebo tests for 2021q1 and 2021q2 show that Germany's consumption did not recover nearly as well as that of the control group. Taken together, this implies that German consumers brought forward some purchases to benefit from the VAT reduction. Put differently, consumption in Germany would have decreased to even lower levels in the second half of 2020 without the VAT cut policy.

Our robustness tests indicate that the relatively bad performance of the German economy during the treatment period and thereafter cannot be explained by overly cautious consumer sentiment or Covid anxiety. However, the surge of Covid cases at the end of 2020 in Germany alongside stricter lockdown measures (as compared to the counterfactual) might have contributed to the relative ineffectiveness of the German VAT cut. Moreover, our extensions indicate a particular sensitivity of the estimated treatment effect to the exclusion of countries that implemented direct (targeted) fiscal transfers. This corroborates our theoretical considerations that unconventional fiscal policies are inferior tools compared to direct transfer payments when it comes to stimulating aggregate demand (during deep recessions). We attribute this to a multitude of factors. First, the pass-through of the VAT rate cut might be imperfect. Second, this measure is relatively less comprehensible and salient when compared to direct transfer payments. Third, consumers facing saving, credit, or liquidity constraints are limited in their ability to respond to a VAT rate reduction. Finally, the measure relies heavily on timing since the intertemporal substitution effect builds up over time and reaches its maximum right before the increase in the VAT rate. At that time, however, stricter lockdown measures had been re-implemented, muting a part of the response, also in light of the increased uncertainty induced by unclear future economic prospects.

Our paper adds to the growing body of literature that analyzes the determinants of successful stabilization policies during (health) crises and sheds more light on the

question of the best fiscal response that governments can adopt to stimulate aggregate demand in the presence of supply shocks and government imposed stay-at-home orders. We also build on the literature that studies the determinants of the efficacy of fiscal policy (e.g. Alloza 2022; Auerbach and Gorodnichenko 2012; Auerbach et al. 2022; Castelnuovo and Lim 2019; Kaplan and Violante 2014; Kinda, Lengyel, and Chahande 2022; Sims and Wolff 2018) and add to the strand of literature that studies the transmission mechanism and effects of unconventional fiscal policy (e.g. Baker, Johnson, and Kueng 2021; Baker et al. 2019; Barrell and Weale 2009; Blundell 2009; Chirakijja et al. 2010; Crossley, Low, and Wakefield 2009; Crossley, Low, and Sleeman 2014; D'Acunto, Hoang, and Weber 2018; D'Acunto, Hoang, and Weber 2022; D'Acunto et al. 2021; Feldstein 2002).

The remainder of this paper is organized as follows. Section 2 discusses a temporary VAT cut as an unconventional fiscal policy measure and the factors affecting its transmission. Section 3 explains our study design and describes how we obtain a credible counterfactual for Germany. Section 4 presents our empirical results alongside a discussion of the robustness of our findings using various model extensions and validation exercises. Section 5 contains a more detailed analysis and discussion of the fiscal response of selected other countries. Section 6 concludes.

2 Theoretical Considerations

2.1 A Temporary VAT Cut as Unconventional Fiscal Policy Measure

The temporary reduction of the VAT rate is an unconventional form of fiscal policy. D'Acunto, Hoang, and Weber (2018, 519) define unconventional fiscal policy as "… policies that generate an increasing path of consumption taxes that result in households' higher inflation expectations and negative real interest rates." Thus, unconventional fiscal policy relies on households as agents of transmission for fiscal policy (D'Acunto, Hoang, and Weber 2022). Private spending is incentivized through the channel of lowering real interest rates, either by a pre-announced permanent increase of consumption taxes, or – as in the case of the German VAT cut – by temporarily reducing the tax rate for the duration of a pre-specified period. Assuming that monetary policy is kept constant (or constrained by the zero lower bound), a change in inflation expectations should translate directly to a change in the perceived real interest rate. The reduction of real interest rates induces an intertemporal substitution effect via the consumption Euler equation, leading consumers

to save less in the current period and to bring forward planned future expenditures to benefit from the relatively lower prices induced by the VAT cut.

However, temporary VAT reductions have rarely been used in the past. Therefore, little is known about the usefulness and relative effectiveness of these measures compared to conventional fiscal policy. In fact, there is only one known case where a temporary VAT cut was adopted to stimulate demand. In December 2008, the UK reduced their regular VAT rate from 17.5 % to 15 % for a duration of 13 months (see, e.g. Barrell and Weale 2009; Blundell 2009; Chirakijja et al. 2010; Crossley, Low, and Wakefield 2009; Crossley, Low, and Sleeman 2014). Blundell (2009) and Crossley, Low, and Wakefield (2009) document a relatively small income effect of this temporary consumption tax reduction in the UK (as compared to conventional fiscal policy).[4]

Moreover, we believe that the dynamic nature of the pandemic and the overall high level of uncertainty regarding potential demand and supply-side restrictions sets the most recent global economic crisis apart from previous recessions. This is in line with Guerrieri et al. (2022) who find that global health shocks, which lead to restrictions on public life and asymmetrically affect economic activity in specific sectors, result in lower fiscal multipliers compared to supply shock-induced recessions in which sectors are affected equally. Therefore, one must be cautious to apply the existing evidence on government spending multipliers during recessions (including studies of the UK VAT cut) to the Covid-19 crisis.

2.2 Determinants of the Efficacy of a Temporary VAT Cut

According to Ramey (2021), successful fiscal stabilization policy should be salient, comprehensible, and actionable.[5] Following this line of thought, we discuss some of the factors that might affect the efficacy of a temporary VAT cut as an unconventional fiscal policy measure in general and specifically during the Covid-19 pandemic.

2.2.1 Pass-through

Pass-through is usually assumed to be incomplete for temporary reductions in the VAT rate. According to Crossley, Low, and Wakefield (2009), firms face menu costs of changing prices twice during a relatively short period and have an incentive to withhold some of the price reduction to increase their profit margins. In addition, the

4 In the German case, where the reduced rate – that applies mostly to basic needs items – was lowered as well, the income effect for consumers should be higher than compared to the UK case where only the standard rate was reduced.

5 See also Bachmann et al. (2021, 2023a, 2023b).

rate of the pass-through likely depends on the degree of competitiveness in the market and the price sensitivity of consumers (Montag, Sagimuldina, and Schnitzer 2021). Most importantly, the ability to boost consumer spending depends on the *perceptions* and *expectations* of the rate of the pass-through (as opposed to the actual rate) since households' inflation expectations are the transmission channel through which this unconventional fiscal measure works. Thus, the effect of the VAT cut is mediated by the perceived change in consumer prices as consumers might not be able to fully observe the price changes. For the German VAT cut, survey results by Bachmann et al. (2021) imply a slightly hampered effect of the stimulus, since only 65 % of consumers perceived a pass-through of the lowered VAT rate of more than 1 %.

Empirical evidence for the actual pass-through rates of a temporary VAT cut is scarce. Pass-through rates were evaluated for the German fuel market by Montag, Sagimuldina, and Schnitzer (2021). The authors observe a pass-through rate of approximately 80 % in the case of diesel fuel, which was higher than for other fuel types, and explain this by diesel users exhibiting higher levels of price-sensitivity. Fuest et al. (2021a, 2021b) investigate the price developments of approximately 130,000 products sold at German supermarkets against their Austrian counterparts. Their results indicate an asymmetric response to the temporary VAT reduction. Prices decreased by 1.3 % on average, implying a pass-through rate of about 70 %. However, even three months after the return to the normal VAT rates, prices were still 0.5–0.6 % lower than during the pre-treatment period. More generally, Benzarti et al. (2020) find an asymmetry with regards to the pass-through rates of planned increases in taxes and temporary reductions, with the former being reflected to a significantly larger degree in consumer prices.

2.2.2 Complexity and Salience of Measures

Ex-ante survey results in Bachmann et al. (2021) show that most consumers knew about the reduction of the VAT rate, but only 58 % of the surveyed households were fully informed about the return to the normal rate. Clearly, only those consumers who were fully informed about the policy could have adjusted their inflation expectations and had a motive to alter their consumption decisions through an intertemporal substitution effect. In addition, while most larger stores announced they would pass the full VAT reduction on to consumers, prices were often only reduced at the cash desk (Egner 2021). Of course, this helps saving menu costs. However, price changes become less salient when these are not reflected in posted prices, which could negatively affect the perception of the pass-through rate (see, e.g. Baker, Johnson, and Kueng 2021; Chetty, Looney, and Kroft 2009). By comparison, policies such as lump-sum payments in form of a stimulus cheque or a cash transfer

to a bank account are more salient, since consumers can directly observe the full income effect of the policy.

Empirical evidence suggests that policies which require high levels of consumer sophistication are less successful than simpler and easy-to-grasp measures (see, e.g. D'Acunto, Hoang, and Weber 2022; D'Acunto et al. 2021; D'Acunto et al. 2023).[6] D'Acunto, Hoang, and Weber (2022) study how households respond to economic policies that work through the channel of changes in consumers' inflation expectations. The authors find that consumers adjusted their purchasing behaviour according to the Euler equation in response to unconventional fiscal policy measures, but showed no response to unconventional monetary policy (forward guidance), which they explain by the more trivial implications of changes in consumption taxes. However, compared to receiving a direct cash transfer, the VAT rate reduction likely requires stronger cognitive abilities and higher levels of consumers' "informedness" to affect households' spending decisions.[7]

2.2.3 Dynamics of Recession and Timing of Policy Measure

We suspect that the timing – especially in interplay with pandemic containment measures and the dynamic nature of the recession – severely affected which policies worked best in stimulating aggregate demand. Both theory and empirical evidence indicate that intertemporal substitution effects are moderate at the beginning and rise steadily before reaching their maximum right before the increase in the VAT rate (see, e.g. Bachmann et al. 2021, 2023a, 2023b; Crossley, Low, and Sleeman 2014; D'Acunto, Hoang, and Weber 2017, 2022). Moreover, as consumption is expected to decrease during the period after the return to the normal rate, the VAT rate increase should ideally occur when the economy is already in the recovery stage (Blundell 2009).

During the Covid-19 pandemic, infection dynamics were volatile and hardly predictable. This led to rapidly changing restrictions on public life, including movement restrictions and shutdowns of whole industries, limiting consumers' abilities to spend. In Germany, infections increased dramatically in Autumn 2020,

6 D'Acunto et al. (2021) study how these human frictions limit the transmission of economic policies and find that consumers in the bottom half of the distribution of cognitive abilities hardly react to economic policies. The authors attribute this to the fact that a large share of recipients are not sufficiently informed about the details of the measures and to their inability to understand the (forward-looking) economic incentives of these policies. Similarly, using data of Finnish men, D'Acunto et al. (2023) find that only high IQ men adjust their consumption plans in line with the Euler equation when updating their inflation expectations.

7 Ramey (2021) argues that take-up rates of unconventional fiscal policy measures can be improved by proper advertising.

causing the authorities to impose stricter lockdown regulations in November 2020. In fact, in December 2020, when the stimulus effect should have been largest, lockdown stringency was significantly higher in Germany compared to its counterfactual (see Figure A1 in the Appendix). In addition, consumer confidence in the counterfactual economy (that was lower throughout the whole treatment period) caught up with Germany towards the end of the year (see Figure A2 in the Appendix). Therefore, policies that depend crucially on timing (e.g. changes of consumption tax rates) might be inferior tools for stimulating aggregate demand in a highly dynamic and uncertain environment.

2.2.4 Financial Constraints

Based on Berger and Vavra (2015), we conjecture that reduced household income levels and high uncertainty likely cause consumers to become more reluctant to make larger purchases, especially when these require credit-financing (see also Alfaro, Bloom, and Lin 2018, for the "finance-uncertainty multiplier"). Moreover, financial constraints usually rise with the depth of a recession. Auerbach et al. (2022), on the other hand, argue that stimulus payments are typically more effective during recessions. Yet, the authors also acknowledge that this demand-driven effect might be muted by lockdown measures or other supply-side restrictions.

In any case, important distinctions with regards to heterogeneous types of consumers and concerning the type of financial constraints have to be made when analyzing the response of households to different policies. Given the small income effect of a temporary reduction of the VAT rate, mostly those households who are able to bring forward purchases that were planned for a later period are able to benefit from the measure. In addition, consumers facing saving, credit, or liquidity constraints will be very limited in their ability to respond to the VAT rate reduction. Indeed, Baker et al. (2019) and D'Acunto, Hoang, and Weber (2022) find that constrained households show a muted response to unconventional fiscal policy measures.

One general take-away from the recent literature on heterogeneous agents (see, e.g. Guo et al. 2023; Kaplan and Violante 2014) is that the multiplier out of receiving an observable lump-sum cash transfer will be higher than for a temporary VAT reduction, in particular if the transfers are targeted. This is supported by empirical evidence from studies investigating the impact of stimulus payments during the Covid-19 pandemic. For example, Baker et al. (2020) and Bachmann, Bayer, and Kornejew (2022) find that particularly low-income households spent considerable amounts of the received transfer shortly after receiving it, implying a large marginal propensity to consume (MPC) for the group of hand-to-mouth consumers. Baker et al. (2020) and Coibion, Gorodnichenko, and Weber (2020) show that the MPC out of the additional income received through stimulus cheques declined with the liquidity of

households. Finally, Behringer, Dullien, and Gechert (2021) show that people reacted more to the Kinderbonus than to the temporary VAT rate reduction and that the difference was largely driven by low- and middle-income households.

2.2.5 Uncertainty

Due to the high level of uncertainty caused by the dynamic development of the pandemic and the resulting vast and rapid changes of government restrictions, (risk-averse) households might have been more reluctant to bring forward large purchases. This leads, together with increasing pre-cautionary savings, to a muted effect of the stabilization policy (Blundell 2009; Kinda, Lengyel, and Chahande 2022). Moreover, as many Germans were on short-time work schemes, their monthly income was significantly reduced. As the uncertainty about future income and employment prospects rises, uncertainty about future demand for certain goods (in particular, more expensive durable goods) increases as well. This reduces the value of bringing forward consumption and causes consumers to postpone spending to a period of lower uncertainty (Blundell 2009). Similar to Spilimbergo et al. (2008), we conjecture that a reduction of just a few percentage points (pp) in the VAT rate with unobservable pass-through might fail to offset the precautionary savings motive of households when consumers adopt a "wait and see"-approach in light of high uncertainty regarding their future wealth level.

Empirical evidence by Alloza (2022) shows that high levels of uncertainty can mute the response to increases in government spending. On the other hand, Kinda, Lengyel, and Chahande (2022) find a positive association between uncertainty and the magnitude of fiscal spending multipliers, in particular when uncertainty decreases over time (see also Bloom 2014; Bloom et al. 2018). Applying these results to the German VAT rate cut might be bad news in two regards. First, towards the end of 2020, uncertainty regarding the development of the crisis increased as Covid cases surged and the government tightened lockdown restrictions. Second, the stimulating effect of a temporary VAT rate reduction is most pronounced right before the return to normal rates. Hence, the previous results of Bloom (2014), Bloom et al. (2018), and Kinda, Lengyel, and Chahande (2022) apply only to a very limited extent (if at all) since the policy relies heavily on timing. On the other hand, direct transfers (e.g. the Kinderbonus or US stimulus cheques) could be saved by recipients and spent at a later date, providing at least a delayed stimulus.

3 Empirical Methodology

The aim of our paper is to analyze the (relative) efficacy of the German VAT cut during the Covid-19 pandemic. Hence, we consider this policy measure as a treatment

and study the effect of an intervention on a single aggregate outcome (i.e. consumption growth) by comparing it to a group of similar units that are not subject to treatment.[8] The average treatment effect on the treated (ATT) is defined as follows:

$$\text{ATT} = E[gC(1) \mid T = 1] - E[gC(0) \mid T = 1] \tag{1}$$

The treatment indicator T is a binary dummy variable that is equal to 1 for the treated unit and 0 for all others and gC is the consumption growth rate to the same quarter of the previous year. The ATT can be interpreted as the difference in Germany's observed consumption growth rate under the intervention ($E[gC(1)|T = 1]$) and the growth rate we would have observed in Germany without the adoption of the temporary VAT rate reduction ($E[gC(0)|T = 1]$). Since we cannot observe the latter, we need to design a proxy for the counterfactual German economy to estimate the effect of the VAT cut on consumer spending (relative to other fiscal measures).

The main difficulty of our analysis is to establish a research design that allows us to identify the causal effect of the intervention in the absence of a randomized experimental setting. To credibly attribute the change in private consumption during the treatment period to the VAT reduction, we must come up with a way to control for various factors that could potentially bias the estimate of the treatment effect. We try to solve the identification problem and to construct a credible counterfactual of Germany in a two-step procedure. First, we carry out a careful pre-selection of the donor pool countries to obtain a control group with a high similarity regarding important *post-treatment characteristics*. Second, we apply a reweighting scheme on the pre-selected donor countries so that systematic differences between Germany and the control units are removed and these are on virtually the same trajectory *before* the imposition of treatment. Hence, the synthetic control group should only differ from Germany in the way that it did not implement the temporary VAT rate reduction.

3.1 Step 1: Pre-selection Based on Post-treatment Characteristics

To interpret the treatment effect in a reasonable way, it is crucial to illustrate the assumptions we make about the counterfactual German economy. In our setup, the weighted control group cannot simply represent Germany without the VAT cut as most of the potential donor pool countries also implemented large-scale fiscal

8 Ever since Abadie and Gardeazabal (2003) developed the synthetic control method, the use of quantitative designs for policy evaluations and observational studies has become increasingly popular (see, e.g., Abadie, Diamond, and Hainmueller 2010; Born et al. 2021; Neuenkirch 2020).

measures to counter the consequences of the Covid-19 pandemic. To tackle these challenges, the matching procedure is applied on a carefully pre-selected pool of donor countries. Accordingly, the ideal synthetic control group should feature the same expenditures for the fiscal package (as % of GDP) as Germany and should only differ in a way that it did not implement the temporary VAT rate reduction. Put differently, we construct a counterfactual Germany based on the assumption that if Germany had not chosen the VAT cut as a specific policy to boost consumption, it would have been replaced by a different fiscal measure with the same expenditures (as % of GDP).[9]

Our starting point is a pool consisting of OECD countries and additional advanced East Asian non-OECD economies. In a first step, we select only those countries with a comparable fiscal package size during the treatment period. Furthermore, we remove those countries that also used wide-ranging temporary VAT rate reductions (e.g. Cyprus or Ireland) from the pool of potential donors. These countries are not suited for an analysis of the relative efficacy of the German VAT cut in comparison to countries with other fiscal measures of similar size. This exclusion yields a donor pool of 24 countries and is used for the benchmark estimations (specification Full in Table 1).[10]

To reduce the level of heterogeneity in the donor pool with respect to important post-treatment characteristics, we narrow it down along two different dimensions. Following our first exclusion criterion, we keep only those countries with a similar fiscal package size in both quarters of the treatment period (specification Excl. 1a in Table 1).[11] With our second exclusion criterion, we remove those countries that used comparable, but not full-scale VAT cut policies for non-medical products during the treatment period (specification Excl. 1b in Table 1). Lastly, we combine those two dimensions and leave only those countries in the donor pool with a similar fiscal package size during the treatment period, but no (partial) VAT rate reduction (specification Excl. 2 in Table 1).

The variation of the donor pool composition allows us to analyze the relative effectiveness of the different fiscal responses in the countries that make up the

9 Accordingly, our research design does not provide us an estimate for the *absolute* treatment effect of the policy. However, this question has been addressed using survey-based designs or DSGE models (cf. the literature cited in Section 1).

10 For that purpose, we rely on the category "additional spending or foregone revenues in the non-health sector (as % of GDP)" in the IMF Fiscal Monitor datasets of October 2020 and January 2021. Countries included in the donor pool require a fiscal package size within the range of ±4.5 pp around the German value in at least one quarter of the treatment period. This particular threshold value is chosen to ensure a donor pool that is sufficiently large and at the same time relatively homogeneous.

11 We keep only those countries whose fiscal package size was within the range of ±5.5 pp in both quarters of the intervention period (2020q3–2020q4).

Table 1: Pre-selection of donor pool countries.

Full: All Countries – Full donor pool of 24 advanced economies.
Australia, Austria, Belgium, Canada, Czechia, Denmark, France, Greece, Hong Kong, Israel, Italy, Japan, Latvia, Lithuania, Luxembourg, Netherlands, Norway, Poland, Singapore, Slovenia, Sweden, Switzerland, United Kingdom, United States.
Excl. 1a: Package Size – exclusion based on "different" fiscal package size.
Removes Denmark, Lithuania, Luxembourg, the Netherlands, Norway, and Sweden from the full donor pool. 18 countries are remaining.
Excl. 1b: Similar Policy – exclusion based on "similar" VAT reduction policies.
Removes Austria, Belgium, Czechia, Greece, Norway, and the United Kingdom from the full donor pool. 18 countries are remaining.
Excl. 2: Strict – Strict exclusion (combination of Excl. 1a and Excl. 1b).
Removes Austria, Belgium, Czechia, Denmark, Greece, Lithuania, Luxembourg, the Netherlands, Norway, Sweden, and the United Kingdom from the full donor pool. 13 countries are remaining.

counterfactual twin economy. This potential to gather evidence on the cost-effectiveness of the different fiscal measures is further exploited by various validation exercises outlined in Section 3.3. Finally, we compare Germany and the donor pool countries with respect to their lockdown stringency, Covid anxiety, and consumer confidence since post-treatment differences in these variables across countries might confound the interpretation of the treatment effect.

3.2 Step 2: Matching on Pre-treatment Characteristics

Relying on the four different specifications, we apply a reweighting scheme on the pre-selected donor countries so that systematic pre-treatment differences between Germany and the control units are removed. We achieve this by employing a matching procedure where we construct a single artificial twin economy ("synthetic control") from the donor pool that closely resembles the German economy just before the onset of the pandemic (2019q4) with respect to the covariates we suspect to influence the likelihood of being selected into treatment and that might, at the same time, influence the outcome variable of interest (see also the discussion in, e.g. Gutmann, Neuenkirch, and Neumeier 2021; Neuenkirch and Neumeier 2016). These variables are GDP per capita, the shares of private consumption and government spending relative to GDP, as well as the growth rates of real GDP and private consumption to the same quarter in the previous year and three years ago.[12] The

12 Data is taken from the OECD, the IMF, and national statistical offices.

synthetic control is obtained by reweighting the group of donor pool countries so that covariate balance between the treated and untreated units is achieved.[13] Put differently, we remove systematic differences between the treated and the control units and ensure that these are on virtually the same trajectory before the imposition of treatment, in particular due to the usage of the three-year growth rates.

By matching on these covariates, we obtain a synthetic control that is highly similar to Germany regarding its pre-treatment characteristics, allowing us to attribute the differences in the observations of our variable of interest between the two groups to the effect of the treatment. Hence, we mimic a random selection into treatment and control for the influence of these confounders on our estimated ATT:

$$\widehat{\text{ATT}} = E[gC(1) \mid T = 1, X = x] - E[gC(0) \mid T = 0, X = x] \tag{2}$$

The vector x contains the matching covariates. The weights for the construction of the synthetic control are obtained via entropy balancing, a pre-processing method designed by Hainmueller (2012) that employs a reweighting scheme to achieve covariate balance in observational studies with binary treatments. As we match on the last observation before the outbreak of the Covid-19 pandemic, we construct a synthetic twin economy that closely resembles Germany in terms of its macroeconomic situation just before the health shock hit all (developed) countries worldwide. Put differently, the weights are chosen to create a doppelganger that is as similar as possible to Germany. At the same time, the weights should be as close as possible to uniform base weights.

3.3 Extensions and Robustness Tests

Apart from estimating the ATT of Germany's VAT rate reduction, we conduct several alternative analyses to evaluate the robustness of our results and to increase the credibility of our causal interpretation. These validation exercises also help us to gain insights about and to foster the discussion on the relative effectiveness of the different emergency fiscal policy measures.

First, we use placebo tests to validate our findings. In most settings, no effect should be found in the absence of treatment (Eggers, Tuñon, and Dafoe 2021). This means that we should not detect a significant difference between Germany and its doppelganger before the treatment was in place. Such a test is particularly important in our setting, since we match on the last observation before the onset of the Covid-19 pandemic (2019q4), but our treatment period is 2020q3–2020q4. Hence, we carry out

13 It has to be noted that it is difficult to consistently achieve covariate balance with more than these seven covariates in a donor pool of 13–24 countries.

placebo tests for 2020q1 and 2020q2 to check whether Germany's consumer spending was affected differently by the pandemic shock than that of the synthetic control.[14] The same tests are carried out for 2021q1 and 2021q2. However, as a temporary tax cut works through an income effect and an intertemporal substitution effect, we expect a part of the consumer spending that would normally happen in 2021 to be brought forward to the period with the tax cut in place.

Second, as suggested by Abadie (2021) and implemented in Abadie, Diamond, and Hainmueller (2015), Barber and West (2022), and Cho (2020), we conduct a "leave-one-out" analysis, where one country at a time is excluded from the donor pool and the analysis is repeated, all else being equal. Should the exclusion of a certain country from the donor pool lead to substantial changes in the direction or magnitude of the estimated treatment effect (while the alternative twin economy remains a good match for Germany), we investigate the economic situation and the policy response of the excluded country during the treatment period more closely. This exercise is used to gather evidence on the cost-effectiveness of the different fiscal measures and to provide policy advice on which measure(s) provided the greatest "bang for the buck."

4 Empirical Results

4.1 Descriptive Statistics

The upper panel of Table 2 shows the descriptive statistics for Germany and an equally weighted average of the 24 countries in the full donor pool prior to the pandemic (in 2019q4). There are no statistically significant differences for the variables GDP per capita, the consumption to GDP ratio, and the one-year growth rates of real GDP and consumption. However, Germany appears to be on a different growth and consumption trajectory compared to the average donor pool country, while also having a different level of government spending.

The lower panel of Table 2 illustrates how closely the synthetic control resembles Germany's economy when relying on the broadest donor pool of 24 countries as there are no longer significant differences in the means of the two groups. Despite the small sample size and our choice to match on seven covariates, the weights obtained by the entropy balancing procedure allow us to construct synthetic controls that are successful in replicating Germany's macroeconomic situation and trajectory before the pandemic. This also holds for the three other donor pools, with only a minor difference in the three-year growth rate of real GDP remaining in the case of the

14 Alternatively, one could interpret the onset of the pandemic as another "treatment."

Table 2: Covariate balancing: full donor pool.

	(1) Germany	(2a) unweighted control	(3a) = (2a) − (1) difference	
Y (pc in 1000 USD)	56.27	53.27	−3.01	[0.48]
C/Y	0.517	0.534	0.017	[0.35]
G/Y (annual value 2019)	0.443	0.399	−0.044	[0.03]
gY (1-year)	0.894	1.554	0.660	[0.08]
gC (1-year)	2.486	2.611	0.125	[0.78]
gY (3-year)	4.642	6.715	2.073	[0.01]
gC (3-year)	8.359	10.531	2.172	[0.03]
	(1) Germany	**(2b) weighted control**	**(3b) = (2b) − (1) difference**	
Y (pc in 1000 USD)	56.27	55.72	−0.55	[0.90]
C/Y	0.517	0.520	0.003	[0.88]
G/Y (annual value 2019)	0.443	0.436	−0.007	[0.62]
gY (1-year)	0.894	1.010	0.116	[0.67]
gC (1-year)	2.486	2.513	0.027	[0.94]
gY (3-year)	4.642	5.008	0.366	[0.42]
gC (3-year)	8.359	8.742	0.383	[0.59]

Column (1) shows the conditions in Germany in 2019q4 and column (2a) the corresponding average conditions in the unweighted control group. Column (3a) displays the difference between (2a) and (1) with the *p*-value of a *t*-test in brackets. Column (2b) shows the average conditions in the synthetic control group (obtained using entropy balancing and the full donor pool) and Column (3b) displays the difference between (2b) and (1) with the *p*-value of a *t*-test in brackets. *Y*, real GDP; *C*, private consumption; *G*, government spending; *gY*, growth rate of real GDP; *gG*, growth rate of private consumption.

pre-selection based on the fiscal package size (Excl. 1a) and the strict pre-selection (Excl. 2).[15] However, this should not be a concern as Germany is on virtually the same consumption trajectory when compared to its doppelganger (see also Figure 1 below).

Table 3 shows the composition of Germany's doppelganger for all four donor pools. The five countries with the largest weights are highlighted in bold. Without any further pre-selection (column Full), Denmark (27.5 %), the Netherlands (14.2 %), Greece (12.1 %), Canada (9.3 %), and Japan (7.9 %) are most fitting to replicate the macroeconomic situation of Germany in 2019q4. Canada remains among the most important donors for all specifications. When restricting the donor pool, other countries like Australia, Austria, or France are stepping in and receive larger weights.

15 Results are not included for brevity, but are available upon request.

Table 3: Weights obtained using entropy balancing.

	Full: All Countries	Excl. 1a: Package Size	Excl. 1b: Similar Policy	Excl. 2: Strict
Australia	0.006	0.015	0.021	**0.234**
Austria	0.015	**0.228**	–	–
Belgium	0.018	**0.122**	–	–
Canada	**0.093**	**0.443**	**0.135**	**0.210**
Czechia	0.006	0.005	–	–
Denmark	**0.275**	–	**0.228**	–
France	0.010	0.048	0.021	**0.362**
Greece	**0.121**	0.000	–	–
Hong Kong	0.022	0.004	0.000	**0.097**
Israel	0.001	0.000	0.004	0.008
Italy	0.063	0.006	**0.159**	0.014
Japan	**0.079**	**0.076**	**0.097**	0.000
Latvia	0.000	0.000	0.000	0.019
Lithuania	0.001	–	0.002	–
Luxembourg	0.057	–	0.034	–
Netherlands	**0.142**	–	**0.187**	–
Norway	0.015	–	–	–
Poland	0.002	0.000	0.001	0.029
Singapore	0.022	0.051	0.009	**0.104**
Slovenia	0.000	0.000	0.000	0.006
Sweden	0.027	–	0.025	–
Switzerland	0.000	**0.066**	0.001	0.010
United Kingdom	0.015	0.000	–	–
United States	0.021	0.016	0.083	0.008

Table shows the composition of the synthetic control group based on entropy balancing and the different donor pools. "Excl. 1a: Package Size" removes countries whose fiscal package size was outside the range of ±5.5 pp in one quarter of the intervention period (2020q3–2020q4). "Excl. 1b: Similar Policy" removes countries that used comparable, but not full-scale VAT cut policies for non-medical products during the treatment period. "Excl. 2: Strict" combines the two restrictions. '–' indicates that the respective country was manually excluded. For each donor pool, the five countries with the largest weights are highlighted in bold.

This changing composition of the donor pool is of particular interest for our analysis of the relative efficacy of the German VAT rate cut. While all countries tried to dampen the adverse effects of Covid-19 on the economy, their responses were different regarding the measures used and the size of the stimulus package. For instance, Denmark, Canada, and Japan focused on direct transfers and payments to households to stimulate the economy, whereas Greece also adopted temporary VAT rate reductions for several sectors of their economy (e.g. tourism).[16] Hence, the ATTs

16 See, for instance, the IMF Fiscal Monitor Database of Country Fiscal Measures in Response to the Covid-19 Pandemic (https://www.imf.org/en/Topics/imf-and-covid19/Fiscal-Policies-Database-in-Response-to-COVID-19).

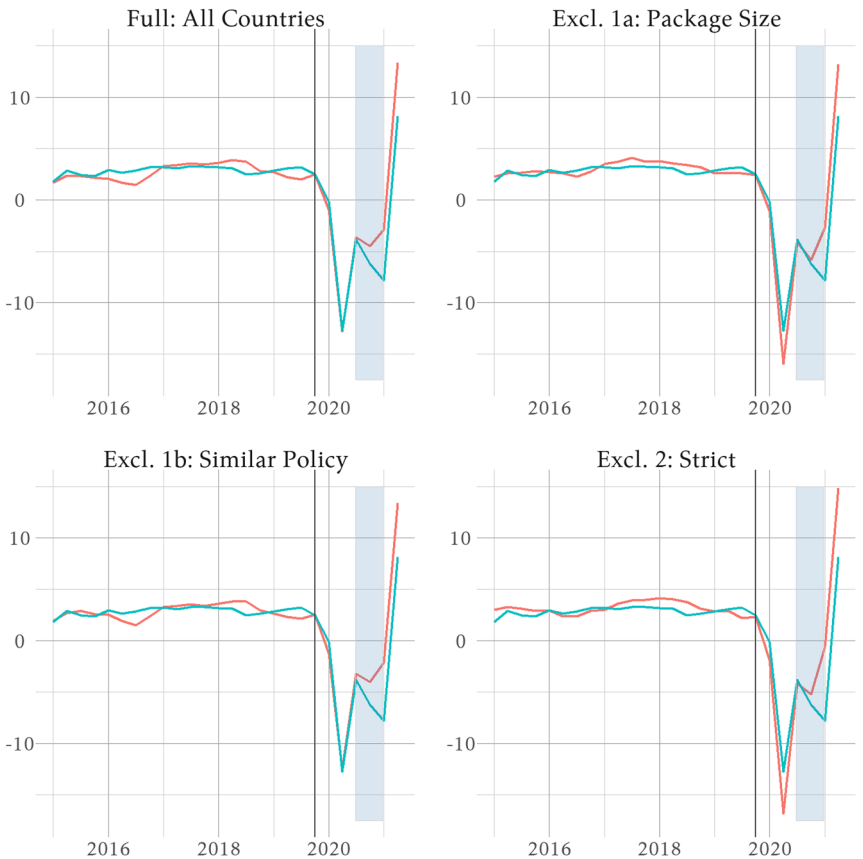

Figure 1: Consumption growth rates: Germany versus synthetic control group. Figure shows the trajectories of the year-over-year consumption growth rates for Germany (observed values, blue line) and the synthetic control group (weighted average, red line) based on the four donor pools. "Excl. 1a: Package Size" removes countries whose fiscal package size was outside the range of ±5.5 pp in one quarter of the intervention period (2020q3–2020q4). "Excl. 1b: Similar Policy" removes countries that used comparable, but not full-scale VAT cut policies for non-medical products during the treatment period. "Excl. 2: Strict" combines the two restrictions. The grey line indicates 2019q4, that is, the observation used in the entropy balancing algorithm. The blue bar highlights the treatment period (2020q3–2020q4).

based on different donor pools (in the next subsection) might reveal interesting insights. This will be complemented by a "leave-one-out" analysis in Section 4.3 where we check if the exclusion of a particular country from the full donor pool (substantially) changes the ATT.

4.2 Baseline Results

Figure 1 shows, based on the different donor pools, the trajectories of Germany (blue line) and its twin economy (red line) for the period 2015q1–2021q2. With each specification of the donor pool, Germany and the weighted control group were virtually identical in their consumption growth rate in the last observation before the outbreak of the pandemic (indicated by the grey vertical lines) and also on the same consumption growth trajectory before 2019q4. This corroborates the efficacy of the entropy balancing algorithm in harmonizing the pre-treatment macroeconomic conditions in Germany and its doppelganger.

Table 4 shows the ATTs for the period 2020q1–2021q2 for the four different donor pools alongside standard errors in parentheses and *p*-values in brackets. In the case of the full donor pool and the group that excludes other countries that adopted partial VAT rate reductions during the treatment period (Excl. 1b), the placebo tests

Table 4: Average treatment effects on the treated.

	Full: All Countries	Excl. 1a: Package Size	Excl. 1b: Similar Policy	Excl. 2: Strict
2020q1	0.844	**0.952**	1.103	1.703
(Placebo)	(0.557)	(0.425)	(0.679)	(1.059)
	[0.13]	[0.04]	[0.12]	[0.14]
2020q2	0.032	**3.205**	−0.220	**4.060**
(Placebo)	(1.262)	(0.964)	(1.316)	(1.379)
	[0.98]	[0.00]	[0.86]	[0.02]
2020q3	−0.192	0.280	−0.610	0.349
(Treatment)	(0.909)	(0.577)	(0.865)	(1.223)
	[0.84]	[0.64]	[0.47]	[0.78]
2020q4	**−1.773**	−0.411	**−2.223**	−1.039
(Treatment)	(0.787)	(0.650)	(0.811)	(0.798)
	[0.04]	[0.53]	[0.02]	[0.23]
2021q1	**−4.957**	**−5.181**	**−5.713**	**−7.279**
(Placebo)	(0.568)	(0.488)	(0.628)	(0.791)
	[0.00]	[0.00]	[0.00]	[0.00]
2021q2	**−5.191**	**−5.045**	**−5.189**	**−6.656**
(Placebo)	(0.814)	(0.842)	(0.882)	(0.876)
	[0.00]	[0.00]	[0.00]	[0.00]

Table shows the average treatment effects on the treated (in percentage points) based on the four synthetic control groups. “Excl. 1a: Package Size” removes countries whose fiscal package size was outside the range of ±5.5 pp in one quarter of the intervention period (2020q3–2020q4). “Excl. 1b: Similar Policy” removes countries that used comparable, but not full-scale VAT cut policies for non-medical products during the treatment period. “Excl. 2: Strict” combines the two restrictions. Standard errors are in parentheses and *p*-values in brackets. ATTs that are significant at the 5 % level are highlighted in bold.

for the first two quarters of 2020 are not significant, indicating that consumer spending initially reacted very similarly to the Covid-19 shock in both groups. The estimated effect of the actual intervention is significantly negative in 2020q4 if no countries (–1.77pp, column Full) or only those countries with a similar measure (–2.22pp, Excl. 1b) are excluded from the donor pool, indicating that a VAT rate cut (and not only the large-scale one implemented in Germany) was relatively ineffective compared to the policy response of the twin economy.

The relative inefficiency of the German VAT rate cut becomes even more striking when considering the actual sizes of the fiscal packages (as % of GDP) in Germany and in the four synthetic control groups (see Table A1 in the Appendix). Indeed, the size of the fiscal package in Germany is numerically larger in 2020q3 and significantly larger in 2020q4 when compared to the weighted averages of the full donor pool and the specification based on Excl. 1b. Hence, we find negative treatment effects for these two specifications in 2020q4 despite smaller expenditures in the synthetic control groups.

In the group where only those countries with a similar fiscal stimulus size are included (Excl. 1a), both placebo tests are significant at the 5 % level with a positive ATT and in the group based on the strict pre-selection (Excl. 2), we observe a significant positive ATT for 2020q2. This implies that Germany – when compared to its doppelganger based on these two donor pools – was initially hit less severely by the Covid shock, as indicated by a smaller decline in consumption. For both specifications, we find no statistically significant estimates of the ATT in the treatment period.

The results for the placebo tests in 2021q1 and 2021q2 appear most striking. Irrespective of the specification, these indicate that Germany's consumption did not recover nearly as well as that of its doppelganger in the first half of 2021 as we observe a relative difference in the consumption growth rate (to the previous year's quarter) between –4.96pp and –7.28pp. There are several possible explanations for this result. As previously illustrated in Sections 2 and 3, negative estimates for the placebo tests in the post-treatment period are not too surprising, as we expect that Germany's consumers brought forward some purchases to benefit from the VAT rate reduction. This implies, however, that consumption in Germany would have decreased to even lower levels in the second half of 2020 without the VAT cut policy. A part of this large difference might also be explained by a level effect and the positive placebo tests in the first half of 2020 as some of the other countries had more catching-up potential in the post-treatment period. Nevertheless, this only holds to some extent for specifications Excl. 1a and Excl. 2 and the magnitude of the difference between Germany's consumption growth rate and that of its twin economy still appears noticeable.

4.3 Extensions and Robustness Tests

4.3.1 Post-treatment Confounders

To rule out that the negative ATTs are a statistical artefact, we compare Germany with its counterfactual during the treatment period with regard to potentially confounding factors. We expect *lockdown stringency* to be an important post-treatment confounder and evaluate ex-post whether the restrictions on public life in Germany and the counterfactual Germany were balanced during the treatment period to ensure that the negative ATTs cannot be explained by differences in this variable. Figure A1 in the Appendix shows the lockdown stringency index (Hale et al. 2021) in Germany (blue line) and the synthetic control group (red line) based on the four donor pools.

Lockdown stringency was quite moderate (as compared to 2020q2) and stable throughout 2020q3 and hardly differed between Germany and the weighted control groups. In fact, in the control group based on the strict pre-selection, lockdown stringency was consistently higher than in Germany in 2020q3. However, as cases surged in Germany during the fall of 2020, stricter lockdown measures were imposed, and from December 2020 onwards, lockdown stringency was (significantly) higher in Germany than in the four donor pool specifications. As previously mentioned, the success of VAT rate reductions depends crucially on timing as the induced intertemporal substitution effect is expected to be largest right before the return to normal rates. Therefore, we conclude that at least some of the stimulating potential of the VAT cut policy was muted by restrictions on spending. Moreover, this may partially explain the large magnitude of the negative ATTs in 2021.

In addition, *sentiment* could have played a role in the ability to stimulate demand during the crisis. Hence, we check if German consumers were more pessimistic or anxious than consumers of the counterfactual Germany. Even under equal lockdown and infection dynamics, differences in household spending could have occurred if consumers in Germany were more anxious of being infected compared to those in the twin economy and thus decided to limit their visits of shops, restaurants, or other crowded places in order to limit their exposure to the virus. In fact, recent findings from Germany (Bachmann, Bayer, and Kornejew 2023a) and the U.S. (Goolsbee and Syverson 2021) imply that government induced restrictions impacted households' consumption response only moderately and that in regions with lax regulations people voluntarily decreased their consumption levels to reduce their infection risk.[17] Thus, higher infection rates in laissez-faire regimes could have induced the

17 In particular the consumption of "non-essential" goods and services that could be easily postponed, such as social consumption and spending on durables, was affected by fears of infection. The

same decline in consumption through health-conscious consumer behavior as strict lockdown measures (Bachmann, Bayer, and Kornejew 2023a).[18] To approximate a health-related sentiment or anxiety component, we create a Covid-worries index based on data by Hensel et al. (2022) for Germany and its twin economy. Based on survey data from March and April 2020, we find that Covid-related anxiety in Germany was significantly lower than in the synthetic control group.[19]

To cover the economic sentiment component, we compare the consumer confidence in Germany and the control group during the treatment period based on the OECD consumer confidence index. Figure A2 in the Appendix shows the consumer confidence index in Germany (blue line) and the synthetic control group (red line) based on the four donor pools.[20] While Germany's economic sentiment was more positive throughout the whole treatment period, this changed in January 2021 for the full donor pool and the donor pool where countries with a partial VAT cut are excluded (Excl. 1b). More interestingly, we can observe that Germany's consumer confidence started declining from September 2020 onward and rebounded only in the beginning of 2021, albeit at lower levels as compared to the counterfactual (with the specification based on Excl. 1a being the only exception).

To summarize, we find that German consumers were more optimistic during the treatment period and on a similar upward trajectory in the post-treatment period in terms of their economic confidence. In addition, there is no evidence for a higher level of Covid anxiety in the period shortly before the VAT cut. Hence, our results do not indicate that the relatively bad performance of the German economy during the treatment period and thereafter can be explained by overly cautious consumer sentiment or Covid anxiety. This is also in line with the survey results of Christelis et al. (2020) who find that German and Dutch consumers had lower levels of concern compared to those in other European countries regarding the financial impact of Covid-19 and health-related issues. In fact, the more positive sentiment might have even (partially) offset the impact of the stricter lockdown measures on the relative performance of the German economy.

health shock thus led to significant changes in consumption patterns, shifting consumer visits away from more contact-intensive and risky sectors to "essential" businesses such as grocery stores (Bachmann, Bayer, and Kornejew 2023a; Goolsbee and Syverson 2021).

18 Indeed, Covid-19 infections in the control group were on average higher towards the end of 2020, implying higher rates of voluntary reductions of consumption in Germany.

19 Unfortunately, this dataset does not cover the level of anxiety later in 2020 or in early-2021.

20 Due to issues with data availability, Norway, Singapore, and Hong Kong are excluded for the construction of the weighted average of the consumer confidence index.

4.3.2 Leave-One-Out Analysis

Figure 2 shows the estimated ATTs of Germany's VAT rate reduction for 2020q3 (left panel) and 2020q4 (right panel) alongside 95 % confidence intervals. The top ATTs are from the previous subsection, followed by the ATTs from the "leave-one-out" analysis (where the label represents the excluded country), and an ATT where Canada, Denmark, Japan, Sweden, and the United States are jointly excluded from the full donor pool.[21] The ATTs in blue (red) are (not) significant at the 5 % level and the dashed lines indicate the point estimates from the analysis without further pre-selection (specification Full) as a reference point.

In 2020q3, the ATT is quite robust to changes in the composition of the donor pool. For all but two specifications, the ATT is close to zero and insignificant, although the effect is larger (and even slightly positive) when comparing Germany only to those countries with a similar fiscal package size or those remaining after the strict pre-selection. The only noticeable difference can be found when Denmark is excluded from the benchmark donor pool. In this case, the estimated ATT for Germany turns positive, indicating that the negative effect of the health shock on the Danish economy was less pronounced.

For 2020q4, we obtain significantly negative ATTs in most of the specifications. Noticeable exceptions are – as already documented in Table 4 – the ATTs according to donor pools with a similar fiscal package size (Excl. 1a) and based on strict exclusion (Excl. 2). Of particular interest are the ATTs when excluding Canada, Denmark, Japan, Sweden, or the United States as these are no longer significantly negative at the 5 % level. Hence, these five countries (in particular, Denmark and Japan) appear to drive the overall negative effect of Germany's ATT in 2020q4.

As a consequence, we remove these five countries jointly from the full donor pool and reestimate the ATT. When relying on such a restriction, the relative effect of Germany's temporary VAT cut turns significantly positive in 2020q3 (1.86pp, p-value <0.01) and 2020q4 (1.04pp, p-value = 0.04). Put differently, the fiscal packages of Canada, Denmark, Japan, and the United States – that mostly focused on direct transfers to stimulate consumption – appear to be particularly effective, which is why we provide a detailed discussion of these and the "special" situation in Sweden in Section 5.

5 Discussion

When interpreting the results, one has to keep in mind that it is challenging to identify the causal effect of a specific policy, given that most countries used (different) measures

21 It has to be noted that covariate balance is hardly affected by the exclusion of a country or the five countries altogether.

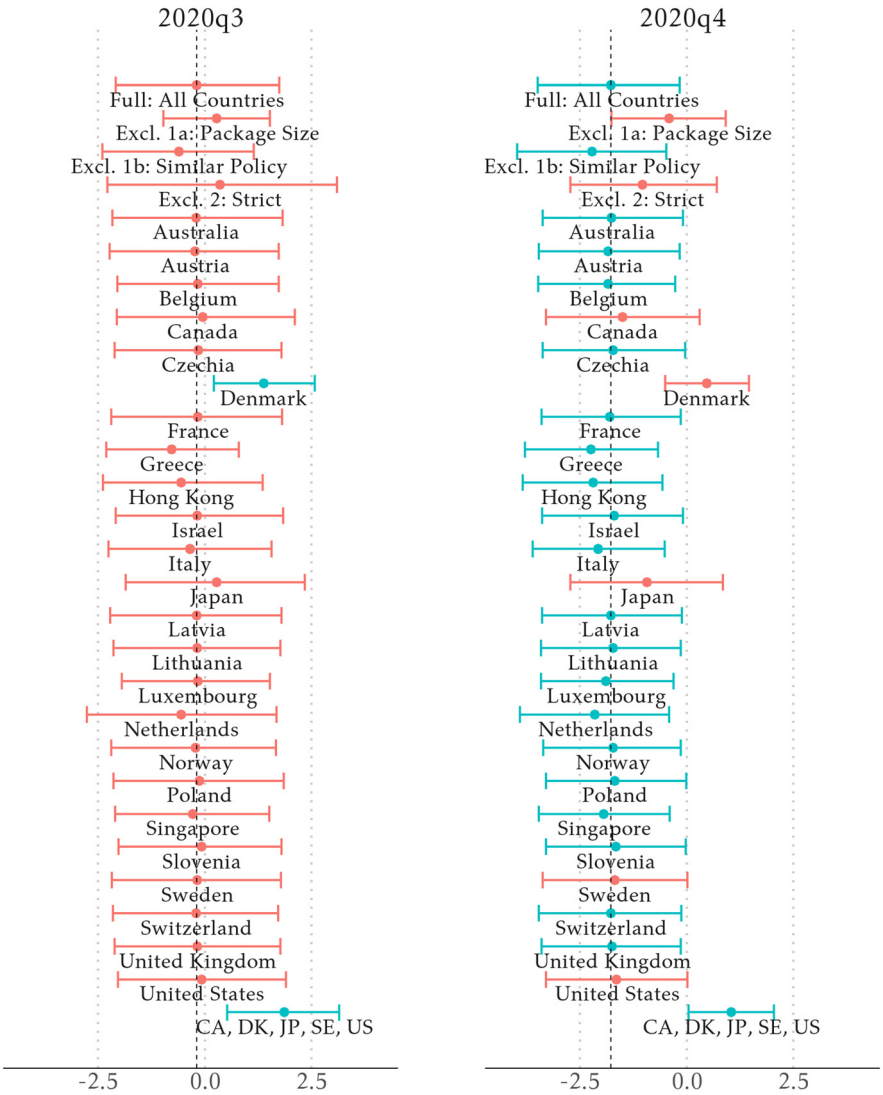

Figure 2: Average treatment effects: robustness tests. Figure shows the estimated ATTs of Germany's VAT rate reduction for 2020q3 (left panel) and 2020q4 (right panel) alongside 95 % confidence intervals. The names below the ATTs refer to the countries omitted in the leave-one-out analysis. ATTs in blue (red) are (not) significant at the 5 % level. The dashed lines indicate the ATTs from the analysis without further pre-selection (specification full) as a reference point.

to stimulate consumption. We can, however, conclude that the German policy response was not significantly more or less effective in boosting consumption during 2020q3 and 2020q4 compared to those countries whose fiscal stimulus size was very similar (Excl. 1a). The ATT obtained after the strict pre-selection (Excl. 2) can be interpreted as the estimated effect of the policy when we compare Germany only to those units that did not adopt any VAT rate reductions while still spending similar amounts for their fiscal stimulus package. Similar to the specification based on Excl. 1a, we do not find a significantly negative ATT.

Given the fact that in both treatment quarters, the ATT is lowest when we compare Germany only to those countries that relied on measures other than (partial) VAT reductions (Excl. 1b), we conclude that the cost-effectiveness of temporary VAT rate reductions for stimulating consumption is inferior to the use of other measures such as (targeted) direct cash transfers. This is corroborated by the results of the "leave-one-out" analysis, which indicates a particular sensitivity of the estimated ATT once we exclude Canada, Denmark, Japan, Sweden, the United States, or all five countries at the same time from the donor pool. Accordingly, we complement our quantitative analysis with a qualitative assessment of the different (fiscal) policy responses of the aforementioned five countries.

5.1 Denmark

How did Denmark respond to the Covid shock and what did it do differently than Germany? According to Andersen (2021), Denmark's health outcomes during the pandemic and the economic situation before the pandemic were favorable in comparison to most OECD countries, which might have positively affected the resilience of private consumption.[22] However, we suspect Denmark's successful stimulus to be largely owed to the "unfreezing" of holiday pay. To offer a quick relief solution for households and to dampen the economic downturn, Danish authorities allowed workers to request a part of their frozen holiday pay in Autumn 2020 and the rest at the beginning of 2021. According to the Danish Ministry of Employment (2021), a total of 31.3 billion DKK of holiday money after taxes was paid out to Danish workers in 2020 (approximately 1.4 % of GDP). We conjecture that a substantial share of those payments was promptly used for consumption purposes since these transfers were

22 In fact, Denmark's consumption growth rates were even positive at 2.04 % in 2020q3 (Germany: −3.82 %) and 0.19 % in 2020q4 (Germany: −6.24 %).

only made on request. Hence, Denmark employed a relatively easy-to-understand (potential) transfer payment that could particularly be helpful for financially constrained consumers. However, only the coincidental change in the Danish holiday pay system made this "clever" measure possible.[23]

5.2 Canada and the United States

In Canada and the United States, policymakers reacted to the (large) drop in consumption induced by the Covid shock with conventional fiscal policy measures.[24] Governments offered large financial support to citizens via direct transfer payments that especially targeted low- and middle-income households.[25] For the US, the aggregate MPC out of the stimulus income was estimated at 0.35 in the month after receiving the transfer (Baker et al. 2020). Similarly, survey results from Coibion, Gorodnichenko, and Weber (2020) indicate an MPC of around 0.4 between April and July 2020. Most strikingly, the MPC of individuals with large balances on their bank accounts was significantly smaller at 0.1 compared to liquidity-constrained individuals with less than 100 USD on their bank accounts, whose MPC was estimated to be above 0.4 (Baker et al. 2020).

23 Denmark reformed its holiday allowance payment scheme just before the outbreak of the pandemic. Previously, workers accrued their holiday allowances, meaning that a part of their current salary (usually 12.5 %) was reserved as holiday pay for the following year, which was not in accordance with EU regulations. The required change to a simultaneous payment scheme would have caused a double pay-out in the year of the change. This prompted policymakers to freeze one year's worth of holiday allowance for each worker in a government fund that was supposed to be returned to workers when these left the (Danish) labour force.

24 In the US, the consumption growth rates were substantially higher in both treatment quarters (–1.63 % in 2020q3 and –1.28 % in 2020q4) when compared to Germany (cf. note 22). In Canada, the value was roughly the same as in Germany in 2020q3 (–3.85 %) and around 2pp higher in 2020q4 (–4.18 %).

25 According to the Canadian Department of Finance (2021), more than 12 million individuals and families received support in form of special "top-up" payments. Adults received, on average, 400 CAD with additional one-time transfers of 300 CAD per child. Moreover, seniors were eligible to receive a one-time tax-free payment of 300 CAD and parts of this group could have obtained another 200 CAD via the "Guaranteed Income Supplement" program or a special top-up payment of 375 CAD (on average). As part of the US CARES Act, stimulus cheques were distributed to most American households in April and May 2020. Recipients were provided 1200 USD per adult and an additional 500 USD for every child under the age of 17. The payments were phased out at income levels over 75,000 USD per individual and singles who earned more than 99,000 USD did not receive the transfers (Coibion, Gorodnichenko, and Weber 2020).

5.3 Japan

The Japanese response was special as it was the only case of large unconditional transfer payments to stimulate consumption. Recipients were given a cash transfer of 100,000 YEN, which is equivalent to 42 % of the median monthly income of full-time workers. These cash transfers were distributed between May and August 2020 irrespective of age, income, and employment status of recipients (Kaneda, Kubota, and Tanaka 2021). It is not surprising that this policy resulted in a lower average MPC out of transfer income as compared to the US, since these transfers were completely untargeted and households with high income and high liquidity are not expected to react substantially to a one-time increase in income. In fact, the estimated MPC ranges between 0.1 (Hattori, Komura, and Unayama 2021, during the first month after the reception) and 0.16 (Kaneda, Kubota, and Tanaka 2021, for the period of six weeks after the reception). Similar to the US stimulus cheques, both papers find that liquidity constrained households reacted more to the cash transfers than unconstrained recipients.[26] Hence, this indicates a lower cost-effectiveness of the Japanese unconditional transfers compared to the US (and Canadian) stimulus cheques or, put differently, larger multipliers for targeted transfers. Yet, the unconditional lump-sum transfer likely caused fewer administrative costs than the targeted ones.

5.4 Sweden

Compared to most advanced economies, Sweden adopted loose lockdown measures and mostly continued "business as usual." Accordingly, we believe that the better performance of the Swedish economy can be largely attributed to consumers facing fewer limitations to spend. Moreover, Swedish consumers were quite optimistic (with respect to economic and health-related indicators) throughout the pandemic and the overall decline of private consumption was less pronounced compared to Germany and most other countries in the donor pool.[27]

26 These results are also in line with the survey results from Albuquerque and Green (2022) that indicate an MPC of 0.11 for an untargeted hypothetical transfer of 500 pounds in the United Kingdom.
27 In fact, Sweden scored the lowest value (most optimistic) regarding our health-related sentiment indicator.

6 Conclusions

In this paper, we provide a comparative evaluation of fiscal stabilization strategies during the Covid-19 pandemic. For this purpose, we use Germany's temporary value-added tax rate reduction as a reference point in a two-step research design. First, we carry out a careful pre-selection of the donor pool countries to obtain a control group with a high similarity regarding important post-treatment characteristics. Second, we apply a reweighting scheme on the pre-selected donor countries so that systematic differences between Germany and the control units are removed and these are on virtually the same trajectory before the imposition of the treatment. Hence, the synthetic control group only differs from Germany in the way that it did not implement the temporary VAT rate reduction, which allows us to evaluate the relative cost-effectiveness of this specific (unconventional) fiscal policy measure.

Our results indicate an insignificant, yet slightly negative average treatment effect of the intervention in 2020q3 and a significantly negative estimate for 2020q4 that further increases in size when countries that used VAT rate reductions in some sectors are excluded from the donor pool. This holds despite the fact that the German fiscal package was even larger when compared to the counterfactual. Hence, we conclude that the German VAT cut policy and partial VAT reductions in other countries were less cost-effective compared to other measures such as (targeted) direct cash transfers. Moreover, placebo tests for 2021q1 and 2021q2 show that Germany's consumption did not recover nearly as well as that of the control group. This implies that German consumers brought forward some purchases to benefit from the VAT reduction. Put differently, consumption in Germany would have decreased to even lower levels in the second half of 2020 without the tax cut policy.

Our robustness tests indicate that the relatively bad performance of the German economy during the treatment period and thereafter cannot be explained by overly cautious consumer sentiment or Covid anxiety. However, the surge of Covid cases at the end of 2020 in Germany alongside stricter lockdown measures (as compared to the counterfactual) might have contributed to the relative ineffectiveness of the German VAT cut and further slowed down the recovery. Moreover, our extensions indicate a particular sensitivity of the estimated treatment effect to the exclusion of countries that implemented (targeted) direct fiscal transfers (e.g. implemented in Canada, Denmark, Japan, and the United States). This corroborates our theoretical considerations that unconventional fiscal policies are inferior tools compared to direct transfer payments when it comes to stimulating aggregate demand (during deep recessions). We attribute this to a multitude of factors. First, the

pass-through of the VAT rate cut might be imperfect. Second, this measure is relatively less comprehensible and salient when compared to direct transfer payments. Third, consumers facing saving, credit, or liquidity constraints are limited in their ability to respond to a VAT rate reduction. Finally, the measure depends heavily on timing since the intertemporal substitution effect builds up over time and reaches its maximum right before the increase in the VAT rate. At that time, however, stricter lockdown measures had been re-implemented, muting a part of the response, also in light of the increased uncertainty induced by unclear future economic prospects.

Our paper focuses on the response of aggregate consumption to the VAT cut (and other fiscal policy measures). However, little is known about the distributional aspects of temporary VAT cuts. Crossley, Low, and Wakefield (2009) find the temporary VAT reduction in the UK during the Global Financial Crisis to be slightly regressive, a finding which is corroborated by Behringer, Dullien, and Gechert (2021) for the German VAT cut. On the other hand, Bachmann et al. (2021) detect a progressiveness of the measure in the German case.[28] As stated by D'Acunto et al. (2021), more complex measures have low take-up rates among consumers that are below the top of the distribution of cognitive abilities. Keeping in mind that cognitive abilities and income are typically positively correlated, the higher complexity of the VAT rate reduction in comparison to simpler measures might favor high-income households. Yet, survey results by Bachmann et al. (2021) indicate that in particular poorer households reacted to the VAT cut. Hence, in light of this scant and mixed evidence, analyzing the distributional effects of different fiscal policies in response to the Covid-19 shock could be an interesting avenue for future research.

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28 It has to be noted that the reduced rate was lowered as well in the German case (but not in the UK case). The reduction of prices for basic needs items could indeed be particularly helpful for low-income households.

Appendix

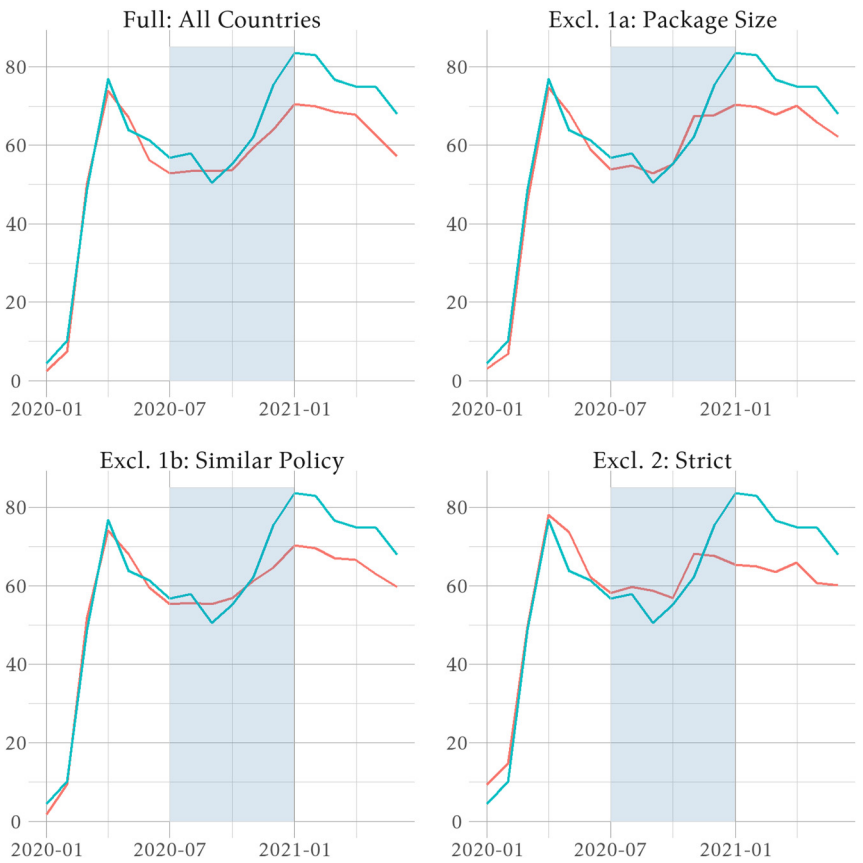

Figure A1: Lockdown stringency: Germany versus synthetic control group. Figure shows the trajectories of the lockdown stringency index (Hale et al. 2021) for Germany (observed values, blue line) and the synthetic control group (weighted average, red line) based on the four donor pools. "Excl. 1a: Package Size" removes countries whose fiscal package size was outside the range of ±5.5 pp in one quarter of the intervention period (2020q3–2020q4). "Excl. 1b: Similar Policy" removes countries that used comparable, but not full-scale VAT cut policies for non-medical products during the treatment period. "Excl. 2: Strict" combines the two restrictions. The blue bar highlights the treatment period (2020q3–2020q4).

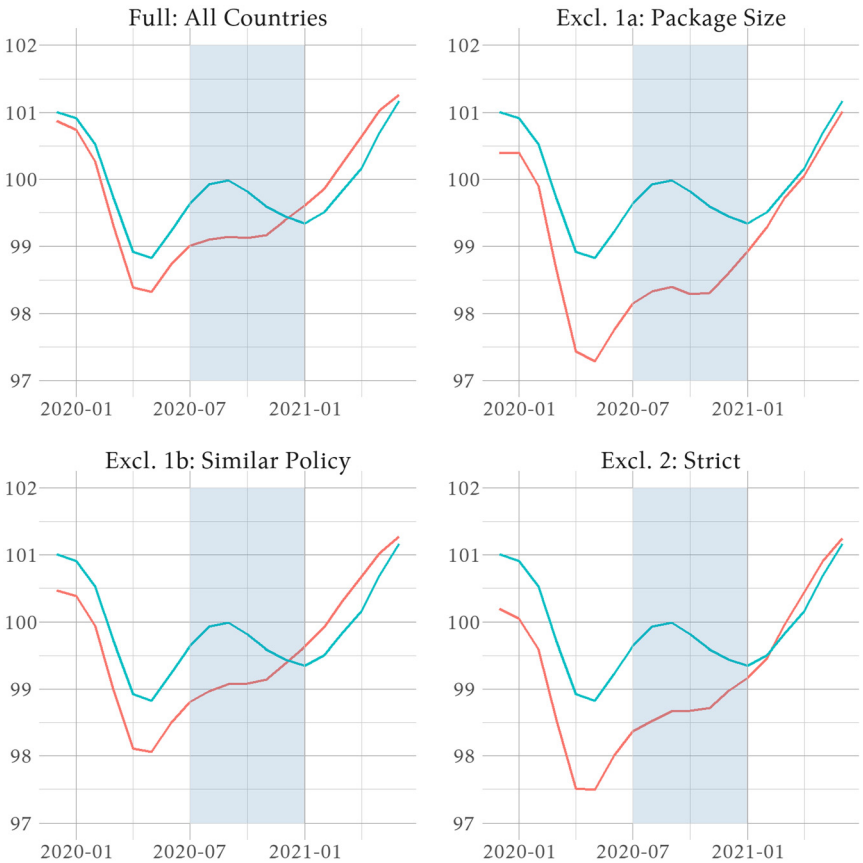

Figure A2: Consumer confidence: Germany versus synthetic control group. Figure shows the trajectories of the OECD's consumer confidence index for Germany (observed values, blue line) and the synthetic control group (weighted average, red line) based on the four donor pools (excluding Norway, Singapore, and Hong Kong). "Excl. 1a: Package Size" removes countries whose fiscal package size was outside the range of ±5.5 pp in one quarter of the intervention period (2020q3–2020q4). "Excl. 1b: Similar Policy" removes countries that used comparable, but not full-scale VAT cut policies for non-medical products during the treatment period. "Excl. 2: Strict" combines the two restrictions. The blue bar highlights the treatment period (2020q3–2020q4).

Table A1: Heterogeneity of fiscal package size.

Germany	Full: All Countries	Excl. 1a: Package Size	Excl. 1b: Similar Policy	Excl. 2: Strict
Weighted mean				
2020q3 7.65	6.84	9.12	7.00	9.08
…Diff. to Germany	−0.81	1.47	−0.65	1.43
	[0.17]	[0.09]	[0.37]	[0.19]
2020q4 9.83	6.66	10.07	7.09	10.74
…Diff. to Germany	**−3.17**	0.24	**−2.74**	0.91
	[0.00]	[0.76]	[0.03]	[0.36]

Table shows the size of the fiscal package (as % of GDP) in Germany and the weighted average in the four synthetic control groups. "Excl. 1a: Package Size" removes countries whose fiscal package size was outside the range of ±5.5 pp in one quarter of the intervention period (2020q3–2020q4). "Excl. 1b: Similar Policy" removes countries that used comparable, but not full-scale VAT cut policies for non-medical products during the treatment period. "Excl. 2: Strict" combines the two restrictions. *p*-values of differences are in brackets. Differences that are significant at the 5 % level are highlighted in bold. Source: IMF Fiscal Monitor datasets of October 2020 and January 2021, category "additional spending or foregone revenues in the non-health sector."

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