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Supply-chain disruptions and new investment policies in the post-COVID-19 world

Initial insights from project-level data

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Supply-chain disruptions and new investment policies in the post-COVID-19 world

Initial insights from project-level data

By

Monika Sztajerowska*

The COVID-19 pandemic has inflicted a series of shocks on the global economy, not least impacting global trade and investment. During the same time, several countries adopted new foreign direct investment (FDI) related policies. This paper presents novel preliminary evidence on the effects of these new FDI policies and COVID-19-related supply-chain disruptions on cross-border investment. It employs, among others, granular data on FDI policies and investment projects undertaken in a wide range of sectors in 175 host economies worldwide by investors from 46 home countries. It finds that a combination of FDI policies and COVID-19-related measures has a statistically significant and economically meaningful negative effect on the probability of a new cross-border greenfield investment project occurring during the sample period. The effect is the strongest in sectors with high R&D intensity.

Authorised for release by Carmine Di Noia, Director, OECD Directorate for Financial and Enterprise Affairs.

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Key findings

- The COVID-19 pandemic has inflicted a series of interrelated shocks on the global economy. Governments responded with a multitude of policy measures to protect local populations and economies – at times resulting in further supply chain disruptions and economic spillovers.
- Besides introducing a plethora of COVID-19 containment measures, many governments reformed their foreign direct investment (FDI) policies, which regulate market access conditions for foreign-owned firms.
- Using granular data on new FDI measures and COVID-19-related restrictions introduced during the period and data on cross-border greenfield investment projects, this paper provides first initial evidence on the effects of such policies.
- FDI-related measures introduced during this period related primarily to new rules on entry and ownership rules, including new FDI screening mechanisms introduced or reformed by numerous countries during COVID-19 pandemic and thereafter. These policies generally targeted certain sectors and economic activities and aimed mostly to safeguard "essential security" interests.
- New FDI measures aiming to increase control over incoming investment and stringent COVID-19-restrictions are found to have jointly a statistically significant negative effect on cross-border greenfield investment. A joint introduction of an additional measure of each type is associated with a 2.6 percentage point drop in the probability of a cross-border greenfield investment project taking place in a host-country-home-country-sector in a quarter-year, conditional on a set of controls. This points to a possible cumulative effect of supply-chain disruptions and changes to market access rules.
- These effects are economically meaningful: When compared to an unconditional mean probability of a cross-border greenfield investment project taking place, the estimated effect implies a drop in investment probability by 23%.
- Sectors with high R&D intensity were particularly strongly by the combination of two types of policies suggesting that the risk of cumulative effect of FDI policies and supply chain disruptions may be the highest in those sectors.

The COVID-19 pandemic has inflicted a series of interrelated shocks on the global economy. The global output and trade collapsed, and the recovery – while more rapid than in the previous recessions – has been uneven across sectors and countries (OECD, 2021[1]; IMF, 2022[2]). Governments responded with a multitude of policy measures to protect local populations and economies – at times resulting in further supply chain disruptions and spill-overs effects on cross-border trade and investment. The effect of COVID-19-related disruptions on global trade has been analysed in several recent studies (Cerdeiro et al., 2020[3]; Bonadio et al., 2021[4]; Arriola, Kowalski and van Tongeren, 2021[5]; Espitia et al., 2022[6]; Brenton, Ferrantino and Maliszewska, 2022[7]), including from a policy perspective (Antràs, 2020[8]; Miroudot, 2020[9]). While several reports point to the risk of geo-economic fragmentation and reduced investment in certain locations (IMF, 2023[10]), thus-far there is little evidence on the effect of newly adopted investment policies on the observed

cross-border investment patterns. As some of those policies are subject to ongoing adjustments, insights into their effects may assist in the reflection on their future design.

This paper exploits high-frequency data on cross-border greenfield investment (Box 1) combined with data on foreign-direct investment (FDI)-related and COVID-19-containment measures implemented during this period (Box 3) to provide preliminary insights in this regard. The data includes information on investment projects in 75 sectors in 175 host economies by investors from 46 home countries – all OECD Member States and non-OECD G20 countries, for the period from 1 January 2019 until 31 March 2022 (see Annex for the full description of the data and the sample used in the analysis here).[1]

The paper is structured as follows: the first section presents unconditional investment trends during the sample period, the second section includes key results from the empirical analysis, and the third section concludes. The Annex provides further information on the data and the sample used throughout the analysis; presents the methodological approach; and includes additional tables and figures.

Box 1. Project-level data on cross-border greenfield investment

Several databases provide information on different aspects of cross-border investment, ranging from the official foreign direct investment (FDI) statistics compiled by governments to solutions offered by private data providers. Each data source has its own unique benefits and disadvantages, related to the data country and time coverage, frequency, granularity, reliability, and cross-country comparability, among others.

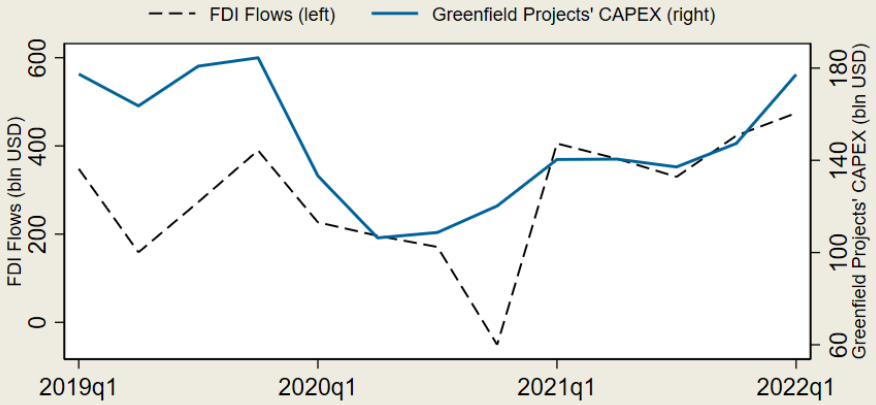
The official foreign direct investment (FDI) statistics follow the international rules on compilation and presentation of FDI data (e.g. the OECD Benchmark definition of FDI (BMD4), the IMF's Balance of Payments and International Investment Position Manual, 6th edition (BPM6)), which ensures their reliability, representativeness, and comparability across countries, regions and over time. Yet, official FDI data disaggregated by finely defined sector and mode of entry is often not available in many countries. As such, an analysis of effects of policies with a sectoral component – such as many FDI-related policies – may not always be possible. In this regard, private data providers offer complementary solutions. Data from private data providers also a priori permit analysis of data at higher frequency.

The fDi Markets database by the Financial Times (www.fdiintelligence.com/fdi-markets) includes data on greenfield cross-border investment projects and the number of jobs created and capital expenditure associated with such projects. The data is sourced mainly from media outlets, research agencies and government agencies. While its scope, compilation methodologies and data sources used differ from the official FDI statistics (ONS, 2020[11]), it tracks well the overall trends in FDI flows over time (Figure 1). As such, it is routinely used by international organisations (OECD, 2023[12]; UNCTAD, 2022[13]) and the academia (Breinlich et al., 2020[14]; Blanchard et al., 2021[15]) in studies analysing cross-border investment. Thanks to its close-to-real-time availability and detailed information on the sector of investment for greenfield investment projects for a large sample of host and home countries, it can, in some cases, serve as a useful analytical tool to better understand trends in cross-border investment.

[1] The period under study covers as much as possible the period prior to the COVID-19 pandemic and its duration until the start of the war in Ukraine. The latter event, and the associated policy responses, had further effects on global economic growth and cross-border trade and investment (Ruta, 2022[39]) that lie outside of the scope of this study.

Figure 1. FDI flows and capital expenditure in cross-border investment projects

In bln USD



Note: "FDI flows" refer to FDI outflows from OECD and non-OECD G20 economies to the world for comparability with the fDi Markets data used in this paper and "Greenfield Projects CAPEX" refer to capital expenditure associated with cross-border investment projects by investors from OECD and non-OECD G20 economies. Official FDI statistics for Q1 2022 are preliminary based on preliminary projections.
Source: OECD International Direct Investment Statistics database (2022) and the Financial Times fDi Markets (2022).

Trends in investment projects during the COVID-19 pandemic

Cross-border greenfield investment dropped sharply during the COVID-19 pandemic…

Looking at the raw data on all cross-border investment projects in the period 1 January 2019 until 31 March 2022 involving investors from 46 OECD and G20 home countries and 75 different sectors in 175 host countries in which those projects took place from the fDi Markets database, the median number of investment projects dropped by 30%, the value of capital expenditure by 29% and the number of associated jobs by 34% during the COVID-19 period, relative to the median recorded prior to the pandemic in 2019 (Figure 2).[2] It is noteworthy that in early 2022, prior to the outbreak of the war in Ukraine, there have been some signs of recovery in all three dimensions before the onset of a new crisis.

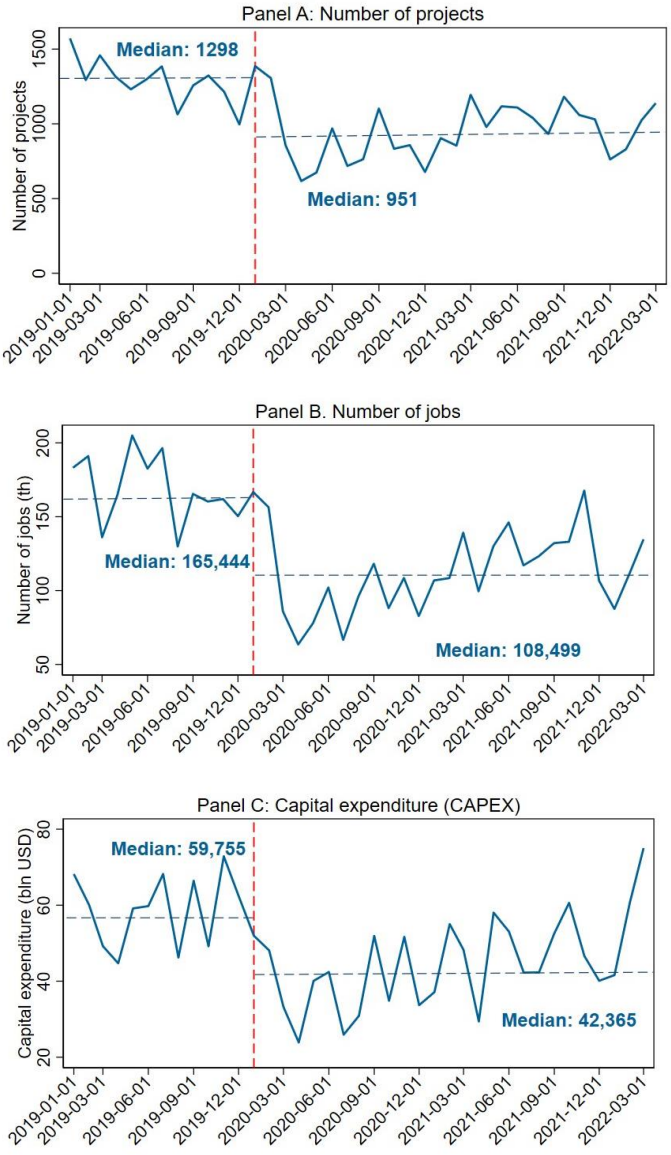
… and that effect has not been purely due to compositional effects

Aggregate patterns in investment projects could be related to changes in the relative importance of investments in or from certain locations and sectors over time. For example, the level and the rate of change in projects in the automotive industry by investors from the United States in Germany is likely to be different from those by investors from Iceland in Costa Rica. Yet, once we control econometrically for compositional effects to identify average relative changes within a given country-pair-sector, a significant drop in the number of investment projects, and, to a lesser extent, the number of jobs and value of capital

[2] Pre-COVID-19 period is defined to mean the time span from 1 January 2019 till 31 January 2020 and the post-COVID-19 period from 1 February 2020 (first day of the month after the WHO's announcement of COVID-19 Public Health Emergency of International Concern) until 31 March 2022. The comparison is made by taking a median value per period of monthly number of projects, value of capital expenditure and the number of jobs associated with cross-border greenfield investment projects, respectively (see Annex for more information on the data).

expenditure is confirmed (Figure 3).[3] These trends show very similar patterns when monthly data is used instead and are robust to controlling for countries' real quarter-level output (Figure A A.2, Figure A A.4).

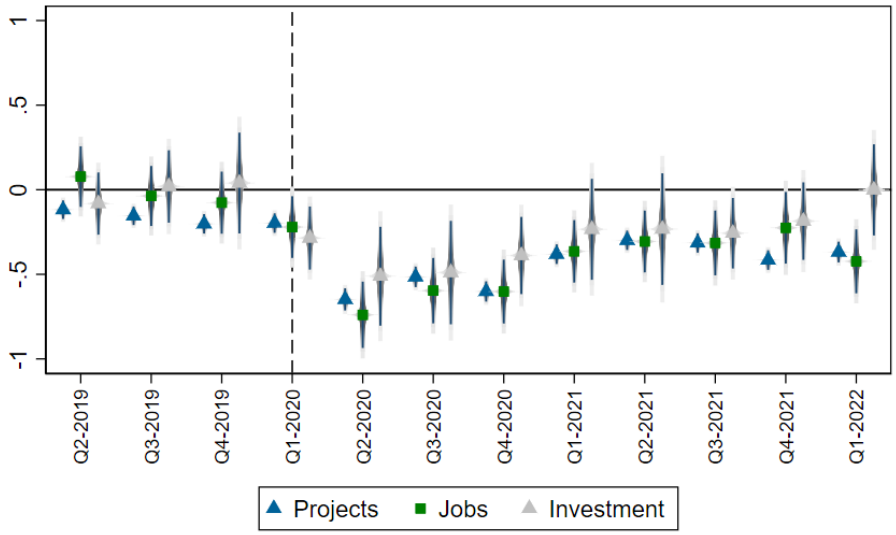
Figure 2. Number of cross-border greenfield investment projects pre- and post-COVID-19



Note: The blue line indicates the number of cross-border greenfield investment projects involving investors from OECD and G20 home economies from the Financial Times fDi Markets database (2022[16]) (see Annex A). The red vertical dotted line indicates the date when the World Health Organization declared the COVID-19 outbreak a Public Health Emergency of International Concern (30 January 2020). The blue horizontal dashed line shows the median number of cross-border greenfield investment projects in the pre-COVID-19 (i.e., 1 January 2019-31 January 2020 and post-COVID-19 period (1 February 2020-31 March 2022).
Source: The Financial Times fDi Markets database (2022[16]), Oxford Government Response Tracker from Hale et al. (2021[17]).

[3] This is done through the inclusion of a panel fixed effect (i.e., home-country-host-country-sector), see Equation 1 in the Annex.

Figure 3. Conditional trend in quarterly cross-border greenfield investment pre- and post-COVID-19



Note: The graph shows the estimated coefficients on quarter-year dummies from a Poisson Pseudo-Maximum-Likelihood (PPML) regression where the dependent variable is the number of greenfield cross-border investment projects, the number of jobs created or the value of capital expenditure associated with such projects, respectively, in a host country *i* involving investors from a home country *j* in a sector *s* in quarter-time period *qt*, and includes panel fixed effects (home-country-host-country-sector) to control for compositional effects. See Equation 1 in the Annex.

The pandemic affected mostly the probability of new investment projects taking place

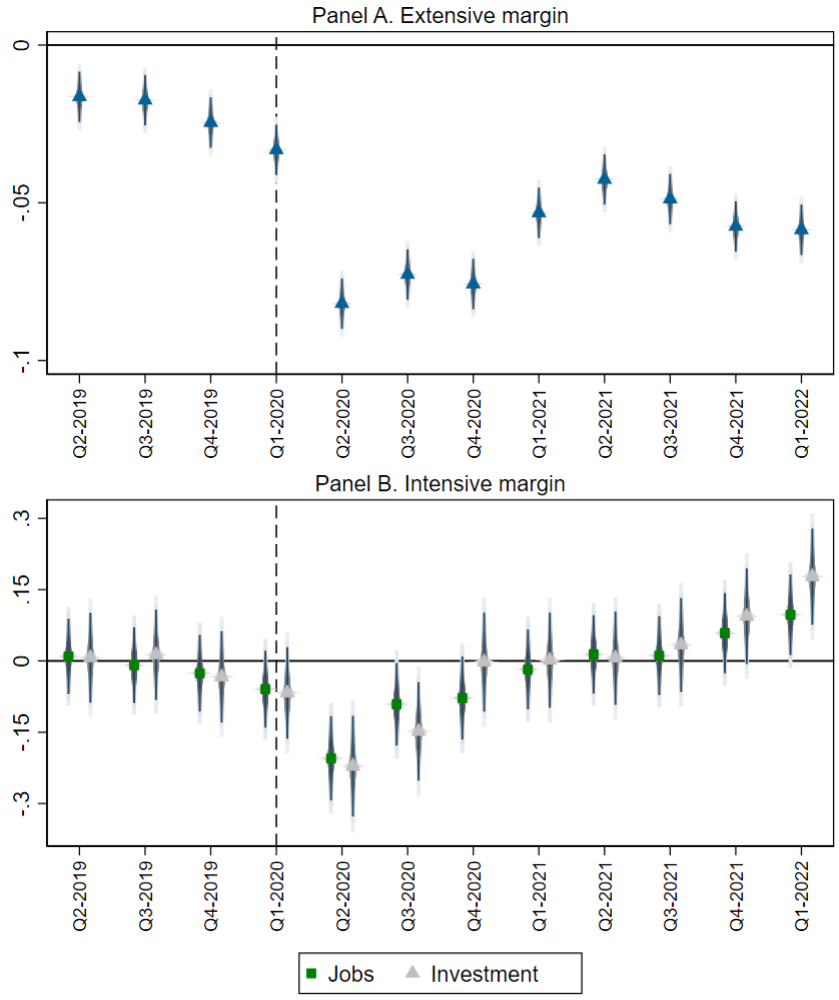
The observed average change in cross-border investment could be driven by different forces. For example, the probability of a new cross-border investment project taking place (i.e., so-called extensive margin) or the level of investment activity could be lower (i.e., so-called intensive margin).

To identify the role of these different margins of adjustment, we perform additional regressions using instead as dependent variables: i) a binary indicator that takes a value of 1 when a greenfield cross-border project takes place within a given home-country-host-country-sector in a given period, or 0 otherwise (extensive margin); and ii) the log of number of jobs and value of capital expenditure associated with such projects, respectively (intensive margin).[4] Figure 5 shows that the drop in cross-border greenfield investment has been more persistent for the extensive (Panel A) than for the intensive margin (Panel B). The same patterns are maintained when monthly-level data is used instead (see Figure A A.2 and Figure A A.3).

Given these results, we will focus on the extensive margin of adjustment in the rest of the analysis. In addition, as the focus in this paper is the study of the role of policy changes on investment outcomes, the analysis is also performed at the quarterly (rather than monthly) level, where the effects of such policy changes can plausibly be observed.

[4] The former regression used a PPML estimator and combined both the extensive and intensive margin. Using binary indicators in an LPM estimation, on the one hand, and numbers expressed in logs in an OLS estimation, on the other, allows us to look separately at those margins of adjustment. See Equations 1-3 in the Annex.

Figure 4. Conditional trend in quarterly cross-border greenfield investment pre- and post-COVID-19, by margin of investment



Note: Panel A shows the estimated coefficients on quarter-year dummies from a linear probability model (LPM) regression where the dependent variable is a dummy taking a value of 1 when a greenfield cross-border investment project takes place in the host country *i* involving investors from a home country *j* in sector *s* in a quarter-year time period *qt*, or 0 otherwise. Panel B shows the estimated coefficients on quarter-year dummies from an ordinary least-squares (OLS) regression where the dependent variable is the number of jobs (in logs) or the value of capital expenditure (in logs) associated with such projects, respectively. Q1 2019 is the omitted (reference) category. Results are robust to controlling for quarterly real GDP of the host and home country in the period *q(t-1)*. See Equation 2-3 in Annex.

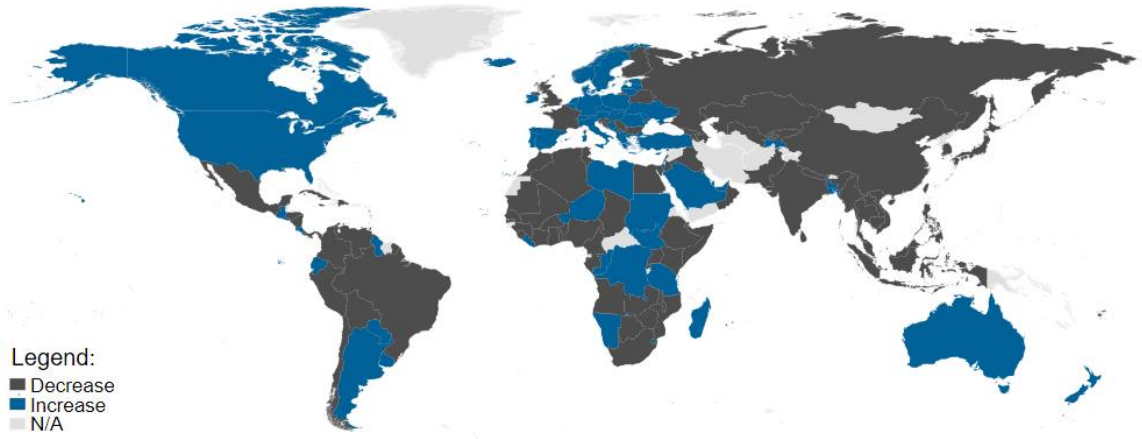
There has been a sectoral and spatial dimension to changes in investment patterns

Unsurprisingly, there has been a heterogeneity of responses across sectors and countries. For example, some sectors saw stronger adjustments in unconditional number of investment projects, number of jobs or value of investment (Figure A A.5), reflecting their intrinsic characteristics and the extent to which they interacted with demand and supply shocks during the pandemic, among others.

There has also been a spatial dimension to the adjustment. For example, emerging economies have experienced more frequently drops in their unconditional share of cross-border investment than more advanced economies (Figure 5). Econometric analysis also reveals that the role of distance in influencing the probability of a new project taking place between a given country pair in a particular sector appears to have increased after the outbreak of the pandemic (see Box 2). Despite these general patterns, there

have been substantial differences in cross-border greenfield investment outcomes across individual countries (Figure A A.6).

Figure 5. Changes in Country Shares in Cross-Border Greenfield Investment Pre- and Post-COVID-19



Note: The figure depicts in blue host countries that experienced an increase in their share of the number of cross-border greenfield investment projects in the post-COVID-19 period (1 February 2020-31 March 2022) relative to the pre-COVID-19 period (i.e., 1 January 2019-31 January 2020). See Figure A A.6 for the breakdown by country and Figure A A.7 for equivalent maps using the number of jobs and the value of capital expenditure associated with cross-border greenfield investment projects.

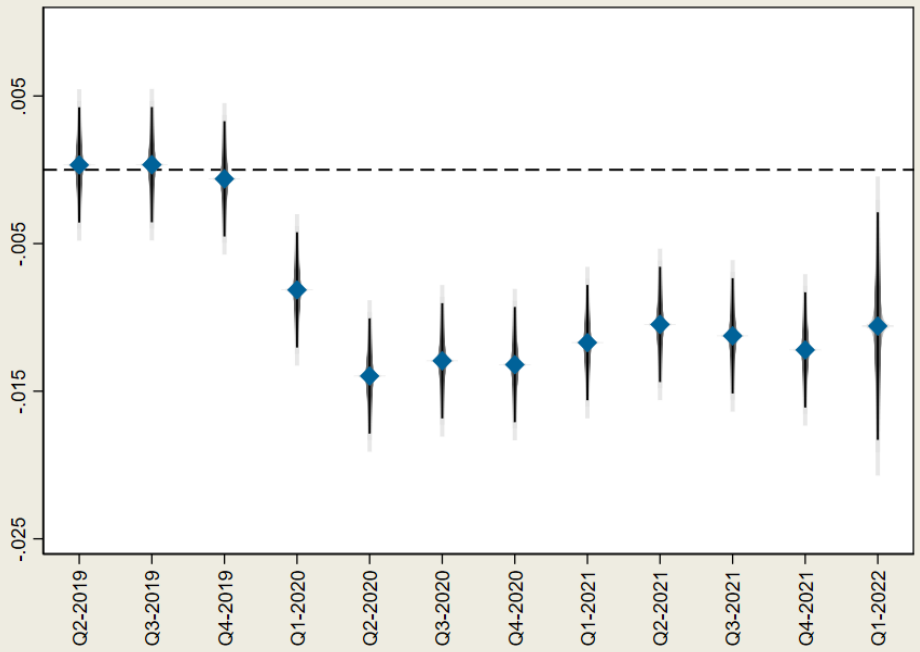
Box 2. A rising role of geographic distance for cross-border greenfield investment?

Learning about business opportunities, locating suitable suppliers and clients and navigating administrative requirements for doing business further from home is subject to information frictions. As such, geographic distance often serves as a proxy for co-ordination costs associated with cross-border trade and multinational activity and is documented to be associated with lower trade and investment (Disdier and Head, 2008[17]; Irarrazabal, Moxnes and Opromolla, 2013[18]; Ramondo, Clare and Tintelnot, 2015[19]). A rise in the role of distance can, therefore, be indicative of a rise in such costs.

To see what role the distance played during the COVID-19 pandemic, we focus on the extensive margin of investment – i.e., the probability that an investment project takes place between a given pair of countries in a given sector and quarter-year time – and control for a set of time-variant host-country-, home-country and sector characteristics through relevant fixed effects. We then plot the estimated coefficient on the distance variable (in logs) interacted with the quarter-year dummies to observe the average effect of distance on investment probability over time.

The estimated coefficient starts being negative and statistically significant after the onset of the pandemic (Figure 6), pointing to a potential increase in co-ordination costs for multinationals. The results point to the same patterns when using other estimation methods (e.g., PPML and OLS).

Figure 6. Estimated effect of geographic distance after the COVID-19 outbreak



Note: The graph presents the estimated coefficients on quarter-year dummies interacted with bilateral distance (in logs) between the host country *i* where the cross-border greenfield investment project is located and the home country of the investor *j* from a LPM regression where the dependent variable is a binary indicator that takes a value of 1 if an investment project takes place in country *i* in sector *s* involving an investor from a home country *j* in quarter-year period *qt*, or 0 otherwise; and includes home-sector-year and host-sector-year fixed effects to control for a set of home-sector and host-sector time-variant factors. The results are robust to the inclusion of controls for quarterly real GDP of the host and home country, respectively, from IMF (IMF, 2023[20]) in period *q(t-1)*.

What was the role of new FDI policies and COVID-19-containment measures?

A natural question emerges: to what extent the varying investment outcomes in different countries may have been related to specific policies adopted by those countries, or their partners, during this period? A wide literature on foreign direct investment (FDI) and activity of multinational enterprises (MNEs) shows that a plethora of sector-, country- and bilateral factors influence cross-border location decisions of firms.[5] Therefore, to understand the effect of any policy changes in host countries during the COVID-19 pandemic on the probability of a cross-border greenfield investment taking place between a given country pair in a given sector and time period, we use an empirical approach that allows us to control for other sources of observed and unobserved heterogeneity.

Specifically, we control for host-country, home-country and bilateral characteristics, sectoral dynamics and cyclical factors through the use of fixed effects (i.e. host-country-sector-year, home-country-sector-year, home-country-host-country-sector and quarter-time) and other relevant controls (see Annex A).[6]

To capture changes in policies during the sample period, we exploit new high-frequency data on both government COVID-19-containment- and FDI-related measures in force during this period. The former information comes from the COVID-19 Government Response Tracker maintained by the University of Oxford (Hale et al., 2021[21]) and the latter from the Global Trade Alert maintained by the University of St. Gallen (GTA, 2022[22]), which are described in Box 3 and Annex A. To control for other confounding factors, we also add relevant data on changes to consumer mobility and local health outcomes in the host and home economy in each quarter-year in the sample period, respectively. We combine this data with project-level data on cross-border greenfield investment from the fDi Markets, described in Box 1. The data is cleaned and transformed into a matrix with information on the incidence of cross-border greenfield investment projects between a country pair in a given sector in a quarter-year time period between Q1 2019-Q1 2022 (see Annex A for the description of data and methodology).

[5] e.g. Carr, Markusen, and Maskus (2001[40]); Head and Mayer (2004[41]), Ramondo, Rodríguez-Clare, and Tintelnot (2015[19]), Alviarez (2019[42]).

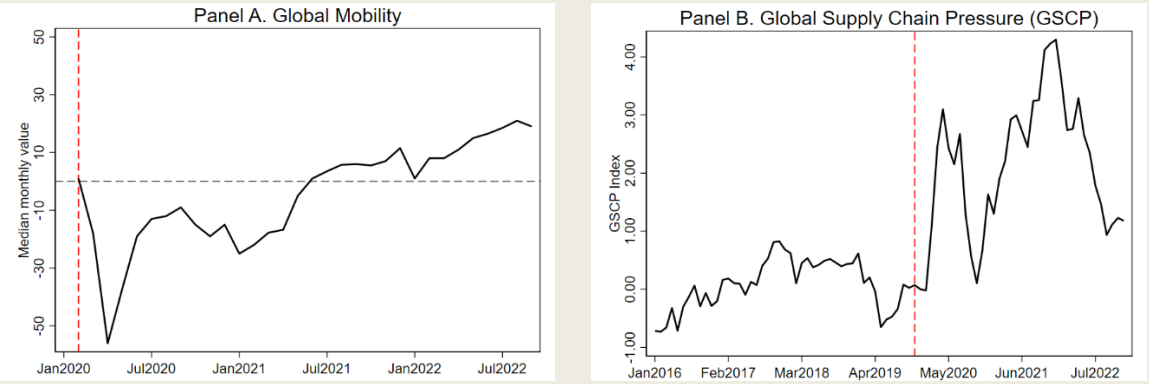
[6] The baseline specification includes host-home-sector, host-sector-year, home-sector-year and quarter-year fixed effects and additional controls, such as host- and home country health outcomes (i.e. median quarterly number of deaths, in log, in the host and home country) from Oxford Government Response Tracker (Hale et al., 2021[21]); changes to retail-space visits during the period relative to the benchmark from Google LLC; and COVID-19-related and FDI related measured in the home country, sourced from Hale et al., (2021[21]) and GTA (2022[22]), respectively (see Equation 1 in Annex A). The dependent variable is a binary indicator taking a value of 1 if a cross-border greenfield investment project took place between a given country pair in a given sector in a quarter year, and 0 otherwise. In robustness checks, we also control for host and home country real quarterly GDP for the sample of countries for which such data is available.

Box 3. Real-time data on policy-relevant developments during COVID-19

There has been significant progress in improving access to real-time policy-relevant data in the recent years, including during the COVID-19 pandemic. This ranges from the use of indicators of economic activity, such as consumption data based on bank and credit-card transactions (Bounie et al., 2020[23]) to metrics related to global trade and supply chains (Cerdeiro et al., 2020[3]; Ahir, Bloom and Furceri, 2022[24]; Benigno et al., 2022[25]) and specific policies – such as COVID-19-related and other relevant measures taken by governments. This note utilises several datasets with relevant information:

- COVID-Response Stringency: The Oxford COVID-19 Government Response Tracker (OxCGRT) collects daily data on policy measures that governments have taken to tackle COVID-19 since 1 January 2020, covering more than 180 countries (Hale et al., 2021[17]). The data includes information on work closures and other restrictions as well as the number of deaths and the overall stringency of government actions.
- FDI Policies: The Global Trade Alert (GTA) database, developed and maintained by the University of St. Gallen, includes more than 33 000 records of state acts taken since November 2008. It provides the exact date of the adoption of the act as well as its revocation, whenever applicable, permitting construction of measures for different time frequencies. The data captures measures in different categories, including those related to FDI, such as restrictions on foreign entry and operations as well as conditions for labour mobility and employment, and classifies them depending on whether they may potentially have a discriminatory character.
- Global Mobility and Other Data: Other sources of data can be helpful to control for confounding factors influencing investment during the period. For example, COVID-19 Community Mobility Reports by Google LLC (2022[26]) provide information on change in visits to retail and other spaces compared to a baseline, using aggregate anonymised data from Google Maps. This allows controlling for country-specific changes in consumer mobility, which can serve as a proxy for shocks to local demand (Espitia et al., 2022[6]). Factors relating to broader global supply chain pressures that are common across countries – such as those tracked by the (Benigno et al., 2022[25])– or other relevant trends can also be controlled for using fixed effects.

Figure 7. Examples of real-time policy-relevant data



Note: Panel A on the left shows a median monthly value of changes in global mobility in places associated with retail activity relative to the pre-pandemic benchmark (i.e., the median value, for the corresponding day of the week, during the 5-week period Jan 3–Feb 6, 2020), using Google Maps. Panel B shows monthly values of Global Supply Chain Pressure Index (GSCPI).
Source: Author's elaboration using the data from Google LLC (2022[26]) and Benigno et al., (2022[25]).

Numerous countries reformed investment policies regulating market access rules…

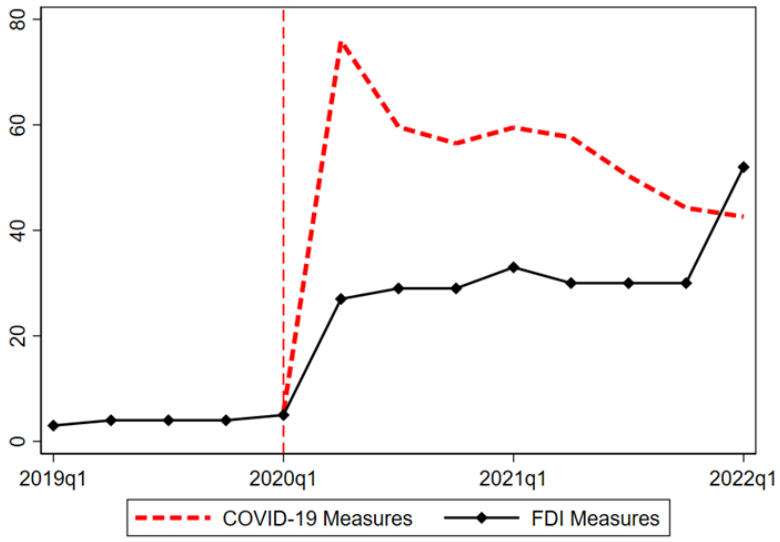
How frequent are these types of policies during the sample period?

Most countries worldwide introduced some measures to contain the spread or mitigate the effects of the COVID-19 crisis, according to the data in Oxford Government COVID-19 Response Tracker (Hale et al., 2021[21]).[7] Countries have varied in the duration and intensity of adoption of such restrictions. In general, the countries' median quarterly score on the Oxford COVID-19 Stringency Index peaked in the second quarter of 2020 and has been falling thereafter (Figure 8). Some of the measures included in the Index – such as workplace closures – have involved direct supply chain disruptions in some countries and industries. They are, hence, used here as a proxy for COVID-19-related supply-side disruptions.

Second, several countries have also introduced recent FDI-related measures aiming to increase control over incoming investment during the same period (Figure 8). The majority of them established new, or adapted earlier, rules on entry and ownership, often taking a form of so-called FDI screening mechanisms mostly aimed to safeguard essential security interests (OECD-UNCTAD, 2020[27]; 2020[28]; 2021[29]; OECD, 2020[30]; OECD, 2020[31]). Such screening mechanisms, applicable only to foreign investors, typically involve an additional review procedure that certain investments need to undergo and obtain an approval from the government for the investment to be completed (see Box 4 for more information). As highlighted by the OECD several publications, there has been a strong reform momentum in this policy area in recent years with numerous countries adopting such policies in a short period of time.

As a result, in some countries, investors in certain sectors and from certain origins faced both types of measures – COVID-19-containment- and FDI-related measures – at the same time.

Figure 8. The evolution of COVID-19-containment- and recent FDI-related measures



Note: The red dotted line depicts the level of COVID-19 restrictions across all countries in the sample as captured by a quarterly median value of COVID-19 Overall Stringency Index that takes values from 0 to 100 (100=strictest) from (Hale et al., 2021[21]). The black line indicates the number of recent FDI-related measures in force aiming to increase control over incoming investment introduced between Q1 2019 and Q1 2022 from (GTA, 2022[22]).
Source: Author's elaboration using Oxford Government COVID-19 Response Tracker from (Hale et al., 2021[21]) and (GTA, 2022[22]).

[7] 97.8% of countries tracked in the Oxford COVID-19 Government Response Tracker introduced some COVID-19-related restrictions with differing severity.

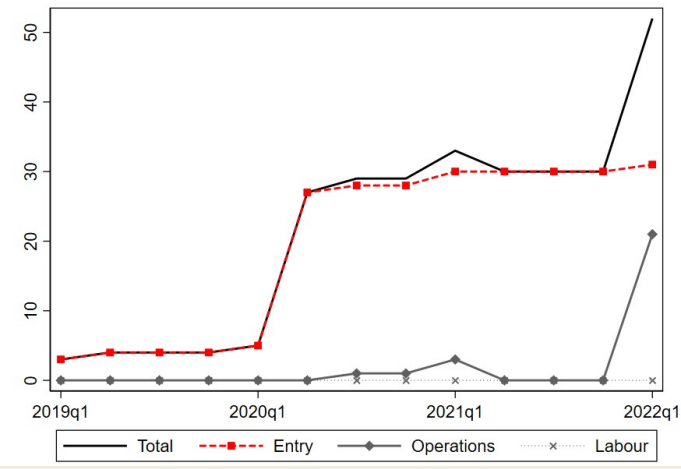
Box 4 New FDI-related measures during COVID-19: what do we see in the Global Trade Alert?

The OECD is tracking the information on the adoption of FDI measures by 62 countries participating in the Freedom of Investment (FOI) process. Investment measures consist of measures that impose or remove discrimination against foreign or non-resident investors. The data is being collected since 2008 and undergoes a stringent review, provides sources of data for all the measures, and is publicly available. However, as of now, the data does not contain readily available coding of measures by the affected sector using standard sector classifications. Due to its focus on the FOI participants, it also does not cover all possible host destinations of OECD and G20 investments analysed in this paper.

This type of information is also gathered by the Global Trade Alert (GTA, 2022[22]), developed and is maintained by the University of St. Gallen since 2008. The database contains information of state acts adopted by 174 countries and affecting 224 countries. Importantly, it also provides information on the sectors affected by each measure, using standard CPC 2.1 sector classification at the 3-digit level. The measures that may increase discrimination of foreign versus domestic investors are classified in "red" and "amber" categories. This global coverage and data on the affected sector and type of measure, make the database an attractive tool to gauge possible effects of recent FDI measures aiming to increase control over incoming cross-border investment. In the future, OECD data could be used for this purpose.

What FDI-related measures are covered and observed during the sample period in (GTA, 2022[22])? In general, the database includes measures pertaining to: i) new ownership and entry rules; and ii) treatment and operations of foreign-owned firms. The former can include maximum foreign equity limits and FDI screening mechanisms, while the latter may refer to restrictions on the establishment of branches or the acquisition of land for business purposes, among others. In addition, iii) rules on labour market access and post-migration treatment can also be considered relevant (restrictions on key personnel are included in the OECD FDI Regulatory Restrictiveness Index). When defined in such a manner (i-iii), the most dominant type of FDI measure aiming to increase control over incoming investment adopted during the sample period have been ownership and entry rules (Figure 9).[8]

Figure 9. Recent FDI-related measures, by type



Note: The figure depicts the total number of recent FDI-related measures aiming to increase control over incoming investment as captured in the Global Trade Alert (GTA, 2022[22]), i.e., those in "red" and "amber" categories. *Entry* refers to new ownership and entry rules; *Operations* to measures on treatment and operations of foreign-owned firms and *Labour* to labour market access and post-migration treatment.
Source: Author's elaboration using data from the Global Trade Alert (GTA, 2022[22]).

A natural question emerges: to what extent have these two types of measures affected cross-border investment in the post-pandemic period, and has there been any interaction among them? These two sets of government policies had very different objectives and policy design. In particular, COVID-19-related containment measures were restrictions aimed to contain the spread of the virus during the pandemic period. Countries differed in the severity of measures introduced and mostly phased them out by the end of 2022. Meanwhile, FDI-related measures are usually crafted taking into account the overall investment, economic and political objectives of the country. Many of them were introduced during the same period but, unlike COVID-19 restrictions, will remain in place thereafter and, unless reformed, govern market access conditions for investors.

As such, the expected short-term effects of those two types of policies – the focus of the analysis here[9] – can differ. A priori, the presence of a high-level of COVID-19-containment policy restrictions – especially those that entail sharp supply-chain disruptions – can have an immediate negative effect on the probability of announcing or opening a new cross-border project, in particular in sectors most affected by such restrictions. The possible effect of changes in FDI rules on the probability of announcing or opening new investment projects in the short-term is, meanwhile, ambiguous.[10] As such, the imposition of additional FDI-related restrictions may, on average, not have a statistically significant effect on cross-border investment in the short term. However, in presence of possible interactions effects, a combination of containment-related restrictions with new market access rules may tip the balance for some firms and be associated with a lower cross-border investment probability.

Given that effects of some of these policies on short-term cross-border investment patterns are unclear ex ante and can be influenced by numerous factors, the use of econometric techniques, which help control for different sources of heterogeneity, can provide useful preliminary insights in this regard.

COVID-19 containment and FDI-related policies had a negative effect on investment probability…

The results of initial econometric analysis suggest that the presence of a high level of COVID-19-related restrictions in force in the previous period had a statistically significant negative effect on the probability of cross-border greenfield investment taking place in a given country by investors from a particular home country in a given sector in a given quarter-year period (see left Panel in Figure 10).[11]

The combination of such restrictions with the introduction of recent FDI-related measures aiming to increase control over incoming investment was also associated with a lower cross-border greenfield investment probability in a given home-country-host-country sector. Specifically, an introduction of a combination of a high level of COVID-19-containment-related policies and a new FDI-related measure is associated with a 2.6 percentage point drop in the probability of cross-border greenfield investment

[8] The following countries introduced FDI-related measures included in those categories during the sample period: Austria, Belgium, Bulgaria, Canada, Chinese Taipei, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Romania, the Slovak Republic, Slovenia, Spain, Sweden, and the United States.

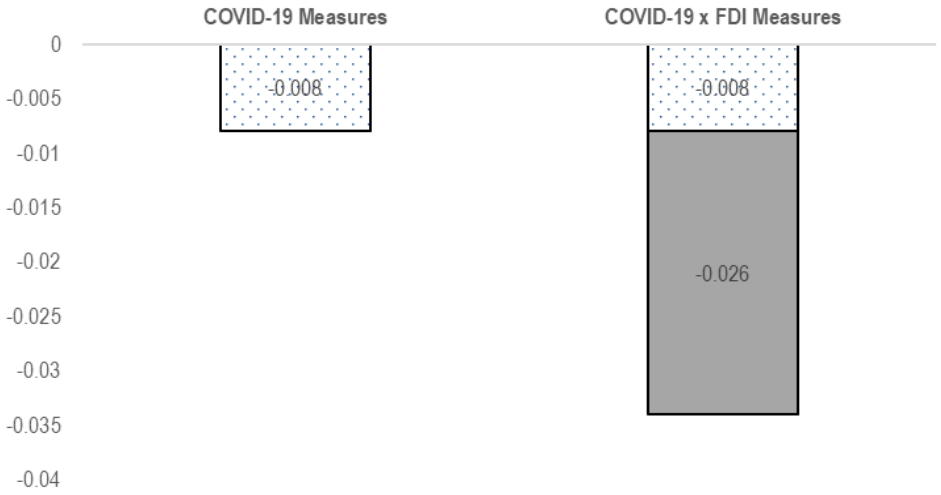
[9] The analysis here can only consider short-term effects of policies in question due to data constraints on FDI projects (available till March 2022 for the analysis in this paper) and because a longer period of time needs to pass since the introduction of those policies to consider their long-term effects.

[10] On the one hand, the announcement or opening of investment projects directly falling under the scope of the FDI screening mechanism could potentially be delayed or cancelled in response to new requirements. On the other hand, investors, who plan such projects for several years in advance are likely to be aware of the planned law changes; hence, announcements or openings of projects decided on in the past may not be affected.

[11] High level of COVID-19 restrictions refers to an above-median level of restrictions registered in the host country in the previous quarter-year period.

project taking place in a host-country-home-country-sector combination at a given time (right Panel in Figure 10).[12] When compared to the unconditional mean probability of such cross-border greenfield investment project taking place in the sample,[13] the estimated effect implies a drop in such investment probability by 23%. When the estimation is rerun using the number of jobs or the value of CAPEX associated with the investment projects, i.e., the measure of the intensive margin of adjustment shown earlier, the negative and statistically significant effect on the combination of COVID-19-containment- and FDI-related measures is maintained.[14]

Figure 10. The role of COVID-19-containment- and recent FDI-related measures on cross-border greenfield investment probability, average effect



Note: The left bar shows the estimated coefficients on a binary variable that take a value of 1 if a host country has above-median level of COVID-19-related containment measures in force – specifically workplace closures – and the bar on the right shows the coefficient on the interaction term between the combination of COVID-19- and recent FDI-related measures aiming to increase control over incoming investment in place in the previous quarter-year period. All coefficients reported are statistically significant at least at 5% level. The coefficient is obtained from a linear probability model (LPM) regression outlined in the Equation 1 in Annex A. Full baseline results are reported in Table A A.3.

… in particular, in some most affected sectors

The effects of COVID-19 and recent FDI-related measures may be most pertinent in some sectors, either explicitly targeted by policy actions or more exposed to their effect due to their intrinsic

[12] COVID-19-containment-related measures refer to workplace closures, mostly closely related to supply-side shocks, and are sourced from the Oxford COVID-19 Government Response Tracker (Hale et al., 2021[21]). FDI-related measures combine foreign entry and ownership rules, treatment and operations of foreign-owned firms, labour market access and post-migration treatment provisions as captured in the Global Trade Alert database (GTA, 2022[22]). During the sample period, most changes to FDI-related measures pertained to entry and ownership rules.

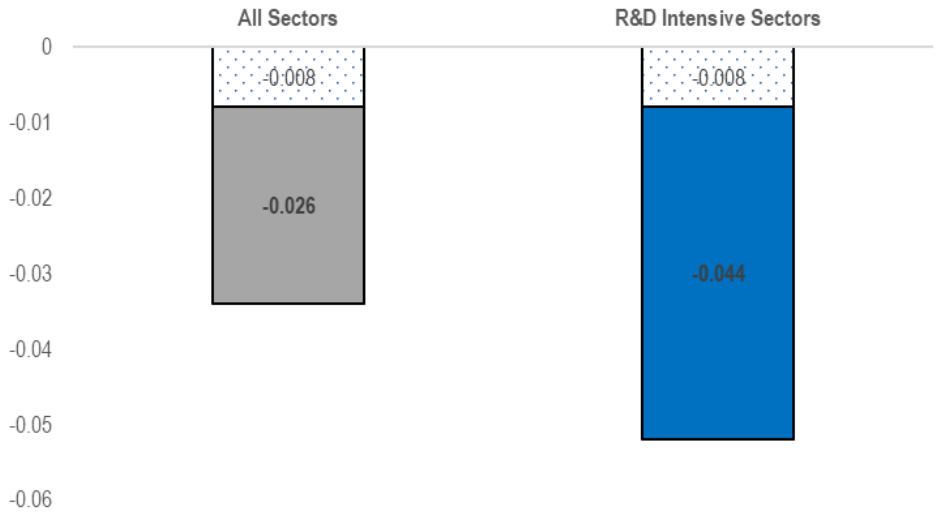
[13] This unconditional mean probability (15%) is based on the sample of host-home-country-sector triplets that experienced at least one greenfield investment project during the sample period used for estimations in this report.

[14] These results need to be interpreted with caution as the coverage of those variables is much more limited.

characteristics. For this purpose, we allow the results to vary for different groups of sectors – those that are amenable to telework, with a high content of routine tasks and with high R&D intensity.[15]

While sectors amenable to telework are found to be less affected by COVID-19 related measures in some specifications, there are no statistically significant differences in the effect of such measures across the different groups of sectors in the baseline specification (Table A A.4).

Figure 11. The role of COVID-19-containment- and new FDI-related measures in cross-border greenfield investment probability, heterogeneous effects by sector



Note: The figure shows the estimated coefficients on a binary variable that take a value of 1 if a host country has above-median level of COVID-19-related containment measures in force – specifically workplace closures – combined with the presence of an FDI-related measure with a potentially discriminatory effect affecting investors from a given home country in a sector in the previous quarter time period. The bar on the left shows the coefficient on this interaction term from the baseline regression. The bar on the right shows the coefficient on the interaction term between the combination of COVID-19 and new FDI-related measures and a binary indicator that classifies a sector a being of high R&D intensity. All coefficients reported are statistically significant at least at 5% level. The coefficient is obtained from a linear probability model (LPM) regression outlined in Equation 2 in Annex A. Full results are reported in Table A A.4.

Meanwhile, the combination of COVID-19- and recent FDI-related measures aiming to increase control over incoming investment has a statistically significant negative effect, which is stronger than the effect of COVID-19 restrictions alone – in the sectors with high R&D intensity (Figure 11).[16] This effect could be related to higher information frictions in such sectors, which may be exacerbated during crisis, and their higher exposure to new FDI screening policies, among others (OECD, 2021[32]).[17]The risk of cumulative effect of different policy measures, thus, appears higher in such sectors. Future research

[15] Sectors are classified using standard 3-digit level NAICS 2012 sector classifications and sector categories established in the literature, in particular Dingel and Neiman (2020[35]) for teleworking intensity, Acemoglu and Restrepo (2019[36]) for content in routine tasks and the OECD classification of R&D intensity (Galindo-Rueda and Verger, 2016[37]). A sector is attributed to a particular category if most sub-sectors in a given classification within 3-digit NAICS sector falls into that category.

[16] Full results by sector are reported in Table A A.4 and the list of sectors in each category is listed in Table A A.2 in the Annex.

[17] As shown in OECD (2021b), countries have increasingly targeted sectors relating to advanced technologies.

could explore further the mechanism through which different sectors are affected differentially by the introduction of such policies.

Conclusion

The analysis presented here provides initial insights on the possible role of COVID-19- and FDI-related policies on short-term cross-border greenfield investment patterns, conditional on other relevant factors. For this purpose, it has relied on data with appropriate country coverage as well as sector granularity and time frequency for the data on investment activity and relevant policies. Initial results suggest that COVID-19- and FDI-related policies, which mostly pertain to market access conditions, have had a negative effect on the probability of new greenfield cross-border investment taking place in a given host-country-home-country-sector in a given quarter-year period. Some sectors – notably those with a high R&D intensity – have been particularly affected by the combination of COVID-19 related supply-chain disruptions and adoption of new investment policies. Future academic research could test the robustness of these findings and explore possible heterogenous effects. In addition, the model and the data presented in this paper yields itself to further extensions, notably to: i) deepen and extend policy analysis to other policies; ii) include other shocks (beyond COVID-19); iv) analyse second-order effects through supply-chain exposure.[18]

[18] For example, other policies could be considered (e.g., trade or fiscal measures) and the OECD data could be systematised to capture different policy measures. Secondary effects of those policy measures on sectors not directly targeted by them could also be included in the analysis.

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Annex A. Data, empirical approach and further tables and figures

1. Data

The analysis presented here uses project-level data from the fDi Markets database by the Financial Times (www.fdiintelligence.com/fdi-markets).

The database provides real-time data on greenfield FDI projects – since 2003 until the current period – for a wide set of host and source countries. Besides the list of projects and the associated sector, host and home country, the database also includes information on capital expenditure and the number of jobs created that are associated with a given project as well as project characteristics (e.g. status). It uses different sources and methodologies than FDI statistics yet follows similar patterns and provides additional granularity, relating to the project's sector, type and investor, among others.

The data used in this analysis comprises 41 318 projects by investors from 46 home countries (all 38 OECD Member States and the remaining non-OECD G20 countries) and all the 175 host countries, in which those projects are located (Figure A A.1) for period 1 January 2019 until 31 March 2022. After matching data with a standard sector classification, the data covers 75 three-digit NAICS 2012 level sectors. The raw data on FDI projects has been transformed into a database with information on the number of projects, capital expenditure and the number of jobs associated with them in a given host-country-home-country-sector tripled for different time frequencies (quarter-year and month-year). Most analysis is performed on a quarterly level with checks undertaken on a monthly level for robustness.

The data on FDI measures of potentially discriminatory character relating to rules on: i) entry and ownership, ii) treatment and operations of foreign-owned firms, iii) labour market access and iv) post-migration treatment and are sourced from the Global Trade Alert database (GTA, 2022[22]).[19] The GTA taxonomy includes measures i) and ii) in its FDI category, together with the provision of financial incentives, under category 4.1.3 in GTA Handbook (Evenett and Fritz, 2022[33]). To conceptually capture all possible relevant restrictions of relevance to foreign investors and avoid confounding the effect of those measures with the provision of financial support by states, we reconstruct the variable pertaining to FDI measures using relevant sub-groups. In particular, financial incentives are excluded and measures pertaining to labour regulations are included, i.e. category 4.1.4 in Evenett and Fritz (2022[33]). As a result, the measure constructed in this manner most closely resembles the components captures in the OECD FDI Regulatory Restrictiveness Index (i.e. foreign equity limitations, screening and approval mechanisms, operational restrictions and restrictions on employment of foreign personnel). Crucially, GTA database provides information on measures that vary not only at the level of implementing host (or home economy) and time, but also sector. GTA codes measures affecting in a particular sector using CPC 2.1 sector classification at the 3-digit level. The data was matched with cross-border greenfield investment data using NAICS 2012 sector classification following Kinzius et al., (2019[34]).

The data on cross-border investment described above and policies of interest is complemented with relevant data on host- and home- country, bilateral- and sector- and time-period specific characteristics

[19] They relate to measures in "red" and "amber" categories.

(see Table A A.1), including COVID-19 restrictions, changes in mobility, and supply chain pressures. Sectors are classified into groups using the sector classifications listed in Table A A.2.

Figure A A.1. Country Coverage

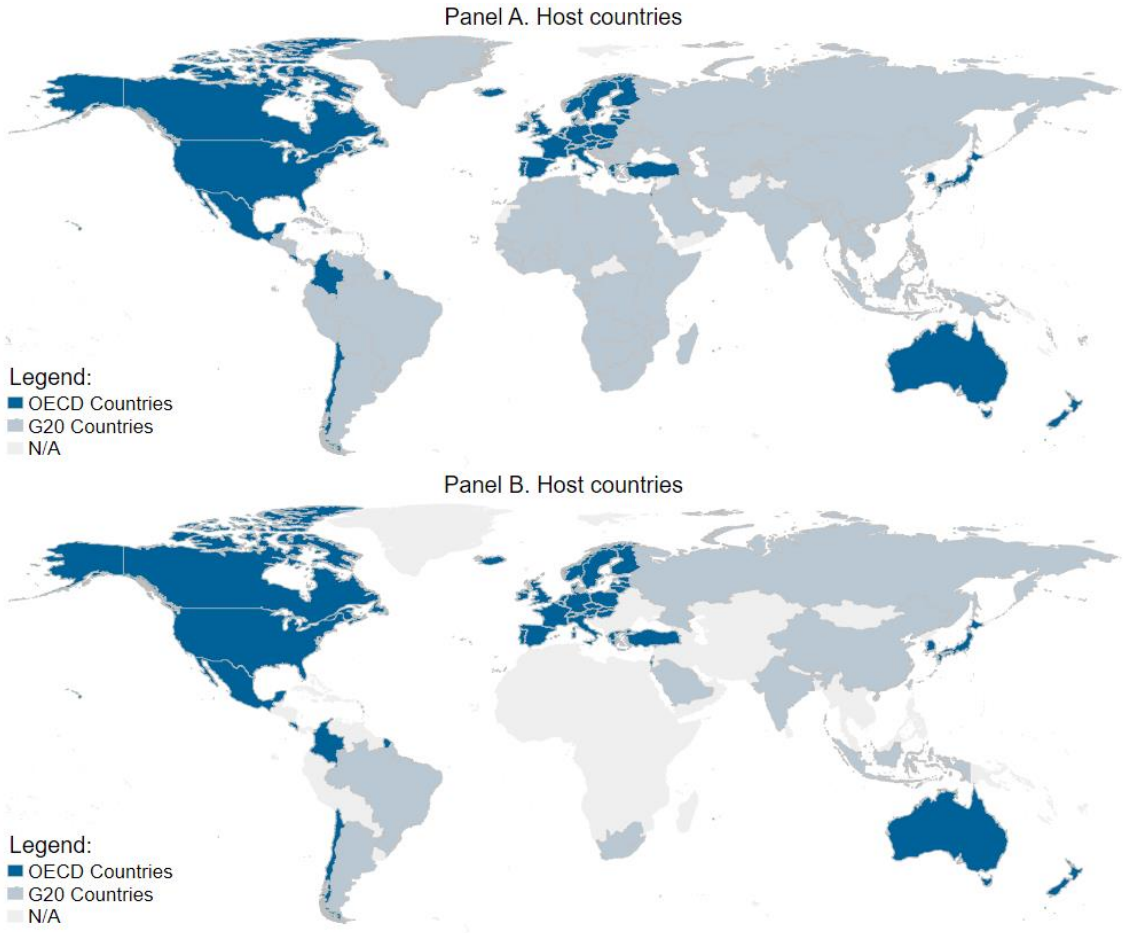


Table A A.1. Definitions of variables and data sources

Variable	Definition	Source
	Policy-related measures	
COVID-19 Measures	Binary indicator=1 if a host (home) country has an above-median level of COVID-19 containment measures (i.e. work closures in the baseline) in the previous quarter-time period (qt-1), or 0 otherwise	Oxford COVID-19 Government Response Tracker (OxCGRT) from Hale et al., (2021[21])
FDI Measures	Binary indicator=1 if a host (home) country has an FDI-related measure with discriminatory character (i.e. "red" and "amber" categories) relating to rules on entry and ownership, treatment and operations of foreign-owned firms, labour market access and post-migration treatment provisions as captured in GTA (2022[22]) data in place affecting a given sector *s* and home country *j* in the previous quarter-time period (qt-1)	Global Trade Alert (GTA, 2022[22])
	Sector characteristics	
High Teleworking Intensity Sectors	Binary indicator=1 if a median sector within a 3-digit NAICS (2012) sector is classified as having a high teleworking intensity by Dingel and Neiman (2020[35])	Dingel and Neiman (2020[35])
High Routine-Tasks Intensity Sectors	Binary indicator=1 if a median sector within a 3-digit NAICS (2012) sector is classified as having a high degree of task routineness by Acemoglu and Restrepo (2019[36])	Acemoglu and Restrepo (2019[36])

Variable	Definition	Source
High R&D Intensity	Binary indicator=1 if a corresponding 3-digit NAICS sector is classified as having a high R&D spending intensity according to the OECD classification developed by Galindo-Rueda and Verger (2016[37])	Galindo-Rueda and Verger (2016[37])
Other controls		
Number of Deaths	A median number of deaths in the host (home) country in a quarter-year period *qt*	Oxford COVID-19 Government Response Tracker (OxCGRT) from Hale et al., (2021[21])
Changes in Mobility in Retail Spaces	A median value of the measure for a given quarter-year period *qt* in a given host (home) country calculated from a daily measure of changes in mobility in retail places (i.e. restaurants, cafes, shopping centres, theme parks, museums, libraries, and movie theatres) obtained from the aggregated Google Maps data where a daily measure capture the change relative to the median daily value from the 5-week period from 3 January to 6 February 2020 (the baseline day).	COVID-19 Community Mobility Reports from Google LLC (2022[26])
GDP	Real gross domestic product (GDP) in a given host (home) country in a quarter-year period *qt*	OECD National Accounts Statistics (OECD, 2023[38]), IMF International Financial Statistics (IMF, 2023[20])
Bilateral Distance	Geographic distance between a host-home country pair (in log)	CEPII

Table A A.2. Sector group classification

Sector Group	Sectors (NAICS 2012 3-Digit Classification)
High Teleworking Intensity	Educational Services (611), Credit Intermediation and Related Activities (522), Data Processing, Hosting, and Related Services (518), Insurance Carriers and Related Activities (524), Museums, Historical Sites, and Similar Institutions (712), Professional, Scientific, and Technical Services (541), Real Estate (531), Securities, Commodity Contracts, and Other Financial Investments and Related Activities (523), Telecommunications (517), Broadcasting (except Internet) (515), Motion Picture and Sound Recording Industries (512), Other Information Services (519), Publishing Industries (except Internet) (511)
High Task-Routineness	Educational Services (611), Credit Intermediation and Related Activities (522), Data Processing, Hosting, and Related Services (518), Insurance Carriers and Related Activities (524), Museums, Historical Sites, and Similar Institutions (712), Professional, Scientific, and Technical Services (541), Real Estate (531), Securities, Commodity Contracts, and Other Financial Investments and Related Activities (523), Telecommunications (517), Machinery Manufacturing (333), Miscellaneous Manufacturing (339), Transportation Equipment Manufacturing (336), Administrative and Support Services (561), Ambulatory Health Care Services (621), Amusement, Gambling, and Recreation Industries (713), Fabricated Metal Product Manufacturing (332), Hospitals (622), Nursing and Residential Care Facilities (623), Paper Manufacturing (322), Performing Arts, Spectator Sports, and Related Industries (711), Primary Metal Manufacturing (331), Rental and Leasing Services (532).
High R&D Intensity	Educational Services (611), Machinery Manufacturing (333), Miscellaneous Manufacturing (339), Transportation Equipment Manufacturing (336), Chemical Manufacturing (325), Computer and Electronic Product Manufacturing (334), Electrical Equipment, Appliance, and Component Manufacturing (335).

Source: Author's elaboration based on Dingel and Neiman (2020[35]), Acemoglu and Restrepo (2019[36]) and Galindo-Rueda and Verger (2016[37]).

2. Methodology

Motivational Evidence

To provide initial motivational evidence on the evolution of cross-border greenfield investment trends during the COVOD-19 period once compositional effects are controlled for, the following specification is used:

$$1) \qquad X_{ijsqt} = \sum_{qt} \mu(qt)\beta_{qt} + \gamma_{ijs} + \varepsilon_{ijsqt}$$

Where X_{ijsqt} is the number of cross-border greenfield investment projects undertaken by an investor from a home country j in sector s in a host country i in a quarter-year period qt, or the number of jobs and value of capital expenditure (CAPEX) associated with those projects, respectively; $\sum_{qt} \mu(qt)$ is a time indicator including the different quarter-year dummies in the sample period (with Q1 2019 being the omitted reference category); γ_{ijs} is the panel fixed effect controlling for host-country-home-country-

sector time-invariant characteristics (i.e., compositional effects), and ε_{ijsqt} is the error term. The specification above is estimated using Poisson Pseudo-Maximum-Likelihood (PPML) estimator.

To further decompose the observed trends into the adjustment along the extensive and intensive margins, two alternative specifications are used.

The following equation describes the specification for the extensive margin adjustment:

$$2) \qquad X_{ijsqt} = \sum_{qt} \mu(qt)\beta_{qt} + \gamma_{ijs} + \varepsilon_{ijsqt}$$

where X_{ijsqt} is a binary indicator taking a value of 1 if a cross-border greenfield investment project by an investor from a home country j took place in sector s in a host country i in a quarter-year period qt; and all the other remaining terms are the same as in Equation 1. The specification above is estimated using ordinary least squares (OLS) estimator.

The following equation describes the specification for the intensive margin adjustment:

$$3) \qquad ln\, X_{ijsqt} = \sum_{qt} \mu(qt)\beta_{qt} + \gamma_{ijs} + \varepsilon_{ijsqt}$$

where $ln\, X_{ijsqt}$ is the number of jobs and value of capital expenditure (CAPEX) associated with cross-border greenfield investment projects undertaken by an investor from a home country j in sector s in a host country i in a quarter-year period qt, expressed in logs, respectively; and all the other remaining terms are the same as in Equation 1. The specification above is estimated using linear probability model (LPM) estimator.

Robust standard errors are clustered at the host-home country level in all the above specifications.

Baseline Specification

To establish the effect of COVID-19-related containment policies and FDI-related policy measures adopted by host economies during the pandemic on the probability of a cross-border greenfield investment project taking place (i.e., extensive margin of investment), a linear probability model (LPM) is adopted with the following baseline specification:

$$4) \qquad I_{ijsqt} = \beta_1 COVID_{i(qt-1)} + \beta_2 FDI_{is(qt-1)} + \beta_3 COVID_{i(qt-1)}\, x\, FDI_{is(qt-1)} + \beta_4 X_{iqt} + \beta_5 Y_{jq(s)t} + \gamma_{ijs} + \rho_{ist} + \sigma_{jst} + \delta_{qt} + \varepsilon_{ijsqt}$$

Where $I_{ijsqt}$is a binary variable that takes a value of 1, when there is a cross-border greenfield investment project by an investor from a home country j taking place in sector s in a host country i in a quarter-year period qt, and 0 otherwise.[20] $COVID_{i(q,t-1)}$ refers to a binary indicator that equals 1 if a host country introduced an above-median level of COVID-19-related containment policies in the previous quarter-year period $(qt-1)$, and 0 otherwise. Specifically, the metric refers to the extent of workplace closures in the host economy, and is calculated using daily data reported in (Hale et al., 2021[21]).[21] $\mathrm{FDI}_{\mathrm{is(qt-1)}}$ refers to a binary indicator that equals 1 if a host country i has a foreign direct investment (FDI)-related measure in place in sector s affecting home country j in the previous quarter-year period $(qt-1)$, and 0 otherwise. These measures of potentially discriminatory character relating to rules on:

[20] The data considered in this study contain announced and open investment projects, which permits the study of immediate investor reactions. While realisation of an investment project takes several years and may, therefore, not react to changes in market and policy conditions in the short-term, project announcements – which capture investors' intentions – can.

[21] Workplace closures are used in the baseline as they are most closely linked to supply-side disruptions (Espitia et al., 2022[6]). In an alternative version, we also control for the presence of international mobility restrictions and the results remain the same. As international mobility restrictions can have a bilateral component that is not captured in the data in Hale et al. (2021[21]), we retain the version using workplace closures as the baseline.

i) entry and ownership, ii) treatment and operations of foreign-owned firms, iii) labour market access and iv) post-migration treatment and are sourced from the Global Trade Alert database (GTA, 2022[22]). $COVID_{i(qt-1)}\ x\ FDI_{is(qt-1)}$ is the interaction term and a binary indicator that equals 1 if the host economy had a combination of COVID-19-containment- and FDI-related measures aiming to increase control over incoming investment in the previous quarter-year period $(qt-1)$, and 0 otherwise, and, and is the main coefficient of interest.

The remaining terms of Equation (4) correspond to fixed effects (γ_{ijs}, ρ_{ist}, σ_{jst}, and δ_{qt}), relevant controls, and ε_{ijsqt} is the error term. In particular, γ_{ijs} is the panel fixed effect and controls for all time-invariant bilateral and sector characteristics that may influence cross-border investment decisions, including distance between the home and host country and other time-invariant gravity controls. The term ρ_{ist} is a host-country-sector-year fixed effect and σ_{jst} is a home-country-sector fixed effect. These fixed effects account for any (time-variant) host- and home-country characteristics that plausible change on an annual basis and sectoral dynamics that may simultaneously influence firm investment decisions and formation of policies of interest over time. These can include any national (or sectoral) investment promotion- or guarantee schemes – either general or specific to certain sectors, the level of development, market size, annual changes to demand or supply, and respective networks of agreements in the host- and home states, and the level of competition or growth dynamics in a sector that vary at annual level. δ_{qt} controls for any global business cycle fluctuations and supply chain disruptions and other time-variant shocks affecting all countries and sectors in a given quarter-year.[22]

Finally, X_{iqt} and $Y_{jq(s)t}$ is a vector of (time-variant) controls for other host-country and home-country characteristics, which vary at the host-country-quarter-year and home-country-(sector-)quarter-year level, respectively, and would not have been captured by ρ_{ist} and σ_{jst} fixed effects. For example, this may include quarterly fluctuations in the local demand or the severity of local health situation in the host and home country, respectively, as they may influence simultaneously the adoption of policies and investment outcomes. To account for this possible source of heterogeneity, we control for a median value in a given quarter-year period qt in the host and home country, of the following measures: i) a change in physical mobility in retail spaces, calculated from aggregate daily data from Google Maps provided by Google LLC (2022[26]), as a proxy for local demand shocks, following Espitia et al., (2022[6]);[23] and ii) of local health outcomes, as captured by the number of recorded deaths calculated from daily data in Hale et al. (2021[21]). The term $Y_{jq(s)t}$ additionally includes controls for the same COVID-19-containment and FDI-related measures in the home country in the previous quarter-year period $(qt-1)$ as those captured in the term $COVID_{i(qt-1)}$ and $FDI_{is(qt-1)}$ for the host country.[24]

Robust standard errors are clustered at the host-home country level.

Alternative Specification to Test Heterogenous Effects

The baseline equation assumes that the effect of COVID-19-containment and FDI-related measures on the extensive margin of investment is symmetric across the different sectors. For example, sectors that are more amenable to teleworking may be less affected by the introduction of COVID-19-related

[22] We also test the robustness of results when a quarter-year-variant index for supply chain pressures is included in the specifications instead of quarter-year fixed effects and results remain stable.

[23] A daily measure of changes in mobility in retail places (i.e. restaurants, cafes, shopping centres, theme parks, museums, libraries, and movie theatres) from Google LLC (2022[26]) captures the change relative to the median daily value from the 5-week period from 3 January to 6 February 2020 (the baseline day).

[24] In robustness checks, we also include quarterly real GDP of the host and home economy (lagged by one period), respectively, to account for changes in the overall output in the economy during the sample period.

measures than other sectors; while specific sectors targeted by FDI measures may be affected for by the presence of those measures -or their combination with COVID-19-related policies.

In order to explore the existence of possible heterogeneous effects of such measures across different sectors, Equation (4) is generalised as follows:

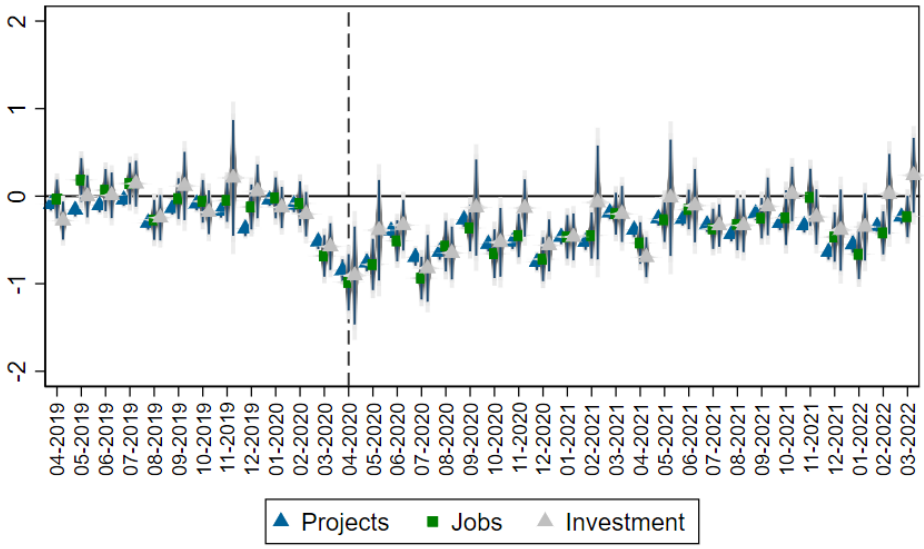
$$5) \qquad I_{ijsqt} = \sum_z \beta_{1,z}\, \vartheta_z COVID_{i(qt-1)} + \sum_z \beta_{2,z}\, \vartheta_z FDI_{is(qt-1)} + \sum_z \beta_{3,z}\, \vartheta_z COVID_{i(qt-1)}\, x\, FDI_{is(qt-1)} + \beta_4 X_{iqt} + \beta_5 Y_{jq(s)t} + \gamma_{ijs} + \rho_{ist} + \sigma_{jst} + \delta_{qt} + \varepsilon_{ijsqt}$$

where ϑ_z identified different types of sectors, including sectors with high or low teleworking intensity (Dingel and Neiman, 2020[35]), sectors with high or low routine-tasks intensity (Acemoglu and Restrepo, 2019[36])) and sectors with high and medium-to-low R&D intensity (Galindo-Rueda and Verger, 2016[37]).

3. Additional figures and tables

Figure A A.2. Conditional trend in monthly cross-border greenfield investment

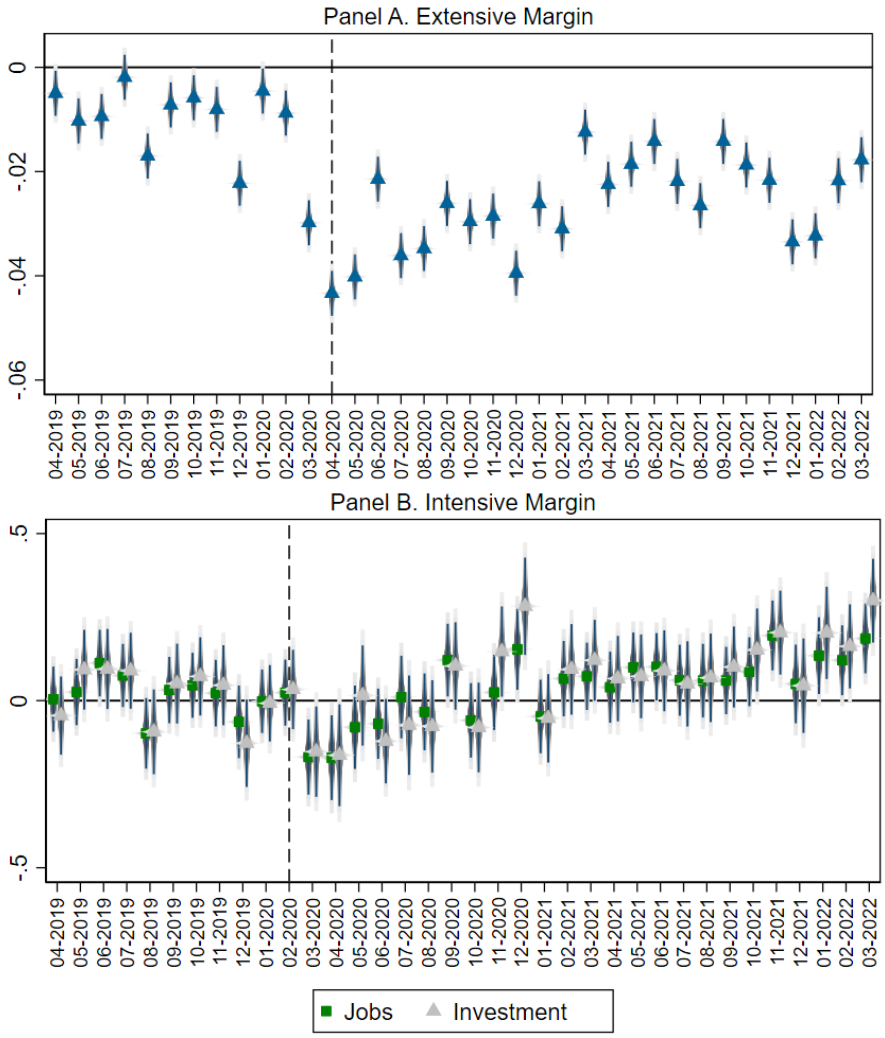
January 2019-March 2022



Note: The figure shows the estimated coefficients on month-year dummies from a Poisson Pseudo-Maximum-Likelihood (PPML) regression where the dependent variable is the number of cross-border greenfield investment projects in a host country *i* involving investors from a home country *j* in a sector *s* in a month-year period *mt* and includes a panel fixed effect (home-host-country-sector). January-March 2019 is the omitted (reference) category to mirror the approach in regressions using quarterly data.

Figure A A.3. Conditional trend in monthly cross-border greenfield investment, by investment margin

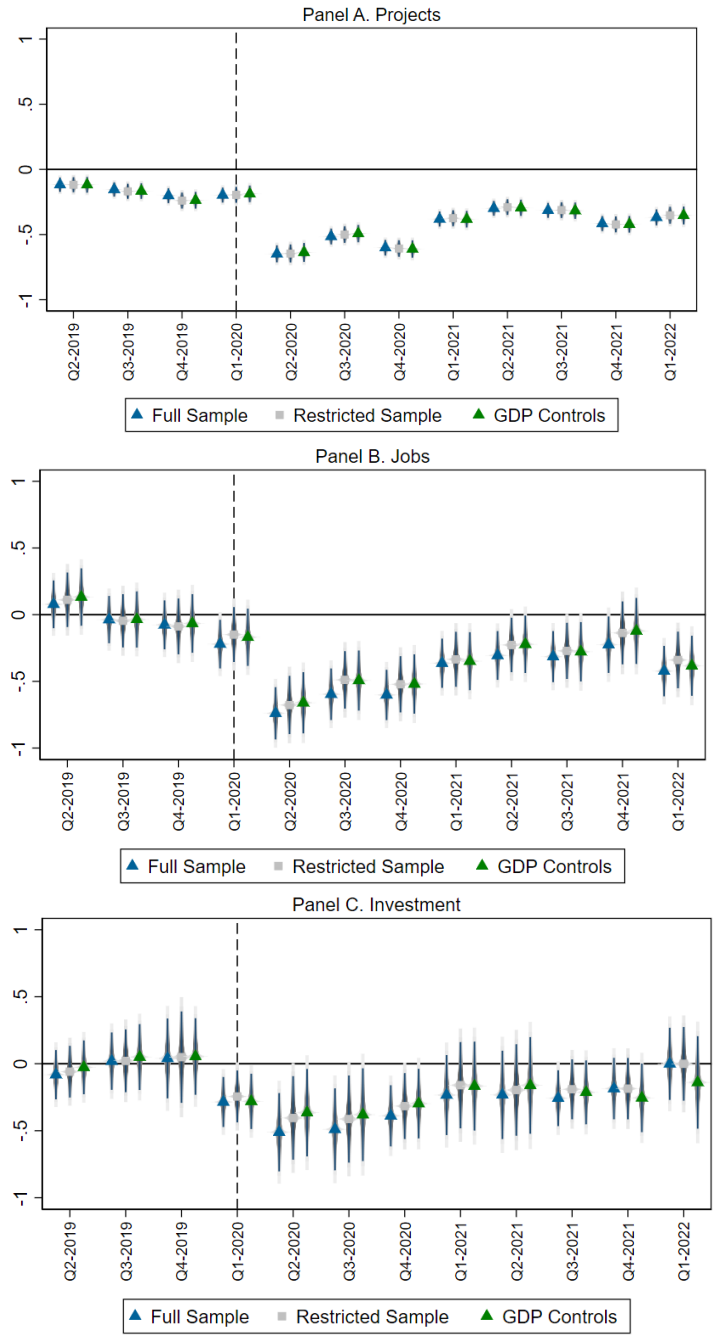
January 2019-March 2022



Note: Panel A shows the estimated coefficients on month-year dummies from a linear probability model (LPM) regression where the dependent variable is a dummy taking a value of 1 when a greenfield cross-border investment project takes place in the host country *i* involving investors from a home country *j* in sector *s* in a month-year period *mt*, or 0 otherwise. Panel B shows the estimated coefficients on month-year dummies from an ordinary least-squares (OLS) regression where the dependent variable is the number of jobs (in logs) and the value of capital expenditure (in logs) associated with such projects, respectively. The period January-March 2019 is the omitted (reference) category to mirror the approach in regressions using quarterly data.

Figure A A.4. Conditional trend in quarterly cross-border greenfield investment with GDP controls, pre- and post-COVID-19

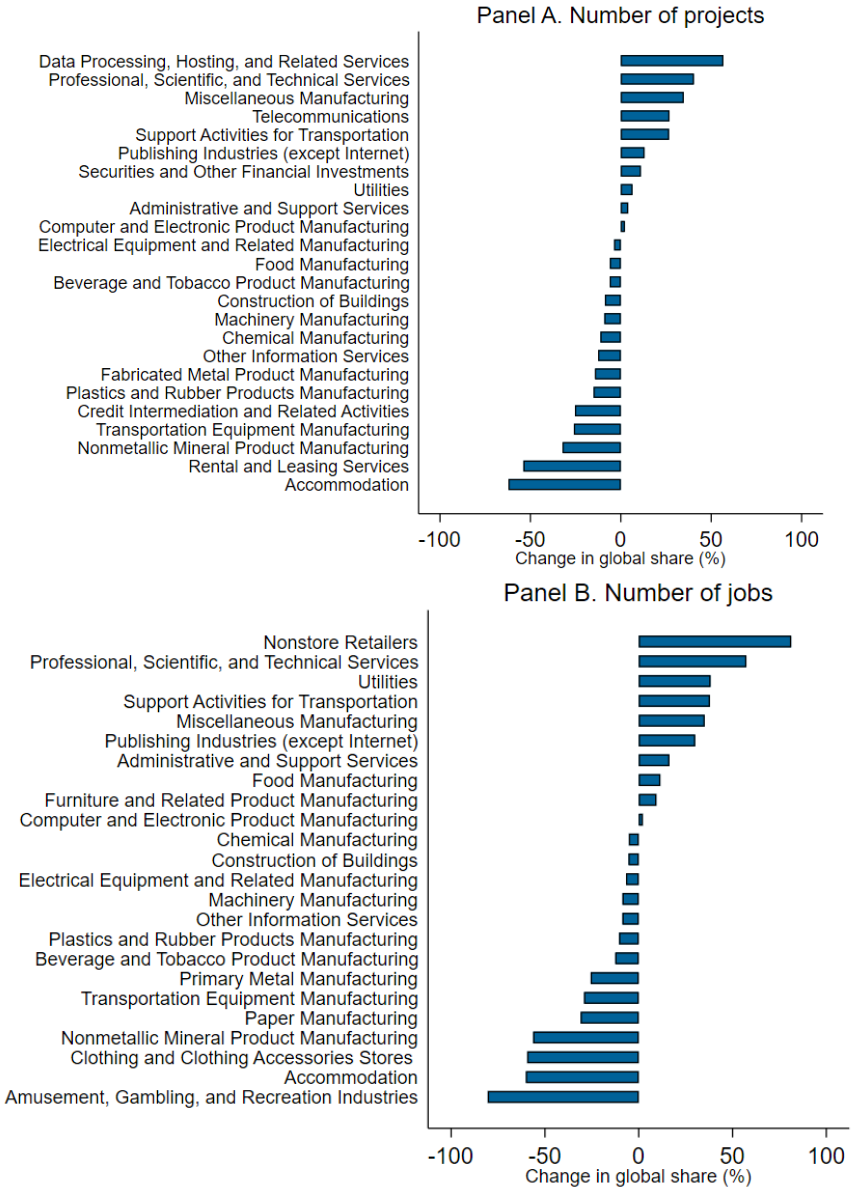
Q1 2019-Q3 2022

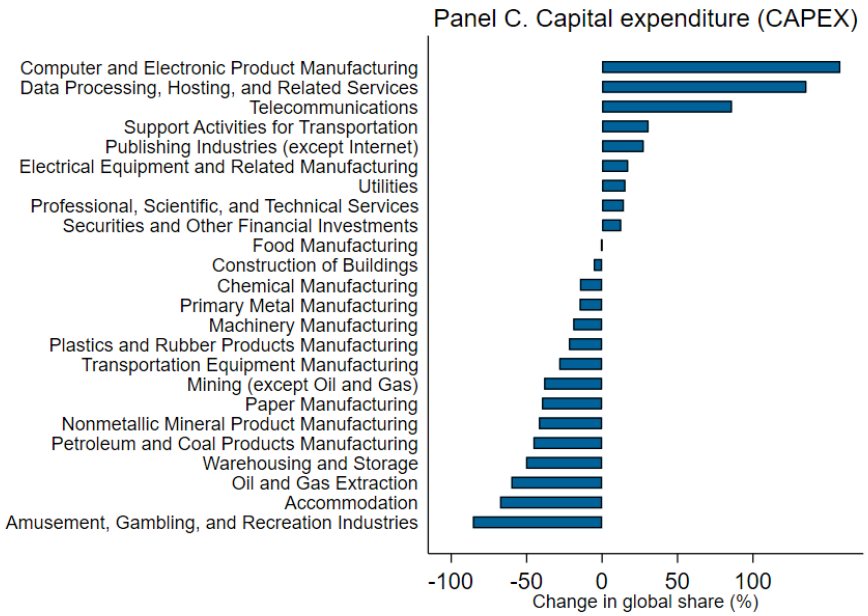


Note: The figure shows the estimated coefficients on quarter-year dummies from a Poisson Pseudo-Maximum-Likelihood (PPML) regression where the dependent variable is the number of cross-border greenfield investment projects in a host country *i* involving investors from a home country *j* in a sector *s* in quarter-year period *qt* and includes panel fixed effects (home-host-country-sector). The blue triangle shows results for the full sample of countries, the grey square indicates results of the same regression for which the data on quarterly real GDP is available from IMF (2023) and the green triangle shows results for the same sample of countries, including quarterly real GDP of the host and home country, respectively, in period *qt-1* as controls.

Figure A A.5. Changes in sectors' share in cross-border greenfield investment pre- and post-COVID-19

Top 25 Sectors

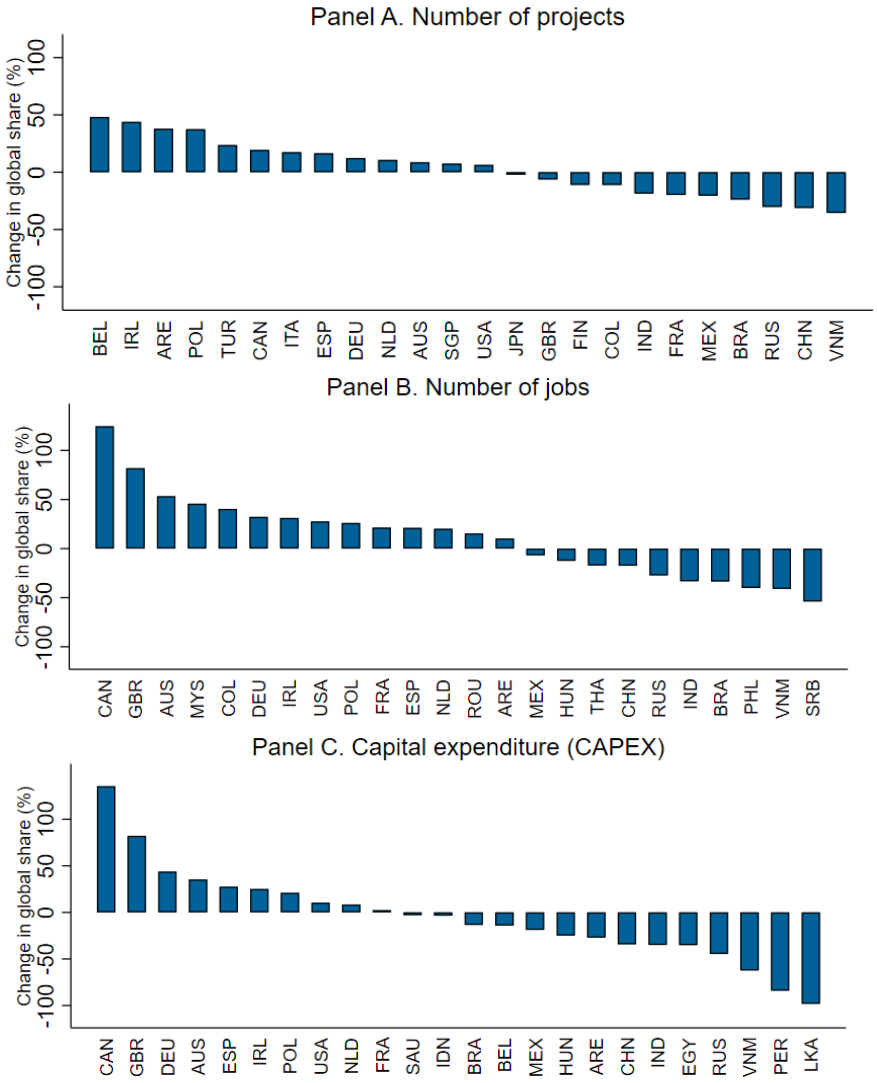




Note: The figure shows the change in the global share of the number of greenfield cross-border investment projects and the associated jobs and capital expenditure for 25 3-digit level NAICS sectors with the highest such share in the pre-COVID-19 period.

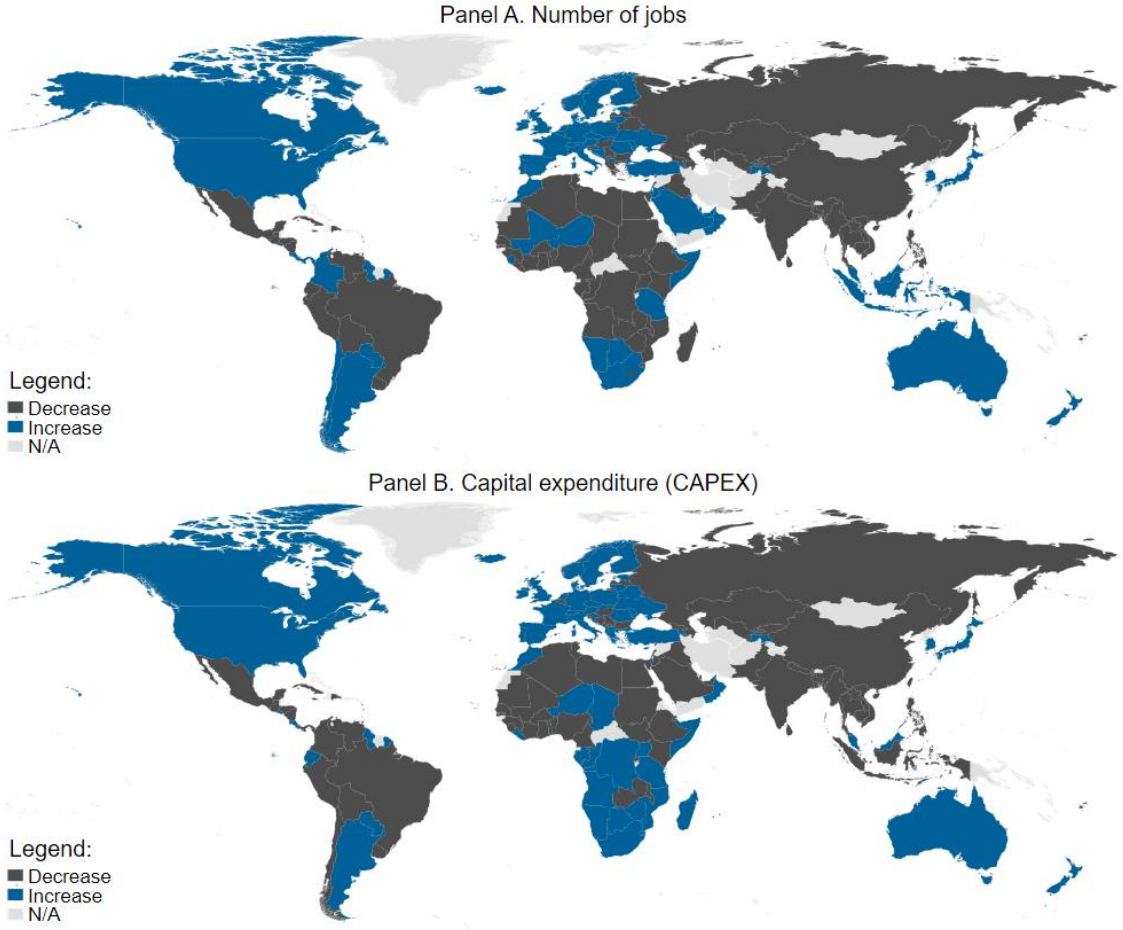
Figure A A.6. Changes in countries' share in cross-border greenfield investment pre- and post-COVID-19

Top 25 Destinations



Note: The figure shows the change in the global share of the number of greenfield cross-border investment projects and the associated jobs and capital expenditure for 25 host countries with the highest such share in the pre-COVID-19 period.

Figure A A.7. Changes in country shares in cross-border greenfield investment pre- and post-COVID-19, alternative metrics



Note: The figure depicts in blue host countries that experienced an increase in their share of the number of jobs and the value of capital expenditure associated with cross-border greenfield investment projects in the post-COVID 19 period (1 February 2020 31 March 2022) relative to pre-COVID-19 period (i.e., 1 January 2019 31 January 2020).

Table A A.3. Baseline results: average effect of COVID-19-related containment and recent FDI-related measures and on cross-border greenfield investment probability

	(1)	(2)	(3)	(4)	(5)	(6)
COVID-19 Measures (qt-1)	-0.012***	-0.012***	-0.010***	-0.008***	-0.008***	-0.008***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)
FDI Measures (qt-1)		-0.023	-0.025	-0.017	-0.007	-0.008
		(0.026)	(0.026)	(0.027)	(0.028)	(0.028)
COVID-19 Measures (qt-1) x FDI Measures (qt-1)				-0.023***	-0.026***	-0.026***
				(0.009)	(0.009)	(0.009)
Fixed Effects and Controls:						
Host-Home-Sector Fixed Effect	YES	YES	YES	YES	YES	YES
Home-Sector-Year Fixed Effect	YES	YES	YES	YES	YES	YES
Host-Sector-Year Fixed Effect	YES	YES	YES	YES	YES	YES
Quarter-Year Fixed Effect	YES	YES	YES	YES	YES	YES
Home COVID-19 Measures (j, qt-1)	YES	YES	YES	YES	YES	YES
Home FDI Measures (j, qt-1)	NO	YES	YES	YES	YES	YES
Host Other Controls (i, qt)	NO	YES	YES	YES	YES	YES
Home Other Controls (j, qt)	NO	NO	YES	YES	YES	YES
Host GDP (i, qt-1)	NO	NO	NO	NO	NO	YES
Home GDP (j, qt-1)	NO	NO	NO	NO	NO	YES
Observations	179377	179377	179377	179377	142570	142570
R-squared	0.733	0.733	0.733	0.733	0.730	0.730

Note: The table above shows the results of a regression from a linear probability model (LPM) regression where the dependent variable is a binary indicator that takes a value of 1 when there is a greenfield cross-border investment project by an investor from a home country *j* in a host country *i* in a sector *s* in a quarter-year *qt* period, and 0 otherwise, and includes host-country-home-country-sector (*ijs*), host-sector-year (*ist*) and home-sector-year (*jst*) and quarter-year (*qt*) fixed effects. All specifications (Columns 1-6) also include a binary indicator taking a value of 1 if a host country *i* had an above-median level of COVID-19 -related measures in place in the previous period (*qt-1*), or 0 otherwise (*COVID-19 Measures*), and the corresponding indicator for the home country *j*. The metric is calculated using daily data from the Oxford Government Response Tracker (Hale et al., 2021[21]). Columns 2-6 additionally include a binary indicator taking a value of 1 if a host country *i* had an FDI-related measure in place affecting investors from a home country *j* in a given sector *s* in the previous period (*qt-1*), or 0 otherwise (*FDI Measures*), and a corresponding indicator for the home country *j*. FDI measures cover all measures with discriminatory effect that relate to the rules on entry and ownership, treatment and operations of foreign-owned firms, labour market access and post-migration treatment as recorded in the Global Trade Alert (GTA, 2022[22]) database – see the description in the section on data of the paper. Columns 3-6 additionally include controls for local demand conditions and health outcomes, namely the median value of the measure that captures changes in local mobility in retail spaces, using aggregate daily Google Maps data from Google LLC (2022[26]); and the number of deaths, using data from the Oxford Government Response Tracker (Hale et al., 2021[21]) in a given period *qt* period in the host and home country, respectively. Columns 4-6 also include the interaction term between COVID-19- and recent FDI-related measures aiming to increase control over incoming investment in place in the host country *i* in a quarter-year period *qt-1*. In addition, Column 5 reports the results of the same specification as in Column 4 for a sample of countries for which quarter-level GDP data is available in IMF (2023[20]); and Column 6 reports the results of a specification that additionally controls for real quarterly GDP in the host and home country in a quarter-time period *qt*, using IMF (2023[20]) data, for the same sample of countries.

Table A A.4. Alternative specification: heterogenous effects of COVID-19-related containment and recent FDI-related measures on cross-border greenfield investment probability by sector type

	(1)	(2)	(3)
COVID-19 Measures (qt-1)	-0.008***	-0.006**	-0.008***
	(0.003)	(0.003)	(0.003)
FDI Measures (qt-1)	0.009	-0.019	-0.034
	(0.038)	(0.033)	(0.031)
COVID-19 Measures (qt-1) x FDI Measures (qt-1)	-0.021**	-0.016	-0.004
	(0.011)	(0.013)	(0.013)
COVID-19 Measures (qt-1) x Telework	-0.000		
	(0.004)		
FDI Measures (qt-1) x Telework	-0.063		
	(0.052)		
COVID-19 Measures (qt-1) x FDI Measures (qt-1) x Telework	-0.006		
	(0.023)		
COVID-19 Measures (qt-1) x Routine		-0.005	
		(0.004)	
FDI Measures (qt-1) x Routine		0.004	
		(0.047)	
COVID-19 Measures (qt-1) x FDI Measures (qt-1) x Routine		-0.012	
		(0.016)	
COVID-19 Measures (qt-1) x High-R&D			-0.003
			(0.005)
FDI Measures (qt-1) x High-R&D			0.050
			(0.052)
COVID-19 Measures (qt-1) x FDI Measures (qt-1) x High-R&D			-0.044**
			(0.019)
Fixed Effects and Controls:			
Baseline Controls	YES	YES	YES
GDP (i, qt-1), GDP (j, qt-1)	NO	NO	NO
Observations	179377	179377	179377
R-squared	0.733	0.733	0.733

Note: The table above shows the results of a regression from a linear probability model (LPM) regression where the dependent variable is a binary indicator that takes a value of 1 when there is a greenfield cross-border investment project by an investor from a home country *j* in a host country *i* in a sector *s* in a quarter-year *qt* period, and 0 otherwise, and includes all the fixed effects and controls included in the baseline specification reported in Column 4 of Table A 8, splitting the effect of the presence of above-median COVID-19- and recent FDI-related measures aiming to increase control over incoming investment in place in the host country in the previous quarter-time period *qt-1* for the different groups of sectors. In particular, *Telework* refers to sectors with high teleworking intensity from Dingel and Neiman (2020[35]); *Routine* refers to sectors with high routine-tasks intensity from Acemoglu and Restrepo (2019[36]) and *High R&D* refers to sectors with high R&D intensity from Galindo-Rueda and Verger (2016[37]).

Table A A.5. Robustness checks: heterogenous effects of COVID-19-related containment and recent FDI-related measures on cross-border greenfield investment probability by sector type

	(1)	(2)	(3)	(4)	(5)	(6)
COVID-19 Measures (qt-1)	-0.007**	-0.006*	-0.007**	-0.007**	-0.006*	-0.007**
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
FDI Measures (qt-1)	0.024	-0.011	-0.026	0.024	-0.011	-0.026
	(0.038)	(0.034)	(0.032)	(0.038)	(0.034)	(0.032)
COVID-19 Measures (qt-1) x FDI Measures (qt-1)	-0.027**	-0.022	-0.006	-0.027**	-0.021	-0.006
	(0.011)	(0.013)	(0.014)	(0.011)	(0.013)	(0.014)
COVID-19 Measures (qt-1) x Telework	-0.002			-0.002		
	(0.005)			(0.005)		
FDI Measures (qt-1) x Telework	-0.076			-0.076		
	(0.054)			(0.054)		
COVID-19 Measures (qt-1) x FDI Measures (qt-1) x Telework	0.004			0.004		
	(0.023)			(0.023)		
COVID-19 Measures (qt-1) x Routine		-0.005			-0.005	
		(0.004)			(0.004)	
FDI Measures (qt-1) x Routine		0.007			0.007	
		(0.047)			(0.047)	
COVID-19 Measures (qt-1) x FDI Measures (qt-1) x Routine		-0.007			-0.007	
		(0.017)			(0.017)	
COVID-19 Measures (qt-1) x High-R&D			-0.003			-0.003
			(0.005)			(0.005)
FDI Measures (qt-1) x High-R&D			0.054			0.054
			(0.055)			(0.055)
COVID-19 Measures (qt-1) x FDI Measures (qt-1) x High-R&D			-0.047**			-0.047**
			(0.020)			(0.020)
Fixed Effects and Controls:						
Baseline Controls	YES	YES	YES	YES	YES	YES
GDP (i, qt-1), GDP (j, qt-1)	NO	NO	NO	YES	YES	YES
Observations	142570	142570	142570	142570	142570	142570
R-squared	0.730	0.730	0.730	0.730	0.730	0.730

Note: The table above shows the results of a regression from a linear probability model (LPM) regression where the dependent variable is a binary indicator that takes a value of 1 when there is a greenfield cross-border investment project by an investor from a home country *j* in a host country *i* in a sector *s* in a quarter-year *qt* period, and 0 otherwise, and includes all the fixed effects and controls included in the baseline specification reported in Column 4 of Table A 8, splitting the effect of the presence of above-median COVID-19- and recent FDI-related measures aiming to increase control over incoming investment in place in the host country in the previous quarter-time period *qt-1* for the different groups of sectors as in Table A9, while including additional controls to test robustness of the results. In particular, Columns 1-3 report the results of regressions for a sample of countries for which quarterly GDP data is available in IMF (2023[20]) using the same specification as in the baseline, and Columns 7-9 additionally include controls for quarterly real GDP in the previous period *qt-1* of the host and home country. *Telework* refers to sectors with high teleworking intensity from Dingel and Neiman (2020[35]); *Routine* refers to sectors with high routine-tasks intensity from Acemoglu and Restrepo (2019[36]) and *High R&D* refers to sectors with high R&D intensity from Galindo-Rueda and Verger (2016[37]).