

Demand-Supply Imbalance during the COVID-19 Pandemic: The Role of Fiscal Policy

François de Soyres, Ana Maria Santacreu, and Henry Young

Abstract

To mitigate the health and economic fallout from the COVID-19 pandemic, governments worldwide engaged in massive fiscal support programs. We show that generous fiscal support is associated with an increase in the demand for consumption goods during the pandemic, but industrial production did not adjust quickly enough to meet the sharp increase in demand. This imbalance between supply and demand across countries contributed to high inflation. Our findings suggest a sizable role for fiscal policy in affecting price stability, above and beyond what a monetary authority can do.

JEL codes: E2, E6, F4

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1. INTRODUCTION

In 1970, Milton Friedman famously said that "inflation is always and everywhere a monetary phenomenon in the sense that it is and can be produced only by a more rapid increase in the quantity of money than in output." The recent concurrence of a surge in inflation in many countries around the world and large fiscal stimulus provided in the face of the COVID-19 pandemic has renewed interest in analyzing the potential role of large fiscal spending as a driver of price increases.

There is a long line of literature about the relationship between monetary policy and fiscal policy and the unpleasant arithmetic of government debt monetization. A distinction that has become central in this particular literature is between fiscal dominance and monetary dominance. Sims, 2011 uses the fiscal theory of the price level to remind us that debt issuance is inflationary when forward-looking agents believe that newly issued government debt is only partially backed by future taxes. After a careful analysis of fiscal policy in the United States in the 1970s, he concludes that "fiscal policy can be a primary transmission mechanism or a primary source for changes in the inflation rate" (pp. 55-56). Given the large fiscal support implemented in the face of the COVID-19 pandemic, and the associated large increase in public debt, a possible shift from monetary to fiscal dominance raises the risk of more persistent inflation (Goodhart and Pradhan, 2021; Cochrane, 2021).

In this article, we bypass the role of government debt and money creation and focus directly on the association between fiscal spending and aggregate demand.¹ We start by using cross-country data and estimating the

¹We presented an earlier version of our analysis in Soyres, Santacreu, and Young, 2022.

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correlation between fiscal support and various measures of economic fluctuations during the pandemic. While the successive waves of the pandemic and associated changes in mobility were the main drivers of economic activity throughout 2020 and 2021, we argue that fiscal stimulus policies might have shaped the response of consumption and production to mobility changes. Indeed, we show that countries behaved differently to lockdowns and reopenings: Countries with a larger stimulus experienced a smaller consumption decrease when mobility went down and a stronger rebound in periods of reopening. However, fiscal stimulus did not have any noticeable association with industrial production movements. By stimulating demand without boosting supply, our results suggest that fiscal support contributed to increased excess demand pressures in goods markets.

Motivated by this observation, and based on the premise that a fiscally induced imbalance between demand and supply could lead to price tensions, we then move to examine the association between exposure to fiscal stimulus, both domestic and foreign, and excess inflation, defined as inflation in excess of the country-specific pre-pandemic average. Given the delay in transmission and the continued increase in inflation from early 2021 onward and across several waves of the pandemic, we focus on a cross-sectional analysis.

Using data on trade in value added, we construct country-specific values of exposure to both domestic and foreign fiscal stimulus, where the latter is composed of two components: (i) a “vertical” component, defined as a trade-weighted average of other countries’ stimulus measures, and (ii) a “horizontal” component capturing the exposure of each country’s import partners to a third country’s fiscal stimulus.²

We find that excess inflation is significantly correlated to each country’s own domestic stimulus and to various exposures of foreign stimulus. A back-of-the-envelope calculation suggests that U.S. fiscal stimulus during the pandemic contributed to an increase in inflation of about 2.6 percentage points in the U.S., 2.3 percentage points in Canada, and 0.6 percentage points in the United Kingdom.

The rest of the article is organized as follows. In section 2, we present some stylized facts about the COVID-19 pandemic and how it impacted economic activity around the world. In section 3 we investigate the association between the size of total fiscal stimulus and the path of consumption and industrial production during the COVID-19 pandemic. In section 4 we discuss the role of domestic and foreign factors on a country’s inflation. In section 5 we examine previous findings and highlights high-level risks to the inflation outlook in the next few quarters. Section 6 concludes.

2. THE COVID CRISIS AND FISCAL POLICY RESPONSES AROUND THE WORLD

The COVID-19 pandemic gave rise to unprecedented global economic conditions. Due to a mix of government-imposed restrictions and voluntary personal decisions, mobility levels, as measured by Google’s Community Mobility Reports, collapsed in March 2020. Since then, mobility has improved, albeit with some volatility that closely tracked the successive waves of the pandemic (Figure 1).

These changes in mobility affected both the supply and demand side of the economy, hampering firms’ ability to produce as well as consumers’ ability to consume. On the supply side, government-imposed mobility restrictions and personal decisions from workers resulted in a dramatic decrease in the volume of production. On the demand side, public health restrictions and high uncertainty from both economic and health conditions contributed to a large decrease in total real consumption in the early part of the pandemic.

The consumption of goods and services behaved very differently than in previous recessions (see Figure 2). In advanced economies, where the data allow us to analyze real consumption expenditures between goods and services separately, consumption of services fell dramatically and then started recovering slowly as containment policies eased and vaccines were made widely available. In contrast, goods consumption fell by less during the beginning of the pandemic and experienced a strong recovery thereafter.³ Industrial production, however, was slow to adjust, creating a discrepancy between supply and demand in goods’ markets that likely played a role in the depletion of inventories and ultimately in recent price tensions.⁴

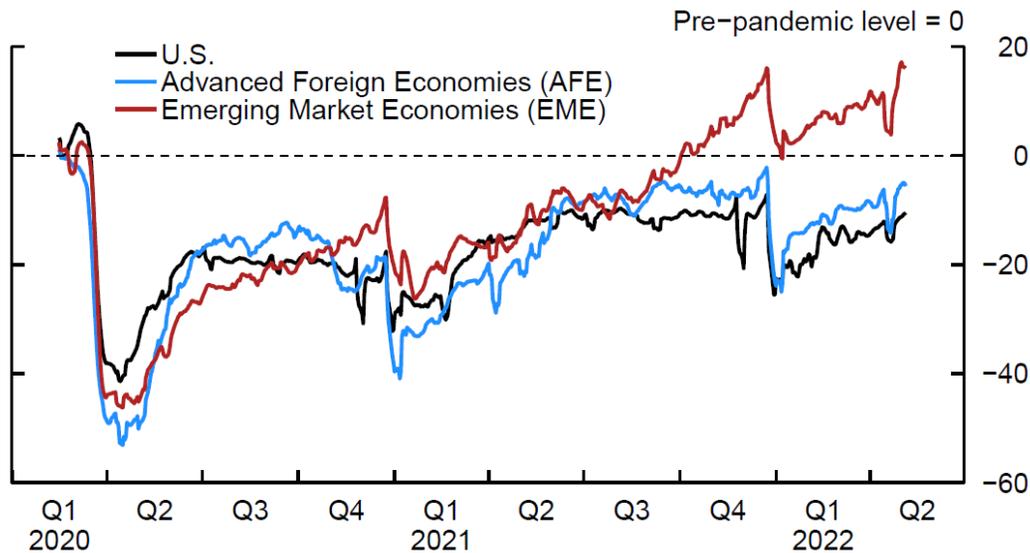
In this article, we mostly focus on the goods market to investigate the imbalance between consumption and production. In the service sector, anecdotal evidence suggests that the production of many services was heavily hampered throughout 2020 and up until today, in part due to the difficulty of finding workers in an environment of health uncertainty and limited daycare options. However, the absence of production data in the

²The analysis of global value chains in the transmission of inflation is related to many articles in recent years, including Auer, Levchenko, and Sauré, 2019, Soyres and Franco Bedoya, 2019, Baldwin and Freeman, 2021, and Santacreu and LaBelle, 2022.

³See Santacreu and LaBelle, 2022.

⁴Several aspects of this line of reasoning, including the role of semiconductors and the importance of supply-chain bottlenecks, have been documented in recent contributions, such as Amiti, Heise, and Wang, 2021, Leibovici and Dunn, 2021, Santacreu and LaBelle, 2021a, Santacreu and LaBelle, 2021b, and Santacreu and LaBelle, 2022.

Figure 1
Evolution of Mobility during the Pandemic



NOTE: Mobility is computed as a simple average of grocery, workplace, retail, recreation, and transportation mobility data from Google's Community Mobility Reports. The series are smoothed using a seven-day moving average, and aggregates are weighted by population. The aggregates are constructed using Federal Reserve Board country classifications. Advanced foreign economies comprise Canada, France, Germany, Italy, Japan, Spain, and the United Kingdom. Emerging market economies comprise Argentina, Brazil, Chile, Colombia, Hong Kong, Korea, Indonesia, Malaysia, the Philippines, Singapore, Taiwan, and Thailand. The series end on May 5, 2022.
 SOURCE: Google's Community Mobility Reports.

service sector prevents us from quantifying the aggregate mismatch between supply and demand.⁵

To mitigate the health and economic fallout of the pandemic, many governments engaged in massive fiscal support programs. Using the International Monetary Fund's World Economic Outlook (WEO) data for 52 advanced foreign and emerging market economies, we define each country's fiscal stimulus during the pandemic as the percentage deviation between government spending and the country-specific pre-pandemic trend. This measure can be constructed for both 2020 and 2021 separately. As illustrated in Panel A of Figure 3, the cross-sectional correlation between 2020 and 2021 fiscal stimulus is high, which means that generous fiscal support in 2020 is also a good predictor of fiscal stimulus in 2021.

Panel B uses the average of 2020 and 2021 values to illustrate the heterogeneity of fiscal support across countries.⁶ Chile, the United Kingdom, the United States, Canada, and Japan are among the countries that displayed the most generous fiscal support. More precisely, in our sample, the average of 2020 and 2021 government spending was 9.45 percent above each country's pre-pandemic trend in advanced foreign economies, while it was only 4.95 percent above trend in emerging market economies.⁷

3. FISCAL SUPPORT, CONSUMPTION, AND PRODUCTION DURING RECOVERY PERIODS OF THE PANDEMIC

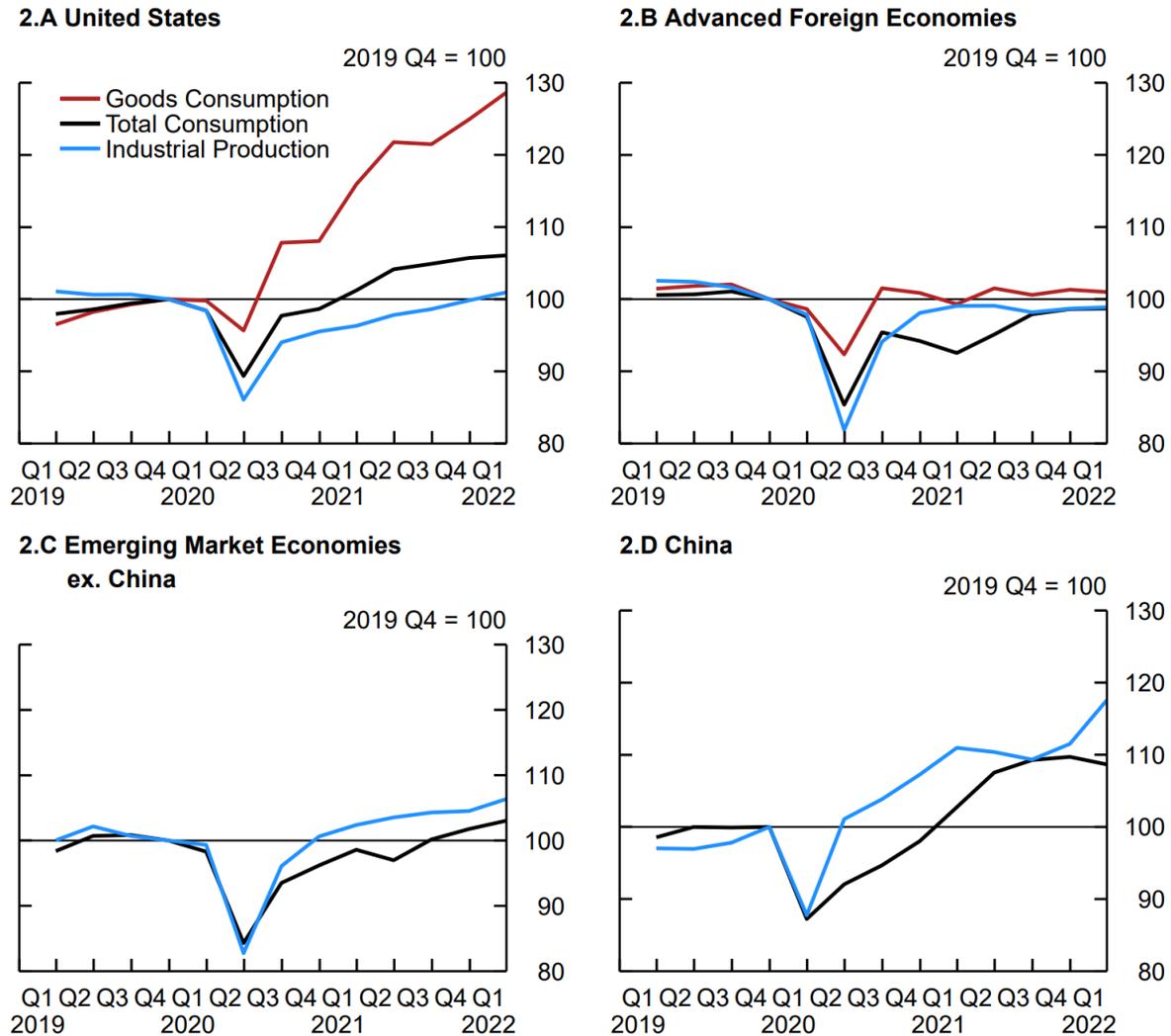
While the pandemic and associated restrictions were the main drivers of economic fluctuations over the past two years, fiscal stimulus policies might have shaped the response of consumption and production to lockdowns

⁵Note that, according to the Bureau of Labor Statistics, service sectors are, on average, more labor intensive than goods sectors, implying that the labor shortages observed in several countries could have been exacerbated if demand for service consumption had grown at a faster rate.

⁶To be more precise, the WEO data have much larger country coverage, and we have estimates of domestic fiscal stimulus for more than 100 countries. However, other data we use in the article restrict our sample size, with coverage ranging from 23 to 52 countries depending on the analysis.

⁷The case of China deserves further explanation. The negative value for our fiscal stimulus variable comes from the conjunction of two phenomena. First, Chinese government spending has been growing at a rapid pre-pandemic pace, with an average growth rate of 9.15 percent from 2015 to 2019. This rapid growth means that for China to have a positive fiscal stimulus, it would need to increase its government spending at a pace larger than 9.15 percent. Second, while 2020 government spending in China was not too far away from its trend, the 2021 spending was only about as big as the 2020 value (and hence much below a trend that grows at 9.15 percent per year). This stark deceleration of government spending came about as China launched what has been called a "deleveraging campaign" to tackle excessive debt from local government and state-owned enterprises.

Figure 2
Consumption and Industrial Production during the Pandemic



NOTE: Goods consumption series are expressed in nominal terms, whereas total consumption series are expressed in real terms. All the series end in 2022 Q1. Industrial production series are aggregated to the quarterly frequency by taking the respective average of the monthly values. The aggregates are constructed using real GDP weights. China consumption data are expressed in per capita terms. Total industrial production excluding construction series is used when possible, but some series use manufacturing industrial production instead due to data limitations. Goods consumption data are available only for the United States and advanced foreign economies.

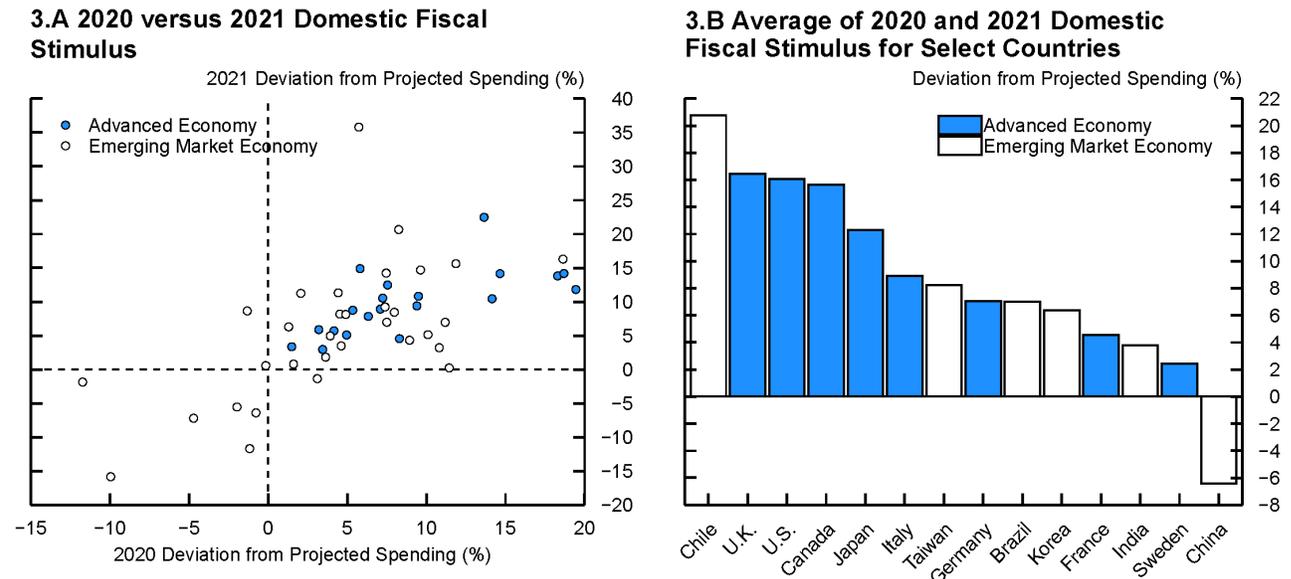
SOURCE: Bureau of Economic Analysis; OECD's National Quarterly Accounts; Haver Analytics.

and consumer preferences, as reflected by changes in mobility. Here, we investigate the association between the size of total fiscal stimulus and the path of consumption and industrial production during the COVID-19 pandemic by evaluating (i) the elasticity of demand and supply to lockdowns and reopenings, as measured by mobility movements, and (ii) the correlation between fiscal stimulus and this elasticity.

3.1 Empirical Setup and Identification Strategy

We use cross-country data to investigate the effect of fiscal stimulus on consumption and on industrial production during the COVID-19 pandemic. Our conjecture is that fiscal stimulus supported the increase in consumption during periods of increased mobility but had only a limited impact on countries' supply as measured by industrial production. Our empirical strategy consists of projecting quarterly real consumption and production growth on changes in mobility in the same quarter as well as on the interaction of these changes with country-specific fiscal stimulus. Our objective is to analyze how fiscal support correlates with country-level consumption and

Figure 3
Pandemic Fiscal Support



NOTE: The 2020 deviation from projected spending is constructed by calculating the percentage change between each government's fiscal spending in 2020 and 2021 against a projected value, respectively. The projected value is calculated by taking the average fiscal spending growth rate for 2015–2019 and forecasting out a year or two years, depending on the base year. Federal Reserve Board country classifications are used to group countries into advanced foreign economy and emerging market economy categories.

SOURCE: International Monetary Fund's World Economic Outlook, January 2022; authors' calculations.

production in response to mobility fluctuations.

Our fiscal stimulus variable is constructed as discussed in Figure 3 and varies across countries and time. For all quarters of 2020, it takes into account government spending in excess of each country's pre-pandemic trend. For all quarters of 2021, the variable takes into account fiscal support provided in both 2020 and 2021. This choice allows us to consider, for each country, the whole stimulus implemented throughout the first and second year of the pandemic, which we then relate to the way countries reacted to the different waves of the pandemic for both 2020 and 2021. As widely noted, the transmission from fiscal stimulus to household consumption can take some time (see Ramey, 2011 or Ramey and Zubairy, 2018 for an extensive discussion of the timing of transmission). As a result, 2020 fiscal support is likely to impact consumption decisions for both 2020 and 2021, which implies that one must consider fiscal stimulus disbursed in 2020 for data in 2021.⁸ We also note that this construction accounts for the slow unwinding of savings, which may be attributed to consumers spending significantly more once restrictions were relaxed in 2021 with the proliferation of vaccines.

To account for possible nonsymmetric effects during periods of tightening or relaxation of public health restrictions, we split quarter-on-quarter mobility changes into two variables, separating positive and negative movements. As will be clear from our results below, such an asymmetric empirical specification is in line with the pattern observed in the data.⁹ All told, our empirical model can be written as

$$(1) \quad \text{Cons_Growth}_{ct} = \beta_1 \text{Mob_Increase}_{ct} + \beta_2 \text{Mob_Decrease}_{ct} \\ + \beta_3 \text{Mob_Increase}_{ct} \times \text{Fiscal_Stim}_{ct} + \beta_4 \text{Mob_Decrease}_{ct} \times \text{Fiscal_Stim}_{ct} \\ + FE_c + \varepsilon_{ct},$$

where β_1 and β_2 capture the correlation between mobility changes and consumption growth for countries without fiscal stimulus. The interaction terms, whose effects are measured by β_3 and β_4 , capture the statistical association between fiscal support and the value of the consumption-mobility nexus. Recall that our fiscal stimulus variable is country-specific and only varies at an annual frequency, whereas all other variables in the

⁸Note, however, that any fiscal stimulus implemented in 2021 cannot affect the elasticity of consumption to lockdowns in 2020. Hence, it would not make sense to use 2021 fiscal support for quarters in 2020 in our panel data set.

⁹We discuss this point more precisely and present the results of the symmetric case in Appendix Appendix 2.1.

model are quarterly. Hence, our identification strategy relies on comparing the elasticity of consumption to mobility changes for countries with different levels of fiscal support: β_3 will be different from zero if fiscal stimulus modifies this elasticity during periods of increased mobility (i.e., reopenings), and β_4 will be different from zero if fiscal stimulus modifies this elasticity during periods of decreased mobility (i.e., closures).

In a separate set of regressions, we perform the same analysis using *Industrial Production* growth as the dependent variable, which allows us to assess the association between fiscal support and the country-level supply of goods. In our baseline specifications, we use country fixed effects to account for observable factors such as heterogeneous trend growth across countries. Our results are qualitatively similar with the addition of several fixed effects.

3.2 Baseline Consumption and Industrial Production Results

Table 1 presents the main results and shows that governments that provided generous fiscal support mitigated the drop in goods consumption in periods of decreased mobility and boosted consumption in periods of increased mobility. The effect of fiscal stimulus on services consumption, however, is insignificant. In addition, our results reveal that generous fiscal spending did not significantly correlate with supply expansion: Countries with larger fiscal support did not have a significantly different association between mobility and industrial production. In other words, supply did not adjust quickly enough to meet the sharp increase in demand for goods.

The table also shows that a 1-standard-deviation increase in fiscal stimulus, which is an increase of government spending of about 6.7 percent compared with the pre-pandemic trend, raises the responsiveness of total consumption to positive mobility movement by about 16 percent. More precisely, for countries without fiscal stimulus, consumption growth increased by 0.25 percentage points in response to a 1-percentage-point increase in mobility. For countries with government spending 6.7 percent above their trend, this elasticity increased to $0.25 + 0.04 = 0.29$ percentage points.

Separating goods and services consumption in columns 2 and 3, respectively, we note that the association between fiscal stimulus and total consumption is entirely driven by goods consumption, where a 1-standard-deviation increase in fiscal support is associated with a 26 percent surge in the link between consumption growth and mobility rebound (from 0.19 to $0.19 + 0.05 = 0.24$), while it reduced the drop in goods consumption during periods of mobility decline by 13 percent (from -0.31 to $-0.31 + 0.04 = -0.27$).

In a robustness exercise presented in Table Appendix 2.3.1 in Appendix Appendix 2, we use an alternative construction of our fiscal stimulus variable, which focuses on 2020 government spending only. The rationale for this exercise is that fiscal support in 2021 might have been disbursed late in that year and hence would not be relevant for understanding consumption behavior in most of the year. Such a time-invariant version of our fiscal stimulus variable for each country means that the identification of the interaction terms relies on comparing countries with each other and assessing if countries with large fiscal stimulus in 2020 were associated with a different elasticity of consumption to mobility. The results show that, with this specification, all of our results are both qualitatively and quantitatively similar to those in Table 1.¹⁰

In summary, our results point to an asymmetric effect of fiscal spending on how consumption reacted to mobility changes. In periods of economic reopening and mobility rebound, fiscal support amplifies the increase in consumption. In periods of mobility decline, however, fiscal support helps households “soften the blow” of reduced activity, implying a smaller decline in consumption in countries with large fiscal stimulus. Hence, in these periods, fiscal support is expected to counterbalance the effect of mobility, and the interaction term has the opposite sign of the standalone mobility variable.

Using our point estimates and country-specific values of fiscal support, Figure 4 quantifies the role of fiscal support in shaping the response of goods consumption to fluctuations in mobility in several groups of countries. As expected given its high fiscal stimulus, consumption movements in the United States were very peculiar, with consumption decreasing significantly less when mobility dropped and rebounding significantly more when mobility increased.

3.3 A Look at Employment Recovery

To further explore the finding that fiscal support was not associated with a rebound in industrial production during periods of increased mobility, we extend our analysis to study the association between fiscal stimulus and labor market activity, using data on both employment and labor force participation (LFP). We first use employment data for 29 countries, separated between goods and services employment, and assess the correlation

¹⁰This consistency is not surprising because the cross-sectional correlation between the 2020 and 2021 fiscal stimulus is 0.63, meaning that generous fiscal support in 2020 is also a good predictor of fiscal stimulus in 2021. On average, in our sample of 52 countries, government spending was 6.19 percent above pre-pandemic trend in 2020 and was 7.23 percent above of the trend in 2021.

Table 1
Relationship between Mobility Movements and Consumption/Industrial Production, with Country-Level Fiscal Stimulus

| | (1) | (2) | (3) | (4) |
|---|--------------------|--------------------|--------------------|-------------------|
| | Total | Goods | Service | Industrial |
| | Consumption | Consumption | Consumption | Production |
| Mob. Increase | 0.25*** (0.04) | 0.19*** (0.03) | 0.32*** (0.06) | 0.20* (0.12) |
| Mob. Decrease | -0.38*** (0.04) | -0.31*** (0.05) | -0.43*** (0.06) | -0.64** (0.26) |
| Mob. Increase × Domestic Fiscal Stimulus | 0.04* (0.02) | 0.05*** (0.01) | 0.02 (0.03) | 0.00 (0.06) |
| Mob. Decrease × Domestic Fiscal Stimulus | -0.01 (0.02) | 0.04*** (0.01) | -0.05* (0.03) | 0.20 (0.15) |
| Country FE | ✓ | ✓ | ✓ | ✓ |
| R^2 | 0.74 | 0.51 | 0.67 | 0.21 |
| Observations | 184 | 184 | 184 | 352 |
| Number of countries | 23 | 23 | 23 | 44 |

NOTE: The left-hand-side variables and mobility variables are quarterly growth rates. *Domestic Fiscal Stimulus* is constructed using a similar definition of deviation from projected spending shown in Figure 3, but for a given country in 2020, the value solely takes the 2020 deviation from projected fiscal spending. However, in 2021 the value is constructed by averaging the 2020 and 2021 values of deviation from projected spending. The variable is then standardized by dividing by its standard deviation. The constant and standalone *Domestic Fiscal Stimulus* variables are omitted from the table for brevity. The data extend from 2020 Q1 to 2021 Q4. Standard errors are clustered at the country level and are shown in parentheses.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

between fiscal spending and employment growth using a similar framework:

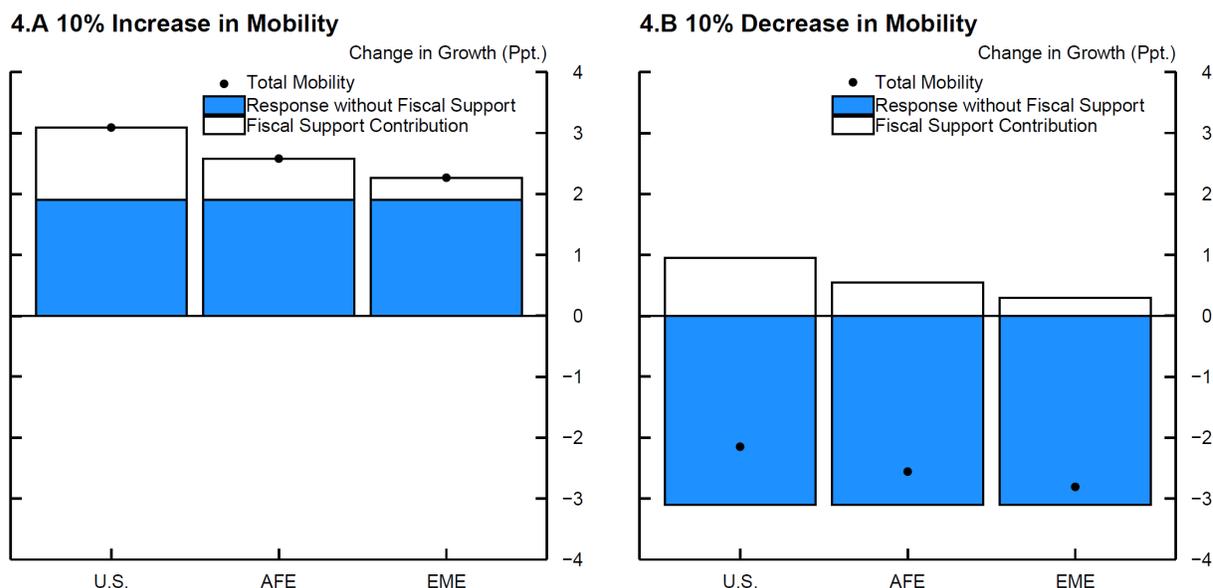
$$(2) \quad \text{Emp_Growth}_{ct} = \beta_1 \text{Mob_Increase}_{ct} + \beta_2 \text{Mob_Decrease}_{ct} \\ + \beta_3 \text{Mob_Increase}_{ct} \times \text{Fiscal_Stim}_{ct} + \beta_4 \text{Mob_Decrease}_{ct} \times \text{Fiscal_Stim}_{ct} \\ + FE_c + \varepsilon_{ct}.$$

The results are presented in the first three columns of Table 2. We find that employment was less sensitive to mobility than either consumption or industrial production. We also note a strong asymmetry in the sensitivity to mobility changes, with employment contracting strongly in periods of restrictions while only picking up modestly in periods of reopening. Related to our previous point, country-specific fiscal stimulus does not appear to have any significant association with the relationship between employment and observed mobility, which is consistent with our previous observation that while fiscal stimulus boosted consumption, its statistical association with industrial production is limited.

In column 4, we also investigate how LFP changed during the subsequent waves of the pandemic and how this elasticity changed for countries with larger fiscal support. Consistent with previous observations, LFP decreased strongly during periods of lockdowns and recovered only modestly in periods of reopening. However, it is interesting to note that countries with larger fiscal stimulus experienced a smaller decline in LFP in periods of mobility decline, as revealed by the positive and significant coefficient for the interaction between mobility decrease and fiscal support.

Overall, the sluggish employment recovery suggests lingering labor market constraints. Many possible explanations have been discussed in recent months, including childcare issues, health concerns, early retirement, the Great Resignation, and lower migration.

Figure 4
Change in Growth Rate of Goods Consumption in Response to Mobility Changes



NOTE: The advanced foreign economy aggregate comprises 19 countries, and the emerging market economy aggregate comprises 32 countries. Countries are equally weighted within the aggregates and are classified using Federal Reserve Board country classifications. SOURCE: Authors' calculations.

3.4 From Supply and Demand Imbalance to Bottlenecks and Inflation

The previous section highlighted that fiscal support during the pandemic boosted goods consumption demand without any noticeable correlation with variables capturing goods' supply. All told, the large increase in demand triggered by the fiscal stimulus policy, together with the slow pace of adjustment in production, likely contributed to the current imbalance in the goods market. The timing of transmission from fiscal support to inflation is, however, uncertain. As aggregate demand was supported by government transfers, goods-producing firms first started to dig into inventories and increase orders to suppliers, both domestic and foreign. Such an increase in demand coupled with limited production and shipping capacity first led to supply chain bottlenecks. As an illustration, the supplier delivery time component of manufacturing purchasing managers' indices (PMIs) across 30 countries, plotted in Figure 5, shows the presence of supply chain delays across the world, especially in the United States and other advanced economies.¹¹

Ultimately, the surge in aggregate demand contributed to the surge in inflation, which we discuss in the next section. However, given the delay in transmission and the continued increase in inflation from early 2021 onward and across several waves of the pandemic, we focus on a cross-sectional analysis instead of using within-country time variation. While this section was devoted to quarter-on-quarter changes in mobility and their statistical association with demand and supply in countries with different levels of fiscal support, our next section examines the imbalance and investigates the "end result" of this process in terms of inflation, using data up until February 2022 (which, for reference, is before Russia's invasion of Ukraine).

4. FISCAL SUPPORT AND INFLATION

As the pandemic disrupted the economy for longer than many expected, inflation started to display a strong upward trajectory. Figure 6 plots the evolution of both headline and core inflation during the pandemic. After an initial decrease during the first COVID-19 wave, both headline and core inflation increased steadily from the end of 2020 and throughout 2021. The first few months of data for 2022 reveal a continued surge, especially core inflation in advanced economies, which suggests a persistent imbalance between high aggregate demand and constrained aggregate supply. In our subsequent analysis, we focus on inflation data up until the invasion of

¹¹ PMIs are indices of the prevailing direction of economic trends. They summarize whether market conditions, as viewed by purchasing managers, are expanding, staying the same, or contracting. In our analysis, we focus on the component related to supplier delivery times.

Table 2
Relationship between Employment and Mobility Movements, with Country-Level Fiscal Stimulus

| | (1) | (2) | (3) | (4) |
|---|--------------------|--------------------|--------------------|--------------------|
| | Total | Goods | Service | Labor Force |
| | Employment | Employment | Employment | Participation |
| Mob. Increase | 0.01 (0.02) | 0.06 (0.06) | -0.02 (0.03) | 0.03 (0.04) |
| Mob. Decrease | -0.22*** (0.06) | -0.13*** (0.06) | -0.25*** (0.08) | -0.24*** (0.06) |
| Mob. Increase × Domestic Fiscal Stimulus | 0.01 (0.02) | -0.04 (0.04) | 0.03 (0.02) | 0.00 (0.02) |
| Mob. Decrease × Domestic Fiscal Stimulus | 0.06 (0.05) | 0.00 (0.04) | 0.08 (0.06) | 0.06** (0.03) |
| Country FE | ✓ | ✓ | ✓ | ✓ |
| R^2 | 0.32 | 0.19 | 0.31 | 0.31 |
| Observations | 232 | 232 | 232 | 245 |
| Number of countries | 29 | 29 | 29 | 31 |

NOTE: The left-hand-side variables and mobility variables are quarterly growth rates. *Domestic Fiscal Stimulus* is constructed using a similar definition of deviation from projected spending shown in Figure 3, but for a given country in 2020, the value solely takes the 2020 deviation from projected fiscal spending. However, in 2021, the value is constructed by averaging the 2020 and 2021 values of deviation from projected spending. The variable is then standardized by dividing by its standard deviation. The constant and standalone *Domestic Fiscal Stimulus* variables are omitted from the table for brevity. The data extend from 2020 Q1 to 2021 Q4. Standard errors are clustered at the country level and are shown in parentheses.

** $p < 0.01$, * $p < 0.05$, * $p < 0.1$

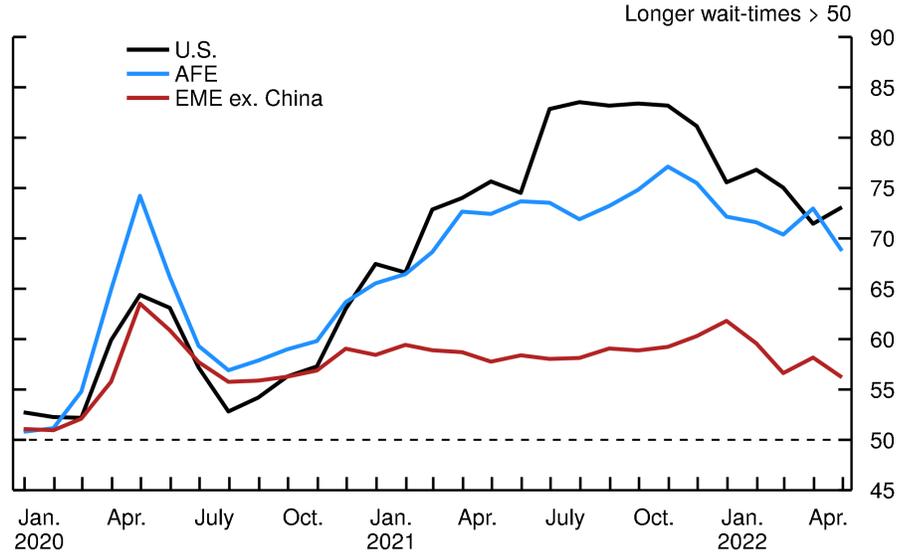
Ukraine (i.e., until February 2022) to avoid taking into account large movements in commodity prices that arose from the war and could have been a confounding factor in our analysis.

As we have previously shown, countries with large fiscal support experienced substantial increases in goods consumption. Moreover, the steep surge in goods consumption in those countries may have also created extra demand in other countries through an increase in demand for imports. This demand surge was met by limited supply capacity and bottlenecks. Indeed, while production, transportation, and shipping capacity have adapted to increasing global value chain participation over the past few decades, the necessary infrastructure appeared to be quite inelastic in the short run.

We investigate the role domestic and foreign factors have on a country's inflation rate by conducting a cross-country regression analysis. For each country, we compute a measure of "excess inflation" by taking the February 2022 12-month inflation rate and subtracting the average rate of inflation that each country experienced during 2015–2019. We then construct several measures of exposure to domestic and foreign fiscal stimulus and project excess inflation on these measures. *Domestic Fiscal Stimulus* captures each country's fiscal support, as discussed in Section 2. *Total Exposure to Foreign Stimulus* measures a country's exposure to foreign stimulus and contains two parts: (i) a vertical component, defined as a trade-weighted average of other countries' stimulus measures, and (ii) a horizontal component capturing the exposure of each country's import partners to a third country's fiscal stimulus. Intuitively, the United States can be exposed to fiscal stimulus from Canada, both through a high import share (i.e., imported inflation) and a high export share (i.e., higher demand from Canada), capturing vertical foreign exposure. Moreover, the price of Canada's exports to the United States may be pushed up by Canada's exposure to Mexico's fiscal stimulus, capturing horizontal foreign exposure.

In practice, we use value-added trade data from the OECD's Trade in Value Added (TiVA) database, which allows us to account for direct and indirect linkages through global value chains. We use 2018 data, which is the

Figure 5
Supplier Delivery Times' Component of PMIs



NOTE: Values larger than 50 denote longer supplier delivery times. Advanced foreign economies (AFE) and emerging market economy (EME, excluding China) aggregates are constructed using bilateral U.S. merchandise export weights. The data end in April 2022.
 SOURCE: S&P Global; Haver Analytics.

latest available year. For any country c , the mathematical definition of our foreign exposure variables can be written as

$$(3) \quad \text{Vertical Exp. to Foreign Stim.}_c = \sum_{j \in \text{Partners}(c)} \frac{T_{c \rightarrow j} + T_{j \rightarrow c}}{GDP_c} \text{Fiscal Stim.}_j,$$

$$(4) \quad \text{Horizontal Exp. to Foreign Stim.}_c = \sum_{j \in \text{Partners}(c)} \sum_{k \in \text{Partners}(j) - c} \frac{T_{j \rightarrow k} + T_{k \rightarrow j}}{GDP_c} \text{Fiscal Stim.}_k,$$

where $T_{c \rightarrow j}$ denotes the value-added trade flow from country c to country j . $\text{Partners}(c)$ is the set of all trade partners of country c . In the definition of *Horizontal Exposure to Foreign Stimulus*, note that the second summation is done over all trade partners except country c . In contrast to the panel analysis presented in Section 3, we use cross-country regressions since the timing of transmission from fiscal stimulus to surges in aggregate demand and ultimately to inflation is uncertain. Fiscal support in any given quarter likely supported consumers' demand both contemporaneously and in the following quarters, with the total effect of fiscal support accumulating throughout the period where fiscal spending remains above trend. Indeed, households savings increased sharply during the pandemic and remained above their pre-pandemic level by mid-2022.

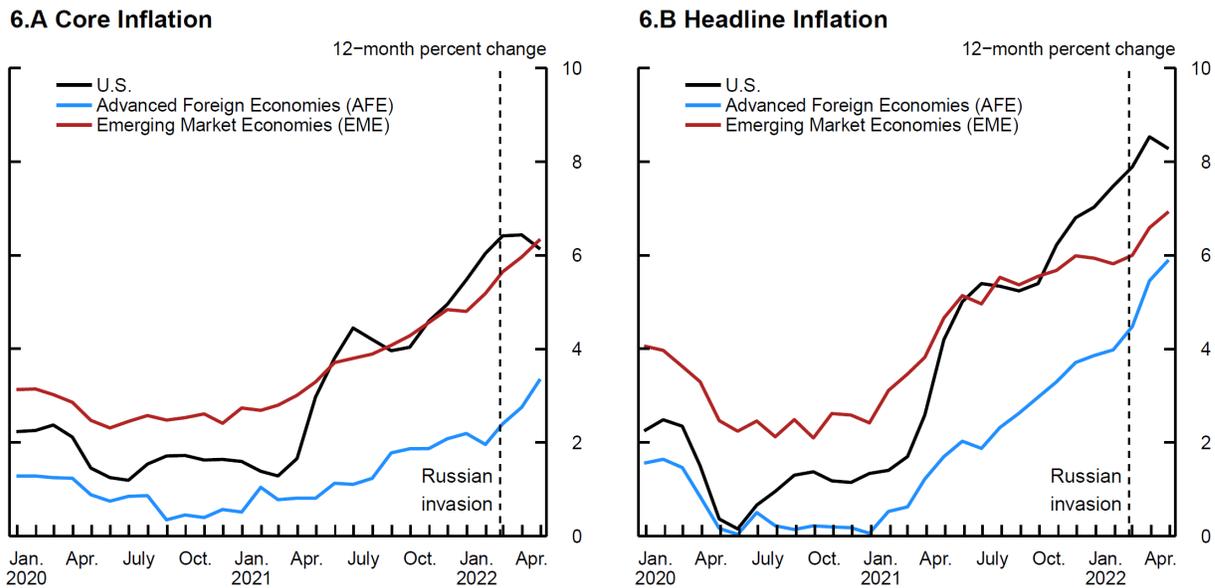
Finally, we construct *Total Exposure to Foreign Stimulus* by simply summing *Horizontal Exposure to Foreign Stimulus* and *Vertical Exposure to Foreign Stimulus*. Our identification is not without limitations, and the results should be viewed as illustrative, highlighting, perhaps, the higher end of potential price pressures from fiscal stimulus during the pandemic. We discuss some of these limitations in Sections 4.3–4.5.

4.1 Baseline Inflation Results

Table 3 presents the main results. The first column shows that excess inflation is significantly correlated to each country's own domestic stimulus. The second column shows that excess inflation is also correlated with exposure to foreign stimulus as measured by *Total Exposure to Foreign Stimulus*.¹² To further investigate the association

¹²We also present in Table Appendix 2.3.3 the results of specifications that distinguish *Horizontal Exposure to Foreign Stimulus* and *Vertical Exposure to Foreign Stimulus*. Both variables are significantly associated with excess inflation when included separately, while only *Horizontal Exposure to Foreign Stimulus* exposure remains significant when both variables are included together.

Figure 6
Evolution of Inflation during the COVID-19 Pandemic



NOTE: The advanced foreign economy and emerging market economy aggregates are weighted by U.S. bilateral import shares and comprise countries forecasted by the Federal Reserve Board. All series end in April 2022.

SOURCE: Haver Analytics.

between excess inflation and exposure to foreign fiscal stimulus, we then construct two new variables that separate *Total Exposure to Foreign Stimulus* into *Export* and *Import* weights, respectively. When including these variables separately in our inflation regressions, as in columns 3 and 4, both types of exposure are significantly correlated with higher inflation. When including both variables as in column 5, the *Import* side captures all the significance. Note, however, that the correlation between *Import* and *Export* is very high and equal to 0.85. Hence, including both variables in the same regression means we should be cautious with the interpretation due to multicollinearity issues.

4.2 Back-of-the-Envelope Calculation: Quantifying the association between Fiscal Stimulus and Excess Inflation

To give a more practical interpretation of our findings, we use our point estimates to compute country-specific values for the contribution of fiscal stimulus to inflation, as shown in Figure 7. Panel A presents the association between excess inflation and exposure to both domestic and foreign stimulus for several regions, based on our regression.¹³ The impact of domestic fiscal stimulus on inflation is highest in the United States and in Chile. Canada, a country with strong trade links with the US, features a high level of excess inflation related to exposure to foreign fiscal stimulus. In large economies with limited openness to international trade, such as the United States, domestic stimulus is a more important driver of excess inflation than foreign stimulus. However, more open countries, or countries that used limited fiscal stimulus during the pandemic, are relatively more impacted by exposure to foreign fiscal stimulus. In our sample, domestic stimulus is associated with 2.6 percentage points in excess inflation in the United States and 1.1 percentage points in Germany.

In Panel B, we dig deeper into foreign exposure and derive a measure of “international spillover” of U.S. fiscal stimulus. In particular, we isolate the share of U.S. stimulus in foreign exposure for several countries and compute the associated excess inflation in those countries. Our estimation implies that U.S. fiscal stimulus was associated with excess inflation of about 2.3 percentage points in Canada and 0.6 percentage points in the United Kingdom. For reference, we present the inflation impact of exposure to domestic and foreign fiscal stimulus for all countries in Appendix Appendix 1, Table Appendix 1.1.

¹³For this chart and Table Appendix 1.1 in Appendix A, we use the point estimates from Table 4, column 7.

Table 3
Fiscal Stimulus and Excess Inflation: Role of Domestic and Foreign Forces

| | (1) | (2) | (3) | (4) | (5) |
|---|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|
| | Excess Headline Inflation | Excess Headline Inflation | Excess Headline Inflation | Excess Headline Inflation | Excess Headline Inflation |
| Domestic Fiscal Stimulus | 1.30*** (0.36) | 1.09*** (0.32) | 1.11*** (0.33) | 1.14*** (0.30) | 1.26*** (0.29) |
| Total Trade-Weighted Exposure to Foreign Stimulus | | 1.43*** (0.40) | | | |
| Export Trade-Weighted Exposure to Foreign Stimulus | | | 1.17*** (0.42) | | -1.61** (0.64) |
| Import Trade-Weighted Exposure to Foreign Stimulus | | | | 1.60*** (0.36) | 3.04*** (0.66) |
| R^2 | 0.19 | 0.42 | 0.34 | 0.48 | 0.53 |
| Observations | 52 | 52 | 52 | 52 | 52 |

NOTE: *Excess Headline Inflation* is computed by subtracting the February 2022 12-month inflation from its 2015–2019 average. *Domestic Fiscal Stimulus* is constructed using a similar definition of deviation from projected spending shown in Figure 3, but it takes the average of 2020 and 2021 deviations from projected fiscal spending. The variable is then standardized by dividing by its standard deviation. *Total Exposure to Foreign Stimulus* is the standardized sum of *Vertical Exposure to Foreign Stimulus* and *Horizontal Exposure to Foreign Stimulus*. The constant and control variables are omitted from the table for brevity. Robust standard errors are in parentheses.

** $p < 0.01$, * $p < 0.05$, * $p < 0.1$

4.3 Robustness: Omitted Variable Bias

The estimation relies on the association between excess inflation and exposure to domestic and foreign fiscal stimulus, but a confounding factor might be that countries that engaged in larger fiscal support are also those that have been the worst hit by the pandemic. Then, if the severity of the pandemic is itself positively correlated with excess inflation over and beyond the effect of fiscal support, the results would suffer from an omitted variable bias. Moreover, the bias would be positive because the fiscal stimulus variable would capture both the direct effect of the pandemic and the effect of the fiscal spending.

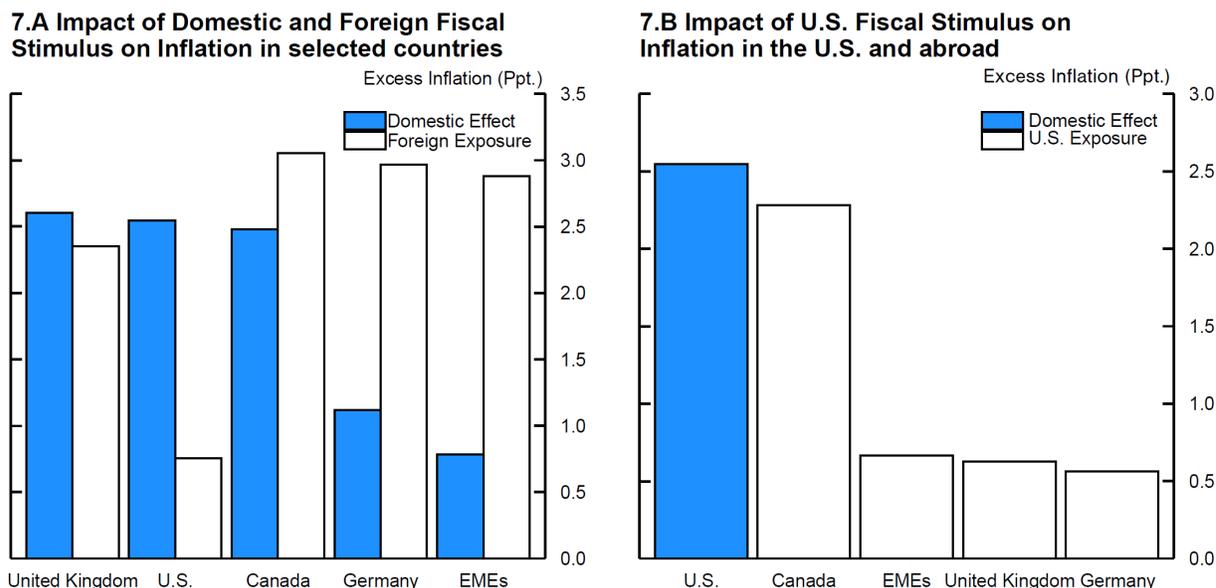
To address this issue, we construct several measures of the “severity” of the pandemic for each country using different approaches and use them as controls in our main specification. We first use industrial production movements as an indicator of the supply-side impact of the health restrictions and compute, for each country, the sum of all negative growth rates as a proxy for the average reduction in production for each country. Since our data are quarterly, we take the sum of all quarters when industrial production had negative growth. Moreover, because the severity of the pandemic is multidimensional, we also experiment with total industrial production growth as a measure of production restrictions. We then take a broader view of pandemic-related restrictions and use mobility movements as an indicator of the severity of health restrictions. Once again, we construct two possible measures of severity, first taking the sum of all negative growth rates for each country and then constructing average total mobility growth which incorporates both lockdown and reopening quarters.

Table 4 presents the results and shows all possible combinations of the controls. Comparing the first column, which simply restates the results in Table 3, to all other specifications in columns 2–7, we see that the results are very robust and all point toward a strong association between excess inflation and exposure to both domestic and foreign fiscal stimulus.

4.4 Robustness: Core Inflation

An additional concern regarding our analysis could be that headline inflation is more driven by volatile items such as food and energy, which are less affected by country-specific fiscal stimulus and whose prices are fixed at

Figure 7
Fiscal Stimulus and Excess Inflation



NOTE: The Euro area comprise France, Germany, Italy, and Spain. Emerging market economies (EMEs) comprise 32 countries using Federal Reserve Board country classifications. Countries are equally weighted within the aggregates.
SOURCE: Authors' calculations.

the world level. In this case, inflation could be driven everywhere by the total world's stimulus and would not be particularly related to exposure through international trade linkages. To address this issue, we also perform an analysis using core inflation instead of headline inflation. Table 5 presents the results, which are consistent with our main analysis.

Moreover, similar to the robustness analysis with headline inflation, we also present the results of our estimation using a varying set of controls, in Table 6. Our main finding remains unchanged: In all specifications, we find that excess core inflation is strongly associated with exposure to both domestic and foreign fiscal stimulus.

4.5 Other Robustness Tests

Finally, we also perform robustness tests on the definition of our fiscal stimulus variable. In the baseline results, a country's fiscal stimulus is constructed using both 2020 and 2021 government spending in excess of each country-specific trend. Such a choice ensures consistency with our panel regressions in Section 3. However, given the high savings rate in many advanced economies throughout 2021, one could argue that excess inflation as of February 2022 would be mostly related to the 2020 fiscal stimulus and not to government spending in 2021. To address this concern, we run all our specifications using a fiscal stimulus variable based on the fiscal stimulus in 2020 only. All the results are unchanged and can be found in Appendix Appendix 2, Tables Appendix 2.3.3-Appendix 2.3.6, which is not surprising given the high correlation between 2020 and 2021 fiscal support.

We also experiment with alternative constructions for the left-hand-side variable in these sets of regressions. Instead of expressing excess inflation as of February 2022, which is our preferred definition as it avoids considering the effect of Russia's invasion of Ukraine, we construct a country-specific average of 2022 inflation using data up until either March or April (depending on each country's available data), from which we subtract the average pre-pandemic inflation rate. Using this definition of excess inflation, we find that the results are robust and qualitatively similar to those in Tables 3 and 4.

All told, despite the robustness tests described above, our analysis could suffer from other biases. For example, a positive bias could arise in our estimate if there is a positive correlation between fiscal and monetary policy support across our sample countries. In this case, our fiscal stimulus variable would capture the effect of both fiscal and monetary policy on inflation and hence should be interpreted as an upper bound of the effect of fiscal stimulus. Future work on this topic would benefit from addressing such concerns.

Table 4
Fiscal Stimulus and Excess Inflation: Controlling for the Severity of the Pandemic

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---------------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|
| | Excess Headline Inflation |
| Domestic Fiscal Stimulus | 1.09*** (0.32) | 1.18*** (0.39) | 0.98*** (0.36) | 0.90* (0.47) | 1.22*** (0.39) | 1.01*** (0.35) | 1.07** (0.43) |
| Total Exposure to Foreign Stimulus | 1.43*** (0.40) | 1.28*** (0.41) | 1.38*** (0.43) | 1.12*** (0.41) | 1.29*** (0.41) | 1.49*** (0.47) | 1.29*** (0.45) |
| <u>Controls</u> | | | | | | | |
| Sum of Negative Growth | | | | | | | |
| Industrial Production | | ✓ | | ✓ | | | |
| Mobility | | | ✓ | ✓ | | | |
| Total Growth | | | | | | | |
| Industrial Production | | | | | ✓ | | ✓ |
| Mobility | | | | | | ✓ | ✓ |
| R^2 | 0.42 | 0.42 | 0.39 | 0.39 | 0.42 | 0.40 | 0.37 |
| Observations | 52 | 46 | 49 | 44 | 46 | 49 | 44 |

NOTE: *Excess Headline Inflation* is computed by subtracting the February 2022 12-month inflation from its 2015–2019 average. *Domestic Fiscal Stimulus* is constructed using a similar definition of deviation from projected spending shown in Figure 3, but it takes the average of 2020 and 2021 deviations from projected fiscal spending. The variable is then standardized by dividing by its standard deviation. *Vertical Exposure to Foreign Stimulus* is the standardized weighted average of the *Domestic Fiscal Stimulus* of a country's trading partners, and *Horizontal Exposure to Foreign Stimulus* is the standardized weighted average of the *Vertical Exposure to Fiscal Stimulus* of a country's trading partners. *Total Exposure to Foreign Stimulus* is the standardized sum of *Vertical Exposure to Foreign Stimulus* and *Horizontal Exposure to Foreign Stimulus*. The constant and control variables are omitted from the table for brevity. Robust standard errors are in parentheses.

** $p < 0.01$, * $p < 0.05$, * $p < 0.1$

5. THE OUTLOOK AHEAD: RISKS COULD COME FROM SERVICES

The large swings in goods demand, coupled with limited production and shipping capacity in many countries, gave rise to bottlenecks and ultimately put pressure on goods inflation. Looking at previous recessions, Figure 8 reveals how different the behavior of consumption during the pandemic was from previous recessions. Given data constraints, we focus on the United States (Panel A) and other advanced economies (Panel B). In both cases, it is very clear that services consumption took a very heavy hit throughout the pandemic, while goods consumption decreased only modestly during the first wave before rebounding extremely strongly and remaining above trend since then.

All told, the rebalancing of consumption was slower in the United States compared with most other advanced economies. While this movement could ease some tensions in the goods market, it also comes with notable risks. For example, the service sector is more labor intensive than the goods sector. As shown in Figure 9, employment intensity in the service sector, as measured by the employment-to-output ratio, is more than twice that in the goods sector. Therefore, rebalancing toward services will likely increase labor demand. Given the current tightness in advanced-economy labor markets, increasing labor demand is likely to put pressure on wages and, at the extreme, could create a risk of a wage-price spiral.

Table 5**Fiscal Stimulus and Excess Core Inflation: Role of Domestic and Foreign Forces**

| | (1) | (2) | (3) | (4) | (5) | (6) | (2) |
|---------------------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
| | Excess Core Inflation |
| Domestic Fiscal Stimulus | 0.96*** (0.30) | | | 0.79*** (0.29) | 0.76** (0.30) | 0.76** (0.31) | 0.77** (0.30) |
| Total Exposure to Foreign Stimulus | | | | | | | 0.90*** (0.32) |
| R^2 | 0.17 | 0.22 | 0.27 | 0.33 | 0.37 | 0.37 | 0.35 |
| Observations | 42 | 42 | 42 | 42 | 42 | 42 | 42 |

NOTE: Robust standard errors are in parentheses.

** $p < 0.01$, * $p < 0.05$, * $p < 0.1$

That said, wage pressures are currently moderate, and total hours worked are still below their 2019 level, suggesting that labor supply has some room to expand. Assuming rebalancing is driven by a reduction in fear related to the pandemic, it could be accompanied by further easing of labor supply constraints. Ultimately, the impact of rebalancing on inflation will depend in part on how fast labor supply adjusts to meet higher demand in the labor market. Should the adjustment be too slow, inflation could remain high for longer.

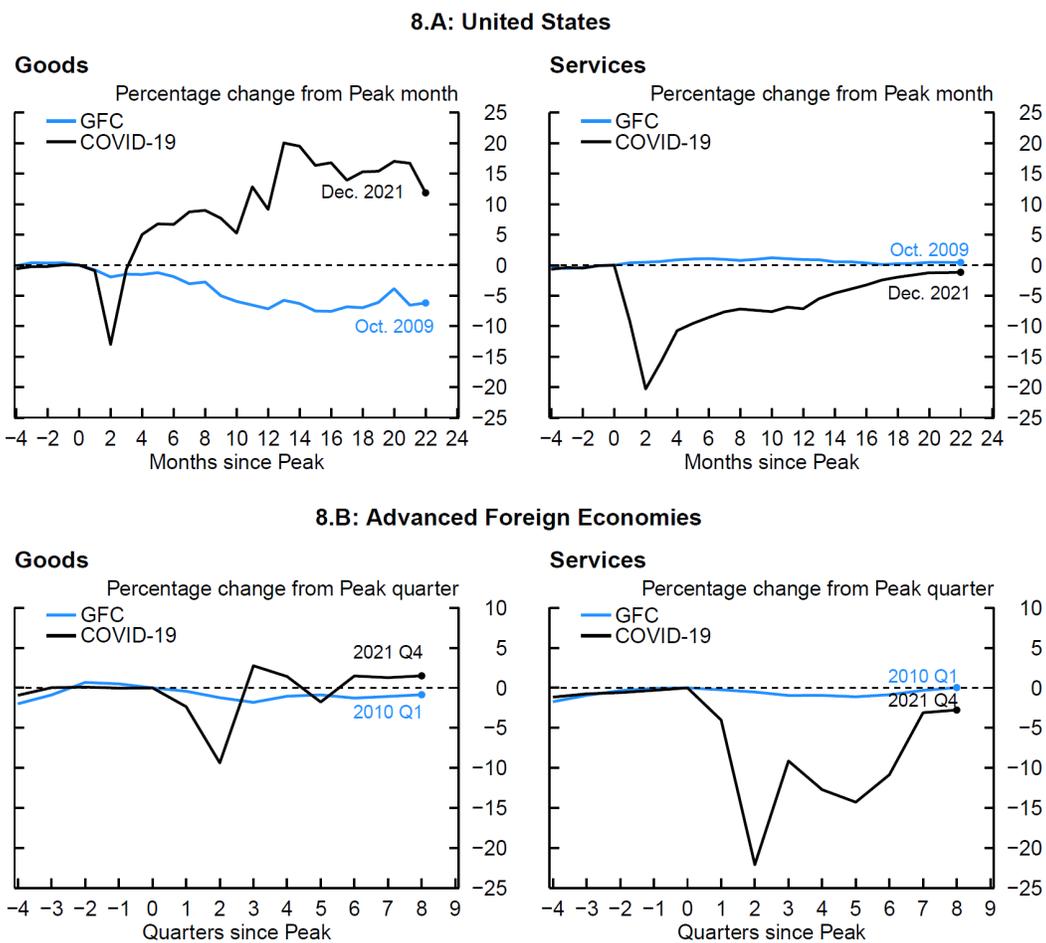
Table 6**Fiscal Stimulus and Excess Core Inflation: Role of Domestic and Foreign Forces with Controls**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---------------------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
| | Excess Core Inflation |
| Domestic Fiscal Stimulus | 0.77** (0.30) | 0.76** (0.31) | 0.75** (0.33) | 0.73* (0.38) | 0.75** (0.32) | 0.79** (0.32) | 0.74** (0.35) |
| Total Exposure to Foreign Stimulus | 0.90*** (0.32) | 0.84** (0.32) | 0.92*** (0.31) | 0.84** (0.32) | 0.83** (0.32) | 0.95*** (0.35) | 0.87** (0.36) |
| Controls | | | | | | | |
| Sum of Negative Growth | | | | | | | |
| Industrial Production | | ✓ | | ✓ | | | |
| Mobility | | | ✓ | ✓ | | | |
| Total Growth | | | | | | | |
| Industrial Production | | | | | ✓ | | ✓ |
| Mobility | | | | | | ✓ | ✓ |
| R^2 | 0.35 | 0.34 | 0.32 | 0.30 | 0.34 | 0.36 | 0.32 |
| Observations | 42 | 39 | 41 | 38 | 39 | 41 | 38 |

NOTE: *Excess Core Inflation* is computed by subtracting the February 2022 12-month core inflation from its 2015–2019 average. *Domestic Fiscal Stimulus* is constructed using a similar definition of deviation from projected spending shown in Figure 3, but it takes the average of 2020 and 2021 deviations from projected fiscal spending. The variable is then standardized by dividing by its standard deviation. *Vertical Exposure to Foreign Stimulus* is the standardized weighted average of the *Domestic Fiscal Stimulus* of a country's trading partners, and *Horizontal Exposure to Foreign Stimulus* is the standardized weighted average of the *Vertical Fiscal Stimulus* of a country's trading partners. *Total Exposure to Foreign Stimulus* is the standardized sum of *Vertical Exposure to Foreign Stimulus* and *Horizontal Exposure to Foreign Stimulus*. The constant and control variables are omitted from the table for brevity. Robust standard errors are in parentheses.

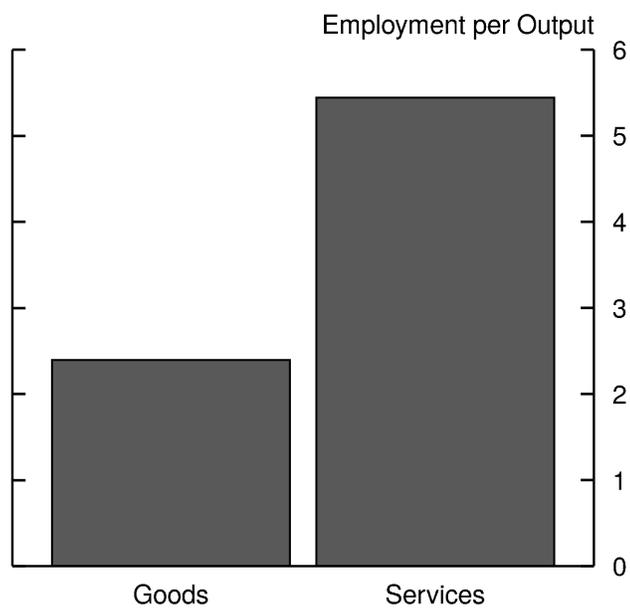
** $p < 0.01$, * $p < 0.05$, * $p < 0.1$

Figure 8
Real Consumption of Goods and Services in the U.S. and Other Advanced Foreign Economies in Recent Recessions



NOTE: The advanced foreign economy aggregate is constructed using GDP weights and includes the United Kingdom, France, Germany, and Canada.
 SOURCE: Bureau of Economic Analysis; Haver Analytics; C.D. Howe Institute Business Cycle Council; Euro Area Business Cycle Network.

Figure 9
Employment Intensity in Goods and Services



NOTE: Employment intensity is constructed by dividing 2020 employment (thousands) by 2020 output (billions of chained 2021 dollars). Aggregates are constructed using industry output as weights. The goods aggregate comprise mining, construction, manufacturing, and utilities, while the services aggregate comprise all other nonagricultural and nongovernment sectors.
SOURCE: Bureau of Labor Statistics.

6. CONCLUSION

The COVID-19 pandemic was a very peculiar economic shock, affecting both firms' ability to produce and consumers' ability to consume, as has been widely noted. In response to this shock, most governments in advanced economies injected large amounts of money into the economy. This policy was successful at boosting consumption, which, together with a relatively inelastic supply, may have led to supply chain bottlenecks and price tensions. This analysis suggests a potentially sizable role that fiscal policy may have played in contributing to upward price pressures.¹⁴ However, one should also recognize the positive role played by generous government support throughout this unprecedented crisis. The large spending supported a strong economic rebound, with both GDP and employment recovering at a remarkable pace, likely preventing worse outcomes despite the price pressures that may have resulted from the spending.

¹⁴In a recent new book, Kehoe and Nicolini, 2021 also argue that many countries in Latin America have been experiencing this link between fiscal spending and inflation over the past six decades. Their lesson is that good economic policy is a combination of good fiscal policy and good monetary policy.

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APPENDIX 1. FULL COUNTRY-SPECIFIC RESULTS

Table Appendix 1.1 presents our estimate of the statistical association between fiscal stimulus and inflation in all countries. It is based on our point estimates in Table 4, column 7 as well as on country-specific values for the exposure to domestic and foreign fiscal stimulus. Our results are consistent with those in our main analysis.

Table Appendix 1.1

Full Country-Specific Results

| Country | Domestic Effect | Foreign Effect | Country | Domestic Effect | Foreign Effect |
|----------------|-----------------|----------------|--------------|-----------------|----------------|
| Chile | 3.29 | 2.14 | Brazil | 1.11 | 1.10 |
| Greece | 2.86 | 2.67 | Latvia | 1.06 | 4.47 |
| Lithuania | 2.77 | 4.49 | Israel | 1.05 | 2.32 |
| United Kingdom | 2.61 | 2.35 | Croatia | 1.03 | 3.77 |
| United States | 2.55 | 0.75 | Luxembourg | 1.02 | 7.00 |
| Canada | 2.48 | 3.05 | Korea | 1.01 | 2.00 |
| Slovakia | 2.29 | 4.70 | Vietnam | 0.93 | 2.70 |
| Ireland | 2.28 | 6.61 | Iceland | 0.80 | 3.90 |
| Slovenia | 2.18 | 4.40 | Finland | 0.78 | 3.00 |
| Japan | 1.95 | 1.16 | France | 0.72 | 2.63 |
| Peru | 1.93 | 1.77 | Indonesia | 0.70 | 1.17 |
| Russia | 1.72 | 1.85 | Estonia | 0.64 | 4.49 |
| Netherlands | 1.64 | 3.94 | India | 0.60 | 1.39 |
| Austria | 1.61 | 3.92 | Bulgaria | 0.58 | 4.08 |
| Denmark | 1.59 | 3.33 | Norway | 0.51 | 3.71 |
| Spain | 1.49 | 2.61 | Romania | 0.43 | 3.22 |
| Poland | 1.44 | 3.66 | Sweden | 0.39 | 3.53 |
| Italy | 1.41 | 2.51 | South Africa | 0.19 | 1.54 |
| Czech Republic | 1.32 | 4.24 | Tunisia | 0.14 | 3.13 |
| Taiwan | 1.30 | 2.51 | Mexico | 0.03 | 3.49 |
| Portugal | 1.27 | 3.40 | Saudi Arabia | -0.57 | 2.51 |
| Thailand | 1.25 | 2.62 | Philippines | -0.59 | 2.33 |
| Kazakhstan | 1.21 | 2.55 | Malaysia | -0.94 | 2.75 |
| Hungary | 1.15 | 4.66 | China | -1.02 | 1.54 |
| Belgium | 1.12 | 4.73 | Colombia | -1.08 | 1.76 |
| Germany | 1.12 | 2.97 | Costa Rica | -2.04 | 2.83 |

APPENDIX 2. ALTERNATIVE SPECIFICATIONS

Appendix 2.1 Further Discussion of Asymmetric Specification

We now provide more discussion of our main specification in equation (1), which takes an asymmetric view and separates positive and negative mobility movements. To better understand the value of our asymmetric specification, let us consider what a symmetric/linear model would imply. Consider the following empirical model:

$$\text{(Appendix 2.1)} \quad \text{Cons_Growth}_{ct} = \beta_1 \text{Mobility}_{ct} + \beta_2 \text{Mobility}_{ct} \times \text{Fiscal_Stim}_{ct} + FE_c + \varepsilon_{ct}.$$

If one estimates (Appendix 2.1) and finds a positive value for β_2 , countries with large fiscal stimulus would be expected to have a larger elasticity of consumption with respect to mobility. In other words, when mobility goes up, consumption is expected to increase more in countries with large fiscal stimulus. Importantly, the symmetric effect would also be true: When mobility goes down, consumption is expected to decrease more in countries with large fiscal support, which is a mechanical consequence of using a linear/symmetric model. In this case, fiscal stimulus always amplifies the effect of mobility.

Overall, in a linear/symmetric regression model, if the "standalone" term for mobility (β_1) and the interaction between mobility and fiscal stimulus (β_2) have the same sign, then fiscal stimulus amplifies the effect of mobility regardless of the direction of the move. If β_1 and β_2 have opposite signs, then fiscal stimulus dampens the effect of mobility on consumption. In either case, the effect is symmetric by construction.

Note that such symmetry is at odds with our above investigation: As shown in Table 1, the standalone and interaction terms have the same sign when mobility increases (implying that consumption increases with mobility and does more so for countries with large fiscal stimulus), whereas the standalone and interaction terms have opposite signs when mobility decreases (implying that consumption goes down when mobility decreases but does less so for countries with large fiscal stimulus).¹⁵

Taken together, the results in Table 1 suggest that a linear/symmetric specification as in equation (Appendix 2.1) is not appropriate. Indeed, in our sample, such a linear/symmetric model yields weak and unstable results, as can be seen in Table Appendix 2.1.1, which is simply the mechanical consequence of the asymmetry we uncover in Table 1: In periods of lockdowns, fiscal stimulus dampened the drop in consumption, and it amplified the consumption rebound in periods of reopening.

Table Appendix 2.1.1

Robustness Test: Consumption's and Industrial Production's Relationship with Mobility Movements, with Country-Level Fiscal Stimulus
Alternative specification: No asymmetry

| | (1) | (2) | (3) | (4) |
|-----------------------------------|----------------------|----------------------|------------------------|--------------------------|
| | Total Consumption | Goods Consumption | Service Consumption | Industrial Production |
| Mobility | 0.31*** (0.02) | 0.25*** (0.02) | 0.36*** (0.02) | 0.39*** (0.07) |
| Mobility \times Fiscal Stimulus | 0.02*** (0.01) | 0.01 (0.01) | 0.03*** (0.01) | -0.09** (0.04) |
| Country FE | ✓ | ✓ | ✓ | ✓ |
| R^2 | 0.73 | 0.60 | 0.66 | 0.20 |
| Observations | 184 | 184 | 184 | 352 |
| Number of countries | 23 | 23 | 23 | 44 |

NOTE: The left-hand-side variables and mobility variables are quarterly growth rates. *Domestic Fiscal Stimulus* is constructed using a similar definition of deviation from projected spending shown in Figure 3, but for a given country in 2020, the value solely takes the 2020 deviation from projected fiscal spending. However, in 2021 the value is constructed by averaging the 2020 and 2021 values of deviation from projected spending. The variable is then standardized by dividing by its standard deviation. The constant and standalone *Domestic Fiscal Stimulus* variables are omitted from the table for brevity. The data extend from 2020 Q1 to 2021 Q4. Standard errors are clustered at the country level and are shown in parentheses.

** $p < 0.01$, * $p < 0.05$, * $p < 0.1$

Appendix 2.2 Disentangling Vertical and Horizontal Exposure

In this section, we present an alternative version of our inflation regressions where we include both horizontal and vertical exposure variables separately. In Table Appendix 2.2.1 we use *Excess Headline Inflation* as the dependent variable, while in Table Appendix 2.2.2 we use *Excess Core Inflation*.

¹⁵Recall that in our asymmetric model, both mobility increase and mobility decrease variables only take positive values. This enables us to have "intuitive" coefficients in the standalone terms: a positive coefficient associated with mobility increase and a negative coefficient associated with mobility decrease.

Table Appendix 2.2.1**Fiscal Stimulus and Excess Inflation: Role of Domestic and Foreign Forces**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|--|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|
| | Excess Headline Inflation |
| Domestic Fiscal Stimulus | 1.30*** (0.37) | | | 1.12*** (0.33) | 1.05*** (0.35) | 1.06*** (0.35) | 1.09*** (0.33) |
| Vertical Exposure to Foreign Stimulus | | 1.49*** (0.44) | | 1.34*** (0.43) | | 0.11 (0.60) | |
| Horizontal Exposure to Foreign Stimulus | | | 1.69*** (0.42) | | 1.52*** (0.37) | 1.42** (0.61) | |
| Total Exposure to Foreign Stimulus | | | | | | | 1.44*** (0.41) |
| R^2 | 0.19 | 0.25 | 0.32 | 0.39 | 0.44 | 0.45 | 0.42 |
| Observations | 52 | 52 | 52 | 52 | 52 | 52 | 52 |

NOTE: *Excess Headline Inflation* is computed by subtracting the February 2022 12-month inflation from its 2015–2019 average. *Domestic Fiscal Stimulus* is constructed using a similar definition of deviation from projected spending shown in Figure 3, but it takes the average of 2020 and 2021 deviations from projected fiscal spending. The variable is then standardized by dividing by its standard deviation. *Vertical Exposure to Foreign Stimulus* is the standardized weighted average of the *Domestic Fiscal Stimulus* of a country's trading partners, and *Horizontal Exposure to Foreign Stimulus* is the standardized weighted average of the *Vertical Fiscal Stimulus* of a country's trading partners. *Total Exposure to Foreign Stimulus* is the standardized sum of *Vertical Exposure to Foreign Stimulus* and *Horizontal Exposure to Foreign Stimulus*. The constant is omitted from the table for brevity. Robust standard errors are in parentheses.

** $p < 0.01$, * $p < 0.05$, * $p < 0.1$

Table Appendix 2.2.2**Fiscal Stimulus and Excess Core Inflation: Role of Domestic and Foreign Forces**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|--|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
| | Excess Core Inflation |
| Domestic Fiscal Stimulus | 0.96*** (0.30) | | | 0.79*** (0.29) | 0.76** (0.30) | 0.76** (0.31) | 0.77** (0.30) |
| Vertical Exposure to Foreign Stimulus | | 0.97*** (0.33) | | 0.84** (0.33) | | 0.10 (0.59) | |
| Horizontal Exposure to Foreign Stimulus | | | 1.09*** (0.32) | | 0.96*** (0.29) | 0.87 (0.59) | |
| Total Exposure to Foreign Stimulus | | | | | | | 0.90*** (0.32) |
| R^2 | 0.17 | 0.22 | 0.27 | 0.33 | 0.37 | 0.37 | 0.35 |
| Observations | 42 | 42 | 42 | 42 | 42 | 42 | 42 |

NOTE: *Excess Core Inflation* is computed by subtracting the February 2022 12-month core inflation from its 2015–2019 average. *Domestic Fiscal Stimulus* is constructed using a similar definition of deviation from projected spending shown in Figure 3, but it takes the average of 2020 and 2021 deviations from projected fiscal spending. The variable is then standardized by dividing by its standard deviation. *Vertical Exposure to Foreign Stimulus* is the standardized weighted average of the *Domestic Fiscal Stimulus* of a country's trading partners, and *Horizontal Exposure to Foreign Stimulus* is the standardized weighted average of the *Vertical Fiscal Stimulus* of a country's trading partners. *Total Exposure to Foreign Stimulus* is the standardized sum of *Vertical Exposure to Foreign Stimulus* and *Horizontal Exposure to Foreign Stimulus*. The constant is omitted from the table for brevity. Robust standard errors are in parentheses.

** $p < 0.01$, * $p < 0.05$, * $p < 0.1$

Appendix 2.3 Alternative Fiscal Stimulus Definition

In this section, Tables Appendix 2.3.1–Appendix 2.3.6 revisit all estimations presented in the main text but investigate the case where the fiscal stimulus variable is constructed using 2020 fiscal stimulus only. The results show that all the findings hold when using this alternative definition.

Table Appendix 2.3.1**Robustness Test: Consumption's and Industrial Production's Relationship with Mobility Movements, with Country-Level Fiscal Stimulus***Alternative definition of Fiscal Stimulus: Based on 2020 government spending only*

| | (1) | (2) | (3) | (4) |
|---------------------------------|--------------------|--------------------|--------------------|-------------------|
| | Total | Goods | Service | Industrial |
| | Consumption | Consumption | Consumption | Production |
| Mob. Increase | 0.25*** (0.03) | 0.19*** (0.03) | 0.31** (0.05) | 0.18 (0.11) |
| Mob. Decrease | -0.37*** (0.03) | -0.29*** (0.04) | -0.44*** (0.05) | -0.61** (0.26) |
| Mob. Increase × Fiscal Stimulus | 0.04** (0.02) | 0.06** (0.01) | 0.03 (0.03) | 0.02 (0.06) |
| Mob. Decrease × Fiscal Stimulus | -0.01 (0.01) | 0.04*** (0.01) | -0.05* (0.03) | 0.19 (0.14) |
| Country FE | ✓ | ✓ | ✓ | ✓ |
| R^2 | 0.73 | 0.59 | 0.67 | 0.18 |
| Observations | 184 | 184 | 184 | 352 |
| Number of countries | 23 | 23 | 23 | 44 |

NOTE: The left-hand-side variables and mobility variables are quarterly growth rates. *Domestic Fiscal Stimulus* is constructed using a similar definition of deviation from projected spending shown in Figure 3, but for a given country, the value solely takes the 2020 deviations from projected fiscal spending. The variable is then standardized by dividing by its standard deviation. The constant is omitted from the table for brevity, and the standalone *Domestic Fiscal Stimulus* variable is absorbed by country fixed effects since it is time invariant. The data extend from 2020 Q1 to 2021 Q4. Standard errors are clustered at the country level and are shown in parentheses.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table Appendix 2.3.2**Robustness Test: Employment's Relationship with Mobility Movements, with Country-Level Fiscal Stimulus****Alternative definition of Fiscal Stimulus: Based on 2020 government spending only**

| | (1) | (2) | (3) | (4) |
|---------------------------------|--------------------|--------------------|--------------------|-------------------|
| | Total | Goods | Service | Labor Force |
| | Employment | Employment | Employment | Participation |
| Mob. Increase | 0.01 (0.02) | 0.06 (0.05) | 0.00 (0.03) | 0.02 (0.04) |
| Mob. Decrease | -0.21*** (0.07) | -0.12*** (0.06) | -0.24*** (0.09) | -0.24** (0.05) |
| Mob. Increase × Fiscal Stimulus | 0.00 (0.01) | -0.04 (0.04) | 0.02 (0.02) | 0.01 (0.02) |
| Mob. Decrease × Fiscal Stimulus | 0.05 (0.05) | 0.00 (0.03) | 0.07 (0.07) | 0.06** (0.03) |
| Country FE | ✓ | ✓ | ✓ | ✓ |
| R^2 | 0.35 | 0.17 | 0.34 | 0.30 |
| Observations | 232 | 232 | 232 | 245 |
| Number of countries | 29 | 29 | 29 | 31 |

NOTE: The left-hand-side variables and mobility variables are quarterly growth rates. *Domestic Fiscal Stimulus* is constructed using a similar definition of deviation from projected spending shown in Figure 3, but for a given country, the value solely takes the 2020 deviation from projected fiscal spending. The variable is then standardized by dividing by its standard deviation. The constant is omitted from the table for brevity, and the standalone *Domestic Fiscal Stimulus* variable is omitted due to using country fixed effects since the variable is now based on 2020 government spending only. The data extend from 2020 Q1 to 2021 Q4. Standard errors are clustered at the country level and are shown in parentheses.

** $p < 0.01$, * $p < 0.05$, * $p < 0.1$

Table Appendix 2.3.3**Robustness Test: Fiscal Stimulus and Excess Inflation****Alternative definition of Fiscal Stimulus: Based on 2020 government spending only**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|--|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|
| | Excess Headline Inflation |
| Domestic Fiscal Stimulus | 0.92** (0.40) | | | 0.84** (0.38) | 0.78** (0.34) | 0.78** (0.34) | 0.81** (0.36) |
| Vertical Exposure to Foreign Stimulus | | 1.11*** (0.39) | | 1.05*** (0.38) | | -0.46 (0.56) | |
| Horizontal Exposure to Foreign Stimulus | | | 1.61*** (0.35) | | 1.54*** (0.34) | 1.90*** (0.56) | |
| Total Exposure to Foreign Stimulus | | | | | | | 1.26*** (0.36) |
| R^2 | 0.10 | 0.14 | 0.29 | 0.22 | 0.36 | 0.37 | 0.27 |
| Observations | 52 | 52 | 52 | 52 | 52 | 52 | 52 |

NOTE: *Excess Headline Inflation* is computed by subtracting the February 2022 12-month inflation from its 2015–2019 average. *Domestic Fiscal Stimulus* is constructed using a similar definition of deviation from projected spending shown in Figure 3 but, for a given country, takes the 2020 deviation from projected fiscal spending. The variable is then standardized by dividing by its standard deviation. *Vertical Exposure to Foreign Stimulus* is the standardized weighted average of the *Domestic Fiscal Stimulus* of a country's trading partners, and *Horizontal Exposure to Foreign Stimulus* is the standardized weighted average of the *Vertical Fiscal Stimulus* of a country's trading partners. *Total Exposure to Foreign Stimulus* is the standardized sum of *Vertical Exposure to Foreign Stimulus* and *Horizontal Exposure to Foreign Stimulus*. The constant is omitted from the table for brevity. Robust standard errors are in parentheses.

** $pp < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table Appendix 2.3.4**Robustness Test: Fiscal Stimulus and Excess Inflation, with Controls**

Alternative definition of Fiscal Stimulus: Based on 2020 government spending only

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---------------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|
| | Excess Headline Inflation |
| Domestic Fiscal Stimulus | 0.81** (0.36) | 0.85** (0.39) | 0.72* (0.37) | 0.67* (0.39) | 0.90** (0.39) | 0.82** (0.38) | 0.82* (0.41) |
| Total Exposure to Foreign Stimulus | 1.26*** (0.36) | 1.11*** (0.36) | 1.12*** (0.38) | 0.85** (0.37) | 1.13*** (0.36) | 1.29*** (0.38) | 1.08*** (0.38) |
| Controls | | | | | | | |
| Sum of Negative Growth | | | | | | | |
| Industrial Production | | ✓ | | ✓ | | | |
| Mobility | | | ✓ | ✓ | | | |
| Total Growth | | | | | | | |
| Industrial Production | | | | | ✓ | | ✓ |
| Mobility | | | | | | ✓ | ✓ |
| R^2 | 0.27 | 0.30 | 0.26 | 0.31 | 0.29 | 0.27 | 0.25 |
| Observations | 52 | 46 | 49 | 44 | 46 | 49 | 44 |

NOTE: *Excess Headline Inflation* is computed by subtracting the February 2022 12-month inflation from its 2015–2019 average. *Domestic Fiscal Stimulus* is constructed using a similar definition of deviation from projected spending shown in Figure 3 but, for a given country, takes the 2020 deviation from projected fiscal spending. The variable is then standardized by dividing by its standard deviation. *Vertical Exposure to Foreign Stimulus* is the standardized weighted average of the *Domestic Fiscal Stimulus* of a country's trading partners, and *Horizontal Exposure to Foreign Stimulus* is the standardized weighted average of the *Vertical Fiscal Stimulus* of a country's trading partners. *Total Exposure to Foreign Stimulus* is the standardized sum of *Vertical Exposure to Foreign Stimulus* and *Horizontal Exposure to Foreign Stimulus*. The constant and controls are omitted from the table for brevity. Robust standard errors are in parentheses.

** $p < 0.01$, * $p < 0.05$, * $p < 0.1$

Table Appendix 2.3.5**Robustness Test: Fiscal Stimulus and Excess Core Inflation****Alternative definition of Fiscal Stimulus: Based on 2020 government spending only**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|--|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
| | Excess Core Inflation |
| Domestic Fiscal Stimulus | 0.75*** (0.34) | | | 0.66** (0.32) | 0.63** (0.30) | 0.65** (0.31) | 0.65** (0.32) |
| Vertical Exposure to Foreign Stimulus | | 0.72** (0.30) | | 0.64** (0.29) | | -0.28 (0.46) | |
| Horizontal Exposure to Foreign Stimulus | | | 1.01*** (0.29) | | 0.94*** (0.28) | 1.17** (0.47) | |
| Total Exposure to Foreign Stimulus | | | | | | | 0.76** (0.30) |
| R^2 | 0.11 | 0.12 | 0.23 | 0.24 | 0.31 | 0.32 | 0.25 |
| Observations | 42 | 42 | 42 | 42 | 42 | 42 | 42 |

NOTE: *Excess Core Inflation* is computed by subtracting the February 2022 12-month core inflation from its 2015–2019 average. *Domestic Fiscal Stimulus* is constructed using a similar definition of deviation from projected spending shown in Figure 3 but, for a given country, takes the 2020 deviation from projected fiscal spending. The variable is then standardized by dividing by its standard deviation. *Vertical Exposure to Foreign Stimulus* is the standardized weighted average of the *Domestic Fiscal Stimulus* of a country's trading partners, and *Horizontal Exposure to Foreign Stimulus* is the standardized weighted average of the *Vertical Fiscal Stimulus* of a country's trading partners. *Total Exposure to Foreign Stimulus* is the standardized sum of *Vertical Exposure to Foreign Stimulus* and *Horizontal Exposure to Foreign Stimulus*. The constant is omitted from the table for brevity. Robust standard errors are in parentheses.

** $p < 0.01$, * $p < 0.05$, * $p < 0.1$

Table Appendix 2.3.6**Robustness Test: Fiscal Stimulus and Excess Core Inflation, with Controls***Alternative definition of Fiscal Sstimulus: Based on 2020 government spending only*

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---------------------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
| | Excess Core Inflation |
| Domestic Fiscal Stimulus | 0.65** (0.32) | 0.67** (0.33) | 0.61* (0.33) | 0.62* (0.34) | 0.68** (0.32) | 0.79** (0.33) | 0.74** (0.35) |
| Total Exposure to Foreign Stimulus | 0.76** (0.30) | 0.70** (0.29) | 0.72** (0.31) | 0.62* (0.32) | 0.70** (0.29) | 0.81*** (0.29) | 0.73** (0.31) |
| Controls | | | | | | | |
| Sum of negative growth | | | | | | | |
| Industrial Production | | ✓ | | ✓ | | | |
| Mobility | | | ✓ | ✓ | | | |
| Total growth | | | | | | | |
| Industrial Production | | | | | ✓ | | ✓ |
| Mobility | | | | | | ✓ | ✓ |
| R^2 | 0.25 | 0.26 | 0.26 | 0.23 | 0.26 | 0.29 | 0.25 |
| Observations | 42 | 39 | 41 | 38 | 39 | 41 | 38 |

NOTE: *Excess Core Inflation* is computed by subtracting the February 2022 12-month core inflation from its 2015–2019 average. *Domestic Fiscal Stimulus* is constructed using a similar definition of deviation from projected spending shown in Figure 3 but, for a given country, takes the 2020 deviation from projected fiscal spending. The variable is then standardized by dividing by its standard deviation. *Vertical Exposure to Foreign Stimulus* is the standardized weighted average of the *Domestic Fiscal Stimulus* of a country's trading partners, and *Horizontal Exposure to Foreign Stimulus* is the standardized weighted average of the *Vertical Fiscal Stimulus* of a country's trading partners. *Total Exposure to Foreign Stimulus* is the standardized sum of *Vertical Exposure to Foreign Stimulus* and *Horizontal Exposure to Foreign Stimulus*. The constant and controls are omitted from the table for brevity. Robust standard errors are in parentheses.

** $p < 0.01$, * $p < 0.05$, * $p < 0.1$