The U.S. Multinational Advantage during the 2008–2009 Financial Crisis: The Role of Services Trade*

Fariha Kamal†
U.S. Census Bureau

Zachary Kroff
U.S. Census Bureau

October 2021
Comments Welcome.

Abstract

We examine whether exporting services enhanced goods-export growth of U.S. multinational enterprises (MNEs) during the 2008–2009 financial crisis using a triple-difference identification strategy combined with propensity-score matching to construct counterfactuals. We find that MNEs that also export services to the same destination (bi-exporters) experienced higher goods-export growth than MNEs that only export goods (mono-exporters) faced with lower foreign demand during the crisis. This effect is driven by exports of intellectual property rights (e.g. trademarks, computer software) to unaffiliated parties. We also find higher growth in foreign affiliates' services sales and domestic services-sector employment at bi-exporters than at mono-exporters. Together, these results suggest that services exports augmented foreign demand for U.S. goods during the crisis.

JEL Codes: F1, F13, F14, F23, H2

Keywords: multinationals, financial crisis, services exports, goods exports, foreign affiliates, employment

*Author contact: `fariha.kamal@census.gov`, and `zachary.kroff@census.gov`. Any opinions and conclusions expressed herein are those of the authors and do not necessarily represent the views of the U.S. Census Bureau or the Bureau of Economic Analysis. The Census Bureau's Disclosure Review Board and Disclosure Avoidance Officers have reviewed this data product for unauthorized disclosure of confidential information and have approved the disclosure avoidance practices applied to this release (DRB Approval Numbers: CBDRB-FY20-CES007-007, CBDRB-FY21-CES007-009; BEA Approval Number: BEA-FY21-P6907751-R1). The statistical analysis of Bureau of Economic Analysis firm-level data on U.S. companies was conducted under arrangements that maintain legal confidentiality requirements. We thank James Fetzer, Alexis Grimm, Raymond Mataloni, and Christopher Steiner for guidance with surveys conducted by the Bureau of Economic Analysis. We thank Laura Alfaro, Emek Basker, J. Bradford Jensen, Shawn Klimek, Raymond Mataloni, Nikolas Zolas and seminar participants at the 2020 Census Bureau Brown Bag Series and 2021 AEA for helpful comments and discussions.

†Corresponding author

1 Introduction

The 2008–2009 global financial crisis was marked by a precipitous decline in international trade relative to gross domestic product (GDP) and has been aptly described as the "Great Trade Collapse" (Baldwin, 2009). Between 2007 and 2009, U.S. GDP declined by 2.7% and U.S. merchandise exports fell by 10%. However, the decline in merchandise exports masks heterogeneity in responses by the type of U.S. exporter: multinational enterprises (MNE) experienced a decline of 1% while non-MNEs experienced a decline of 26% during the same period.[1] This paper examines the performance of MNEs during the global financial crisis to understand the MNE goods-export growth advantage.

We propose a novel channel that may have contributed to the MNE advantage: services exports. This idea is motivated by three empirical regularities. First, recent evidence establishes the complementarity between goods and services trade. Ariu, Mayneris and Parenti (2020) show that demand complementarities between services and goods boost Belgian firms' goods exports.[2] Second, multinationals mediate the majority of U.S. services trade—92% of services exports in 2017—a pattern that holds as far back as 2008 (Bruner and Grimm, 2019). Finally, services trade was especially resilient during the global financial crisis. The value of monthly U.S. goods trade declined by about one-third between July 2008 and February 2009; in contrast, the decline in services trade in the same time period was only about one-tenth (Borchert and Mattoo, 2009). Within U.S. services exports, transport and tourism declined; however, insurance, financial, telecommunications, business, and professional and technical services all grew.[3] Motivated by these facts, we test whether MNE sales of services to the same destination as their goods exports contributed to the goods-export growth advantage during the global financial crisis.

We begin by establishing that multinationals experienced higher goods-export growth than non-multinational goods exporters. We implement nearest-neighbor propensity-score matching to construct a counterfactual using non-multinational goods exporters that share similar observable economic characteristics as multinational goods exporters. Then, using a triple-difference strategy, we compare export growth of MNE and non-MNE goods exporters selling to countries with varying GDP growth before and after the financial crisis. We find that a 1 percentage point (pp) decline in GDP growth is associated with a 0.6pp higher

[1] Calculated using public-use data on U.S. multinational firms from the U.S. Bureau of Economic Analysis and merchandise trade from the U.S. Census Bureau.

[2] We differ from Ariu et al. (2020) in our focus on multinational exporters and attention to the financial crisis period.

[3] These patterns are also corroborated in Belgian data (Ariu, 2016).

goods-export growth at MNE exporters than matched non-MNE exporters. Moreover, while the export growth of MNEs that only export goods is not statistically different from non-MNEs, MNEs that also export services to the same destination experience 1.4pp higher goods-export growth than matched non-MNE exporters.

To minimize concerns that our main result arises due to fundamental differences between MNEs and observationally similar non-MNEs, we implement an alternate control group. Multinationals that only export goods (mono-exporters) are used as controls for multinational goods exporters that also export services to the same destinations (bi-exporters). We find that a 1pp decline in GDP growth is associated with a 1.1pp higher goods-export growth at bi-exporting MNEs than matched MNE mono-exporters.

We perform two checks to confirm the association between the higher MNE goods-export growth and firms' destination-specific services exports. First, we check our baseline result on a third control group: treated MNEs' goods exports to destinations to which they do not also export services. Using the same firm, in different markets, as its own control implicitly controls for any cross-market unobserved traits that influence the decision to export services. Our baseline result is robust to this alternate identification strategy. Second, we test whether the bi-exporter goods-export growth is higher in destinations with low barriers to services trade. If services exports have no role in shaping goods-growth then we should not see a differential effect in countries with low than high services trade barriers. We find that with a 1pp decline in GDP growth, bi-exporters experienced over 3pp higher growth in goods exports than mono-exporters selling to countries with low services trade barriers. These checks are consistent with the idea that services exports to the same destinations enhance multinationals' goods-export growth to destination countries more exposed to the financial crisis.

We extend the analysis to explore the type of exported services associated with the MNE goods-export growth advantage. We classify services exports into five broad categories: rights to intellectual property related to business activities such as trademarks and computer software ($Business\ IP$), rights to intellectual property related to media activities such as film and television ($Media\ IP$), business services, telecommunication, and all other services. We find that MNE goods-export growth is strongest at MNEs that export $Business\ IP$ services. This effect is primarily driven by $Business\ IP$ services exports to unaffiliated rather than affiliated parties. Nonetheless, multinationals may also sell services through their foreign affiliates in a given destination. Focusing on U.S. parent MNEs, we find that foreign affiliates' services sales growth is higher for MNEs with goods and services exports

to the affiliates' country than MNEs with only goods exports to the affiliates' country.[4]

Finally, we seek evidence of within-firm reorganization of domestic activity precipitated by the crisis by comparing domestic employment growth at bi- and mono-exporters. We find that bi-exporters experienced higher employment growth than mono-exporters facing varying degrees of exposure to foreign demand in the post-crisis relative to the pre-crisis period. The growth in employment is driven primarily by employment growth in the services sector, particularly in information and professional and technical services.

Our analysis is made possible by newly constructed links between multinational and services trade surveys collected by the Bureau of Economic Analysis (BEA) and the Census Bureau's Business Register of the universe of U.S. employer establishments (Kamal, McCloskey and Ouyang, 2020). We define the multinational status of firms using the firm-level surveys on U.S. direct investment abroad and foreign direct investment in the U.S. in 2007, before the financial crisis. Thus, our sample includes both U.S. parent multinational firms that have foreign affiliates abroad ("domestic" MNEs) and U.S. affiliates of foreign parent multinational firms ("foreign" MNEs). We define the services export status of a firm using the 2007 Quarterly Survey of Transactions in Selected Services and Intellectual Property with Foreign Persons. This survey contains information on charges for the use of intellectual property, telecommunications, computer, and information services, and other business services (e.g. management consulting, research and development) and together account for almost half of total U.S. services exports.[5] We combine a firm's multinational and services export status with information on its U.S. production and merchandise exports between 2007 and 2009.

This paper makes three main contributions. First, we provide, to the best of our knowledge, the first firm-level evidence on U.S. MNEs and their goods-export adjustments during the 2008–2009 financial crisis. Alfaro and Chen (2012) compare the sales growth of foreign-owned and domestic-owned establishments across 53 countries during the financial crisis. They find that foreign-owned establishments performed significantly better during 2007–2008, but not in non-crisis years. Alviarez, Cravino and Levchenko (2017), using similar data across 34 countries, find that foreign-affiliate sales growth was higher than domestic sales growth from 2004 to 2008 and lower for 2008–2009. Our focus, in contrast to these studies, is on goods-export growth of U.S. multinational firms. Moreover, our analysis en-

[4]Although we include U.S. affiliates of foreign parents in our analysis sample, we do not have information on foreign MNEs' overseas economic activities.

[5]BEA conducts surveys in transport, travel, insurance, and financial services, which account for 13%, 24%, 2%, and 13%, respectively, of overall services exports in 2007 (U.S. Bureau of Economic Analysis, 2020).

compasses not only activities of U.S. affiliates of foreign parents but importantly U.S. parent multinational firms.

Second, we provide evidence corroborating a nascent but growing body of work documenting the interconnections between goods and services trade. Ariu, Breinlich, Corcos and Mion (2019) find that Belgian firms are more likely to source services and goods inputs from the same source country and that goods trade barriers dampen firm-level services imports from the same markets. Berlingieri, Marcolin and Ornelas (2021) find that French firms with more experience exporting goods to a destination are more likely to source export-related service inputs from there rather than domestically. Ariu, Mayneris and Parenti (2020) show, both empirically and theoretically, that services exports act as a demand shifter for firms increasing the perceived quality of a firm's products. Our findings suggest that during periods of negative demand shocks, services may be especially important to boosting the demand for goods exports.

Finally, we shed light on the process of "servitization"—the phenomenon where manufacturers increasingly sell services—in the U.S. economy.[6] Fort, Pierce and Schott (2018) document that non-manufacturing employment at U.S. manufacturing firms increased between 1977 and 2000 before leveling off; about a third of this growth is in professional services. They describe this trend as "[...] an evolution of US manufacturing firms into 'neuro-facturers' that increasingly provide intellectual services rather than physical goods." Given the outsized role multinationals play in the U.S. economy—accounting for over three quarters of total U.S. manufacturing employment and more than 80% of all industrial R&D in 2017 (Foley et al., 2021)—our results suggest that negative demand shocks may necessitate within-firm adjustments at multinationals that favor servitization.

The rest of the paper is organized as follows. We describe the empirical approach in Section 2. Section 3 describes our data sources. We present our baseline results in Section 4; checks to our identification strategy in Section 5; and extensions in Section 6. Section 7 concludes.

2 Econometric Strategy

Our goal in this paper is to evaluate the role of services exports in MNEs' goods-export growth during the 2008–2009 financial crisis. However, firms' multinational and services exporting status are not random. We implement propensity score matching to construct

[6]Empirical evidence of servitization has also been documented in other countries such as France (Crozet and Milet, 2017), the U.K. (Breinlich, Soderbery and Wright, 2018), and India (Grover and Mattoo, 2021).

economically meaningful counterfactuals based on observable characteristics. We proceed as follows. First, we assess whether MNEs differed from non-MNE goods exporters in their goods-export growth. We construct observationally equivalent non-MNE goods exporters for each MNE goods exporter. In our analysis, we separate MNEs that also exported services in 2007 from MNEs that only exported goods and compare the goods-export growth of each type of MNE to non-MNEs. However, non-MNE goods exporters may not be good controls for MNEs that also export services given the dominance of multinationals in U.S. services trade. We construct a second control group which forms the basis for all subsequent analysis. We match each MNE goods exporter that also exports services (bi-exporter) with an observationally equivalent MNE that only exports goods (mono-exporter).

Once we have constructed our control groups, we employ a triple-difference strategy to compare the goods-export growth between MNEs and matched controls faced with varying degrees of exposure to foreign demand in the crisis period compared to the same difference in the pre-crisis period.

2.1 Propensity Score Matching

Our analysis requires constructing two sets of counterfactuals: non-MNE goods exporters and MNEs that only export goods. We separately compare performance of bi-exporting MNEs to the two sets of control firms.

2.1.1 Non-MNE Goods Exporters

We estimate the probability that a goods exporter is a multinational prior to the financial crisis, in 2007, using a probit model as follows:

$$\Phi^{-1}(p_i^{MNE}) = \beta_1 \ln(\frac{Sales}{Employment})_i + \beta_2 \ln Products_i + \beta_3 \ln Countries_i + \beta_4 \ln Exports_i + \varepsilon_i, \tag{1}$$

where Φ is the cumulative distribution function of the standard normal distribution and p_i^{MNE} is the probability that firm i is a multinational in 2007. The explanatory variables are also measured as of 2007. We select the explanatory variables guided by prior work (Alfaro and Chen, 2012; Alviarez et al., 2017): $\ln(\frac{Sales}{Employment})_i$ measures a firm's labor productivity; $\ln Products_i$ is the log total number of HS4 goods exported by the firm; $\ln Countries_i$ is the

log total number of destination countries of a firm's exports; and $\ln Exports_i$ is the log of a firm's total goods exports.[7]

2.1.2 MNE Goods-Only Exporters

We estimate the likelihood that a goods-exporting multinational also exports services prior to the financial crisis, in 2007, using a probit model as follows:

$$\Phi^{-1}(p_i^{SVC}) = \beta_1 \ln(\frac{Sales}{Employment})_i + \beta_2 \ln Products_i + \beta_3 \ln Countries_i + \beta_4 \ln Exports_i + \beta_5 Parent_i + \varepsilon_i, \quad (2)$$

where p_i^{SVC} is the probability that MNE i exported both goods *and* services in 2007. The explanatory variables are also measured as of 2007 and selected as described in Section 2.1.1. We include an additional indicator variable, $Parent_i$, in Equation 2 that indicates whether the MNE is a U.S. parent firm or a U.S. affiliate of a foreign parent firm.

2.2 Triple Difference Identification Strategy

We use a differences-in-differences-in-differences (DDD) estimator to isolate the impacts of declining foreign demand on goods-export growth at MNEs and matched control groups. The DDD estimator exploits three sources of variation. We compare goods-export growth of bi-exporting and mono-exporting MNEs (first difference), selling to countries that experienced higher and lower declines in GDP growth (second difference), before and after the financial crisis (third difference).[8] We estimate the following model,

$$\begin{aligned}\Delta \ln Exports_{icq} = {} & \beta_1 \Delta \ln GDP_{cy} \times MNE_{ic,2007}^{SVC} \times Post \\ & + \beta_2 \Delta \ln GDP_{cy} \times MNE_{ic,2007}^{SVC} + \beta_3 MNE_{ic,2007}^{SVC} \times Post \\ & + \beta_4 MNE_{ic,2007}^{SVC} + \alpha_{iq} + \alpha_{cq} + \alpha_{ir} + \varepsilon_{icq}. \end{aligned} \quad (3)$$

[7] Although we examine growth in arm's-length exports of firms as our main outcome, we include related-party trade to compute the total MNE exports. Related-party relationships are those in which one firm owns a stake of at least 10% in the other. It is an indicator variable; we do not observe the actual equity shares.The ownership status between trading parties is denoted by item 32.C in Form-7501.

[8] Here we explicitly describe the triple difference model where bi-exporting MNEs are the treatment and mono-exporting MNEs are the control groups. Equation 5 describes our specification where all goods-exporting MNEs are the treatment and non-MNEs are the control groups in Section 4.2. Equation 5 is equivalent to Equation 3 but we replace $MNE_{ic,2007}^{SVC}$ with $MNE_{i,2007}$. Note that $MNE_{i,2007}$ is defined at the firm level while $MNE_{ic,2007}^{SVC}$ is defined at the firm-country level.

We examine changes in firm i's arm's-length goods-export growth to destination country c in quarter q: $\Delta \ln Exports_{icq}$ where $\Delta(w) \equiv w_{\tau,y} - w_{\tau,y-1}$ and τ indexes a quarter (1, 2, 3, or 4) in a year y. For example, firm i's goods-export growth in the first quarter of 2007 is given by, $(\ln Exports_{1,2007} - \ln Exports_{1,2006})$. The post period indicator is post-2008Q3.

We include a set of two-way fixed effects.[9] Firm-quarter, α_{iq}, fixed effects control for any time-varying unobservable firm-specific factors such as productivity. Country-quarter, α_{cq}, fixed effects control for time-varying unobservable country-specific factors such as exchange rates or changes in foreign demand. Firm-region, α_{ir}, fixed effects control for firm-specific unobservables that vary at the region level such as local firm presence or trading experience in that market. We define seven regions: North America, Central America, South America, Europe, Asia, Australia and Oceania, and Africa.[10] Robust standard errors are clustered at the country level.

The DDD coefficient of interest is β_1. Conceptually, β_1 can be interpreted as follows,

$$\begin{aligned} &\big[(Y_{bi,High} - Y_{mono,High}) - (Y_{bi,Low} - Y_{mono,High})\big]_{post} \\ -&\big[(Y_{bi,High} - Y_{mono,High}) - (Y_{bi,Low} - Y_{mono,High})\big]_{pre} \end{aligned} \tag{4}$$

where bi ($mono$) denotes MNEs that export both goods and services (MNEs that only export goods) to a given destination; $High$ (Low) denotes countries that experience higher (lower) decline in GDP after the financial crisis. The $High$ (Low) bins are for expositional ease only, since we utilize a continuous measure of GDP growth in our empirical analysis. Therefore, β_1 measures the average change in goods-export growth between MNEs and the control group in response to changes in GDP growth in the crisis period relative to the same difference in the pre-crisis period.

3 Data

We link confidential micro data on services and goods exports of multinational and non-multinational firms operating in the United States. We also examine MNEs' foreign affiliate sales and MNEs' domestic employment.

[9] Inclusion of the fixed effects absorbs the individual coefficients on $\Delta \ln GDP_{cy}$, $Post$, and $\Delta \ln GDP_{cy} \times Post$. We include the terms $MNE^{SVC}_{ic,2007}$, $MNE^{SVC}_{ic,2007} \times Post$, and $\Delta \ln GDP_{cy} \times MNE^{SVC}_{ci,2007}$ in all specifications but suppress them in the table display.

[10] We follow country groupings defined by the U.S. Census Bureau at `https://www.census.gov/foreign-trade/schedules/c/countrycode.html`.

3.1 Multinational Firms

We utilize two surveys collected by the Bureau of Economic Analysis providing comprehensive coverage of U.S. multinational activity to identify the multinational status of firms as of 2007. We use the Annual Survey of U.S. Direct Investment Abroad (Form BE-11) to identify domestic MNEs. We use the Benchmark Survey of Foreign Direct Investment in the U.S. (Form BE-12) to identify foreign MNEs. The data from these surveys form the basis for U.S. balance of payments statistics international transactions and direct investment positions and official statistics on the activities of multinational enterprises (U.S. Bureau of Economic Analysis, 2018).

In addition to identifying firms' multinational status, we also use the 2006-2008 Annual Survey of U.S. Direct Investment Abroad (Form BE-11) and 2009 Benchmark Survey of U.S. Direct Investment Abroad (Form BE-10) to obtain annual services sales by the foreign affiliates of U.S. parents. We observe foreign affiliate sales by affiliation and destination (aggregated geography).[11]

3.2 Firm-Level Trade Data

Our analysis leverages firm-trade transaction level data on the universe of merchandise exports and a select set of services exports.

3.2.1 Merchandise Trade

The Longitudinal Firm Trade Transactions Database (LFTTD) combines merchandise export and import transactions from confidential customs declaration forms with administrative data on the universe of U.S. firms in the non-farm, private sector in the Census Bureau's Business Register (Kamal and Ouyang, 2020). Thus, the LFTTD enables identification of U.S. merchandise exporters and importers. It covers the universe of imported shipments valued over US$2,000 and exported shipments valued over US$2,500 of merchandise goods. We examine firm-country-quarter level export flows between 2006 and 2009. Our outcome variable of interest is the 12-month change in arm's-length exports for a firm selling to a given destination in a given quarter.

[11] On Form BE-11, U.S. parents report foreign affiliates' sales to both affiliated and unaffiliated parties in three mutually exclusive geographic categories: (1) the affiliates' country (i.e., "local"), (2) the U.S., and (3) all other non-U.S. countries.

3.2.2 Services Trade

We draw from data in the 2007 Quarterly Survey of Transactions in Selected Services and Intellectual Property with Foreign Persons (BE-120) that contains information on charges for the use of intellectual property, telecommunications, computer, and information services, and other business services such as professional and management consulting, research and development services, and technical services.[12] The survey contains information about firm exports by detailed services product categories either with affiliated or unaffiliated parties in a given destination country.[13] In 2007, the total value associated with the services trade categories collected in the BE-120 accounted for 43% of total U.S. services exports.[14]

To explore the role of particular services products on goods-export growth, we partition the products into five broad categories and construct the value of services export in each category as a share of the firm's total services exports to a given destination country as follows:

- Business-related Intellectual Property ($Business\ IP$): includes rights related to industrial processes, trademarks, computer software, franchise fees, and other intellectual property and intangibles.
- Media-related Intellectual Property ($Media\ IP$): includes rights related to film and television, books and sound recording, and broadcasting and recording.
- Business Services (BUS): includes R&D testing, legal, accounting, management and consulting, advertising, architectural and engineering, construction, industrial engineering, mining, operational leasing, trade-related, sports and performing arts, educational and training, and other business services
- Telecommunication Services ($TELCOM$): includes computer and data processing, telecommunication, and database and other information services.
- Other Services (OTH): includes industrial-type maintenance and auxiliary insurance.

Using publicly-available information on U.S. services exports, we document the export share of a detailed product within the five broad categories as shown in column (2) of

[12] See `https://apps.bea.gov/surveys/be125/`.

[13] BEA also conducts firm-level surveys on international transactions in financial and insurance. These surveys were not available to us at the time of the study. For details on all services surveys conducted by BEA see `https://www.bea.gov/system/files/2018-04/surveysu.pdf`.

[14] For each detailed services product surveyed in BE-120, we construct the share in total U.S. services exports in 2007 as shown in column (1) of Appendix Table A-4.

Appendix Table A-4. Rights related to industrial processes and computer software account for over 80% of total *Business IP* services; rights related to film and television account for 87% of total *Media IP* services; management and consulting account for about a third and R&D testing, architectural, engineering services together account for another third of total business services; finally, telecommunication, computer and data processing together account for over three quarters of total telecommunication services.

3.3 Firm Characteristics

The Longitudinal Business Database (LBD) tracks U.S. establishments in the non-farm, private sector employer universe over time (Chow, Fort, Goetz, Goldschlag, Lawrence, Perlman, Stinson and White, 2021).[15] It contains information on every establishment's firm affiliation, year of birth, six-digit NAICS, employment, and payroll. We link the LBD to the LFTTD using common firm identifiers. We use information on the firm's total employment in the LBD as of 2007 as explanatory variables in our propensity score model. We obtain information on total firm sales from the 2007 Economic Census.[16]

We use the County Business Patterns Business Register (CBPBR) to obtain firms' quarterly employment to analyze domestic employment growth. The CBPBR contains records of all U.S. establishments with positive payroll and forms the basis for constructing the LBD (Chow et al., 2021).[17]

3.4 Country-level Data

3.4.1 GDP

We use annual GDP information for 186 countries excluding tax havens.[18] Tax havens may be used as a vehicle to lower multinationals' global tax obligations through income shifting across jurisdictions (Dyreng and Hanlon, 2021). Shifting income through the movement of intangible assets such as intellectual property (half of the services exports measured in

[15]LBD excludes operations with no statutory employees, e.g. self-employed, farms (but not agri-business), and the public sector.

[16]The Economic Census includes: Census of Manufactures; Census of Services; Census of Construction; Census of Transportation, Communications, and Utilities; Census of Mining; Census of Retail Trade; Census of Wholesale Trade; Census of Finance, Insurance, and Real Estate.

[17]The CBPBR contains establishment-level variables such as name, address, industry, legal form of organization, establishment and firm identifiers, EIN, annual and quarterly payroll, employment, and county and state FIPS codes.

[18]The following countries in our data are designated as tax havens: Bermuda, Cayman Islands, Hong Kong, Ireland, Luxembourg, Netherlands, Singapore, and Switzerland following Dharmapala and Hines (2009).

the BE-120) is well documented (Jenniges, Mataloni, Stutzman and Xin, 2018). Therefore, excluding tax havens increases confidence that the services export flows in our analysis reflect real economic activity rather than financial accounting.

Measures of GDP is obtained chiefly from the World Bank's World Development Indicators. We supplement GDP information for select countries from the United Nations and the Federal Reserve Economic Data (FRED).[19] We construct annual GDP growth rate using GDP in constant 2010 U.S. dollars (USD). We use quarterly GDP in robustness checks, discussed in Appendix A.2 and displayed in Table A-3, that are available for a smaller subset (45) of countries from the Organisation for Economic Development and Cooperation (OECD).[20]

Table 1 displays the annual GDP growth rate for the top 15 export partners of the U.S. for three time periods: 2006-2007, 2007-2008, and 2008-2009. The countries are ranked in terms of 2007 export value. We can see, in the first column, that the annual growth rate between 2006 and 2007 is positive for all partner countries. In the second column, the growth rate between 2008 and 2007 is positive for most of the countries except for Italy, Japan, and the United Kingdom. Between 2008 and 2009, shown in the last column, almost all 15 trading partners experienced negative GDP growth, with the exception of Australia, China, India, Israel, and South Korea. However, with the exception of India, even the countries with a positive GDP growth rate experienced a decline in their GDP growth between 2007 and 2009 as seen across the three columns. We use the variation in annual GDP growth across all U.S. partner countries to measure the differential exposure of U.S. exporters to foreign demand.

3.4.2 Services Trade Restrictiveness Index

We employ the 2008 Services Trade Restriction Indices (STRI) from the World Bank's Services Trade Restrictions Database (STRD).[21] The STRI assigns a score between 0 to 100 to each country where a higher value indicates higher restrictiveness of policies and regulations that govern foreign services or foreign service providers (Borchert, Gootiiz and Mattoo, 2012). We use both country and country-industry STRI measures differentiated by the modes of supply. The General Agreement on Trade in Services (GATS) defines trade in services as

[19] Accessed at `https://databank.worldbank.org/source/world-development-indicators#`, `https://unstats.un.org/unsd/snaama/Basic`, and `https://fred.stlouisfed.org/series/RGDPNATWA666NRUG#0`.

[20] Data downloaded from `https://data.oecd.org/gdp/quarterly-gdp.htm`.

[21] Accessed at `https://www.worldbank.org/en/research/brief/services-trade-restrictions-database`.

the supply of a service that may be supplied via four "modes": cross-border provision (mode 1), consumption abroad (mode 2), commercial presence in a foreign country (mode 3), and temporary movement of people across borders (mode 4) (Francois and Hoekman, 2010).

We utilize the STRI to create indicator variables that categorize a country as having low or high barriers to services trade. Specifically, we create four indicator variables using four separate STRI measures: (i) mode 1 across all industries; (ii) mode 4 across all industries; (iii) all modes across all industries; and (iv) all modes in the professional services industry. These measures are informed by transactions covered by the BE-120 survey. This survey collects information on U.S. persons' direct transactions, both sales and purchases, with affiliated and unaffiliated foreign persons. Specifically, the survey includes services performed "on a cross-border basis" (mode 1) and "in person" (mode 4).[22] Therefore, we consider modes 1 and 4 separately from all modes of supply. Ideally, we would have a measure of services trade restrictiveness that includes both modes 1 and 4 but excludes mode 3. However, the STRD only includes measures based on modes 1, 3, and 4 either separately or all together. We also consider STRI for the professional services industry because this industry corresponds most closely with activities associated with the types of services (selected business services and intellectual property) collected on the BE-120 survey instrument.

Overall, we expect our restrictiveness indicator based on mode 1 STRI scores to be most salient in the context of our study. Aggregate estimates for the U.S. show that aside from mode 3 (which is excluded in the BE-120 survey), mode 1 is the most prevalent mode of supplying services (see Figure 2 in Mann (2019)); for specific types of services collected in the BE-120, such as charges for intellectual property and business and management consulting categories, cross-border trade is the primary mode of supplying the service (see Figure 3 in Mann (2019)).

Our indicator for a "low" STRI score is equal to 1 when a country's score is less than or equal to the median score among all countries in the STRD database. A low STRI score indicates that there are fewer restrictions faced by U.S. firms exporting services to these countries. We present the underlying STRI data used to construct these four separate indicators in Appendix Figures 1 - 4. Considering different modes of supply and different industries change whether a country is considered to have "low" (below the median line) or "high" (below the median line) restrictiveness. For example, using all modes but comparing the STRI score for the professional services industry (Figure 3) to all industries (Figure 4), we find that countries such as Mexico, Japan, and Germany switch their restrictiveness

[22]This is distinct from foreign affiliate sales information collected in the BE-10 and BE-11 surveys which correspond to commercial presence in countries outside the U.S. (mode 3).

rankings.

4 Results

4.1 Propensity Score Matching

We describe the results from the propensity score matching exercise before presenting our regression results. We begin by describing construction of the two control groups: non-MNE goods exporters and MNEs that only export goods.

4.1.1 Matching non-MNEs

For the first part of our empirical analysis we begin with the sample of all goods exporters in 2007. Then we restrict attention to all multinational exporters and only those non-multinational exporters whose employment is at least as large as the median multinational exporter. This restriction ensures that we are comparing firms of similar size distributions. We further restrict our sample to only include non-multinationals that (i) export the same set of 4-digit Harmonized System (HS4) goods as multinationals; and (ii) export to the same set of destinations as multinationals. These restrictions minimize the possibility that any difference in export growth between MNE and non-MNEs is being driven by product and country compositions.

Then we estimate Equation (1) and obtain propensity scores for all firms in the sample. We implement nearest neighbor matching with replacement such that the same non-multinational firm may be a control for multiple multinational firms. We use five nearest neighbors to allow for larger numbers of unique controls per treatment.[23] We assess how well the propensity score matching performs using the resulting balancing quality between the treated and control groups.

First, we check the difference in the means of the explanatory variables in the propensity score model between the treated and control firms in Panel A of Table 3. We find no statistically significant differences between the treated and control firms in terms of pre-crisis characteristics of labor productivity, number of exported products, or number of export destinations. The difference in means of the size measure (total value of goods exports) is statistically significant although the values are very close: 15.5 and 15.4 for MNEs and non-MNEs, respectively. Second, balancing measures based on the propensity score (Rubin,

[23]Increasing the number of firms in the analysis also ensures compliance with Census Bureau disclosure avoidance rules.

2001) also point to high balancing quality. Rubin's B, the standardized difference in the linear index of the propensity score, is 6.9 and the Rubin's R, the ratio of the propensity score's variance in the treated and untreated sample, is close to 1 (0.96). Finally, the average difference in the propensity scores of the matched firms in our sample is 0.0002. Together, these results lend confidence that our matching procedure has grouped together non-MNE goods exporters with similar observable characteristics. The matched sample contains 5,200 multinational and 4,200 non-multinational exporters.

4.1.2 Matching MNE Goods-Only Exporters

We begin with the sample of all goods-exporting multinationals in 2007. Then we restrict our sample to only include mono-exporting MNEs that export the same set of 4-digit Harmonized System (HS4) goods and to the same set of destinations as bi-exporting MNEs. Then we estimate Equation (2) and obtain propensity scores for all multinational firms in this sample. We implement nearest neighbor matching without replacement. We assess how well the propensity score matching performs using the resulting balancing quality between the treated and control groups.

First, we check the difference in the means of the explanatory variables in the propensity score model between the treated and control firms in Panel B of Table 3. We find no statistically significant differences between the treated and control firms in terms of pre-crisis characteristics of labor productivity, number of exported products, or number of export destinations. The difference in means of the size measure (total value of goods exports) is only marginally significant with a p-value of 0.09. Second, the Rubin's B, the standardized difference in the linear index of the propensity score, is 8.7 and the Rubin's R, the ratio of the propensity score's variance in the treated and untreated sample, is 1.45. Finally, the average difference in the propensity scores of the matched firms in our sample is 0.023. Together, these results lend confidence that our matching procedure has grouped together firms with similar observable characteristics. The matched sample contains 900 bi-exporting MNEs and 900 mono-exporting MNEs.

4.2 The Multinational Advantage

Multinational firms may have higher export growth than non-multinational exporters because they tend to be larger and more productive than non-MNEs (Antrás and Yeaple, 2014). Therefore, we construct a comparable set of non-MNE goods exporter control group using propensity score matching as described in Section 4.1.1 and estimate the following

DDD model,

$$\Delta \ln Exports_{icq} = \beta_1 \Delta \ln GDP_{cy} \times MNE_{i,2007} \times Post + \beta_2 \Delta \ln GDP_{cy} \times MNE_{i,2007} + \alpha_{iq} + \alpha_{cq} + \alpha_{ir} + \varepsilon_{icq}. \quad (5)$$

This specification is identical to Equation 3 except that we replace $MNE^{SVC}_{ic,2007}$ with $MNE_{i,2007}$.[24] We examine growth in arm's-length exports. While MNEs have an additional margin of adjustment—sales to affiliated parties abroad—non-MNE exporters by definition do not engage in affiliated trade. However, this channel would have been very weak during the financial crisis, a global demand shock (Benguria and Taylor, 2020) that dampened demand in all markets, effectively muting this channel. In fact, between 2007 and 2009, U.S. exports with affiliated or related parties declined by 13%, while arm's-length trade declined by 9%.[25]

We present results using two post period indicators. Our main post period indicator is post-2008Q3 given our interest in tracing export growth. The Great Trade Collapse occurred between the third quarter of 2008 and the second quarter of 2009 (Baldwin, 2009). However, the official recession period in the U.S. is dated as beginning in the fourth quarter of 2007 and ending by the second quarter of 2009.[26] We also report results using a post-2007Q4 indicator.

The DDD coefficient of interest is β_1. We present results in Table 4. In column (1), we use a post-2008Q3 indicator and a post-2007Q4 indicator in column (2). Focusing on the first column, we find that MNE exporters facing a 1pp decline in GDP growth experienced 0.6pp higher goods-export growth than matched non-MNE exporters in the post-crisis relative to the pre-crisis period. The DDD coefficient increases slightly, 0.77pp, using a post-2007Q4 indicator as shown in the second column.

We decompose the timing of the MNE advantage in more detail by interacting quarter dummies with $\Delta GDP \times MNE_{i,2007}$, instead of a single $Post$ indicator. In column (3), we begin by interacting with 2008Q4 through 2009Q4 dummies and 2008Q1 through 2009Q4 dummies in column (4). MNEs' goods-export growth is higher in all quarters beginning in 2008Q1, but it is statistically significant in 2008Q4 and 2009Q1.[27] This is consistent with

[24] Inclusion of the fixed effects absorbs the individual coefficients on $MNE_{i,2007}$, $\Delta \ln GDP_{cy}$, $Post$, $\Delta \ln GDP_{cy} \times Post$, and $MNE_{i,2007} \times Post$. We include the term $\Delta \ln GDP_{cy} \times MNE_{i,2007}$ in all specifications but suppress it in the table display.

[25] Authors' calculations from publicly available data at `https://relatedparty.ftd.census.gov/`. Parties are related if either has, directly or indirectly, 10% ownership stake.

[26] See `https://www.nber.org/cycles.html`.

[27] Column (4) shows a statistically significant coefficient for 2008Q2.

the timing of the trade collapse.

4.3 Goods-Export Growth and Services Trade

Having established that MNEs experienced higher goods-export growth than non-MNEs, we now turn to exploring our main hypothesis that services exports by multinationals may have augmented the demand for their goods exports during the global financial crisis compared to non-multinationals. Using the universe of multinationals (identified using BE-11 and BE-12) in 2007 linked to LFTTD, we calculate that multinational firms accounted for 67% of total goods exports. Notably, MNEs that also exported services accounted for 47% of overall goods exports; while MNEs that only exported goods accounted for only 20% of overall exports.

4.3.1 Control Group: Non-Multinational Goods Exporters

We separate MNEs into those that only export goods from those that export both goods and services. The controls for both groups of MNEs are matched non-MNE goods exporters.[28]

In Table 5, column (1) includes multinationals that only export goods and column (2) includes multinationals that export both goods and services to a destination country. We find that the DDD coefficient is negative across both columns, however, it is statistically significant and orders of magnitude larger for bi-exporters. Under column (2), we find that a 1pp decline in GDP growth is associated with 1.4pp higher growth at MNE bi-exporters than matched non-MNE exporters. These results suggest a strong role for exports of services to the same destination markets in shaping the multinational goods-export growth advantage.

4.3.2 Control Group: Multinational Goods-Only Exporters

In this section and all subsequent analysis, we restrict our comparison of goods-export growth between bi-exporting MNEs to mono-exporting MNEs. The control group of goods-only exporting MNEs addresses two main identification concerns. First, MNEs may be inherently different from non-MNEs on time-varying, unobservable characteristics, such as management skills (Bloom et al., 2021). Second, multinational status of a firm may be an important determinant of trade in services as suggested by the overwhelming (over 90%) share of U.S. services exports mediated by multinationals.

[28]The bulk of services exports are mediated by MNEs, however, there are a small number of non-MNEs that also export services. We do not remove these non-MNE services exporters from the control group. This should effectively downward bias the DDD coefficient.

In Table 6, column (1) we find that bi-exporting MNEs exposed to a 1pp decline in GDP growth experienced a 1.1pp higher goods-export growth than matched mono-exporting MNEs in the post-crisis period compared to the same difference in the pre-crisis period. Using the average decline, -5.5pp, in GDP growth among the top 15 U.S. export partners between 2007 and 2009 (calculated as the average difference in growth rates between columns (3) and (1) in Table 1), our results imply that bi-exporting MNEs exposed to decline in foreign demand in these countries experienced over a 6pp higher goods-export growth than matched mono-exporting MNEs. We decompose the timing in more detail by interacting quarter dummies with $\Delta GDP \times MNE^{SVC}_{ic,2007}$ in column (2). Goods-export growth is higher at MNEs in all quarters beginning in 2008Q4, but it is statistically significant in 2009Q2 and 2009Q3.

5 Identification Checks

We perform two checks of our identification strategy and present the results in Table 7. First, we construct an alternate control group using the same set of treated multinational firms but with goods export transactions to countries where it does not also export services. Second, we use measures of services trade restrictiveness in destination countries to confirm the role of services exports in boosting the demand for goods. The underlying idea is that if services exports are indeed shaping the demand for goods, bi-exporting MNEs' goods-export growth should be higher in destinations where there are lower barriers to services trade.

5.1 Alternate Control Group

We focus attention on an alternate control group where we match each multinational that exports services to a destination c with itself but where it only exports goods to a different destination, not c, in a given quarter. This control group has an important advantage: it implicitly controls for any unobservable, particularly in our context, firm-specific factors that determine services exporting status.

We present results using this alternative control group in column (1) of Table 7. We find that the DDD coefficient remains negative and statistically significant. It is also similar in magnitude to the result using the baseline control group of mono-exporting MNEs as shown in column (1) of Table 6.

5.2 Services Trade Barriers

We further probe the services export channel in driving the higher MNE goods-export growth by comparing goods-export growth to destinations with low and high services trade barri-

ers. We use the World Bank's Services Trade Restrictiveness Index (STRI) to measure the restrictions at a destination that firms may face when exporting services. We hypothesize that if services exports is the primary mechanism boosting goods-export growth, then we would expect higher (lower) goods-export growth at destinations with low (high) barriers to services trade.

We interact the DDD coefficient of interest (and all other terms) in Equation 3 with an indicator for whether a destination country c has a low STRI score. We use four different measures of STRI as described in Section 3.4.2. First, we focus on barriers to mode 1 trade across all industries; second, on barriers to mode 4 trade across all industries; third, on barriers to all modes of trade in the professional services industry; and finally, on barriers to all modes of trade across all industries. We present the results in columns (2)–(5), respectively, in Table 7.

Our interest is in the quadruple interaction term which compares goods-export growth at bi- and mono-exporters in response to changes in GDP growth in countries with low services trade barriers than in countries with high services trade barriers, before and after the financial crisis. This coefficient is negative across all four columns but statistically significant for restrictiveness indicators based on mode 1 across all industries (column 2) and all modes in the professional services industry (column 4).

6 Extensions

We have, thus far, established that multinational goods exporters that also exported services to the same destinations experienced higher goods-export growth than multinationals that only exported goods during the 2008-2009 financial crisis. In this section, we extend our results on three dimensions. First, we explore if goods-export growth varies by the types of business services and intellectual property exports. In addition, we explore whether services exported to unaffiliated or affiliated parties played a differential role. Second, we examine the growth in services sales at foreign affiliates of U.S. parents during the crisis period. Finally, we examine the MNEs' U.S. employment growth during the same period.

6.1 Types of Services Exports

Different types of services products may exert differential impacts on goods-export growth. Ariu et al. (2020) formalize the idea that certain goods may be more "bundleable" with services than others. Using data on Belgian firms, they find that transportation, chemical, and machinery and electrical industries are highly "bundleable"; and financial, computer and

business services are often associated with goods. Case studies offer firm and product-specific examples. For instance, General Electric not only sells military-use jet engines but also provides digital and data analytics, such as Predix platform services (Lakhani, Iansiti and Herman, 2015) to "creat[e] efficiencies for its customers that go beyond the physical engine".[29] In the absence of objective measures of "bundleability" of detailed HS codes with detailed services trade categories to establish precise predictions on the relationship between different services trade products and goods-export growth, we consider it an empirical question.

We begin by exploring the production activities of MNEs in our sample in 2007.[30] We measure the share of employment by broad sectors of bi- and mono-exporting MNEs in columns (1) and (2), respectively, of Table 8. We find that about a third of employment is in the wholesale, retail, and transportation sectors for both bi- and mono-exporting MNEs. However, they differ sharply in employment shares in the manufacturing and services sectors. Bi-exporting firms have a smaller share of employment in manufacturing (16% versus 33%) while they tend to have higher shares of employment in a variety of broad services sectors. In particular, the share of employment is much higher in information (12% versus 1%), professional and FIRE (8% versus 4%), and other services (11% versus 4%).

Although bi-exporting MNEs have a lower share of employment in the manufacturing sector than mono-exporting MNEs, we find that bi-exporting MNEs have a higher share of its manufacturing employment in sectors that produce advanced technology products (ATP). We map a set of four-digit manufacturing NAICS into ten different ATP classifications following Goldschlag and Miranda (2020).[31] As shown in the last row of Table 9, 56% of bi-exporting MNEs' employment in the manufacturing sector is in ATP and this share for mono-exporting MNEs is only 36%. Looking within ATP categories, we find that bi-exporting MNEs have higher shares of employment in all categories except "flexible manufacturing" and "weapons". Bi-exporting MNEs have much higher shares of employment in "aerospace" (5% versus 1.3%), "information and communications" (11% versus 6%), "life sciences" (11% versus 7%), and "optoelectronics" (7.28% versus 3.82%).

The industrial distribution of employment at bi- and mono-exporting MNEs show that bi-exporters are more likely to have activity in the services than manufacturing sector. However, manufacturing activity at bi-exporting MNEs tends to be more concentrated in the

[29]Accessed on October 6, 2021 at `https://www.geaviation.com/military/services/digital-services-data-analytics`.

[30]See Jensen (2011) for industrial activities of all U.S. services importers and exporters; and a comprehensive view of services trade and traders in the U.S. economy.

[31]The U.S. Census Bureau defines ATP classifications based on 10-digit HS goods. See `https://www.census.gov/foreign-trade/reference/codes/atp/index.html`.

production of advanced technology products that are more R&D intensive.

We now explore the role of different types of services products, as defined in Section 3.2.2, in shaping goods-export growth in a regression framework. We begin by providing summary statistics. For the average firm in the sample, 35% of their total services exports is in *Business IP*; 1% in *Media IP*; 50% in business services; 10% in telecommunications; and almost 4% accounted for by other services. These means and associated standard deviations are reported in Table A-1. In column (1) of Table 10, we decompose the DDD coefficient in Equation 3 by the type of service being exported. We find that the DDD coefficient is strongest for exports of services related to *Business IP* that measures rights related to industrial processes, trademarks, franchise fees, and other intellectual property and intangibles.

In the next four columns, we decompose services exporters by their mode of sales: sales to unaffiliated or affiliated parties abroad. Columns (2) and (4) show that bi-exporters that sold services to unaffiliated and affiliated buyers, respectively, experienced higher goods-export growth; however, the result is statistically significant for unaffiliated services exports.[32] These results suggest that bi-exporters may be selling services directly to goods buyers in the destination markets. While we do not observe information about the individual goods or services buyer in the data, our analysis focuses on MNEs' services exports to the same destination market as their goods exports. Column (3) reinforces the results in columns (1) and (2): exports of *Business IP* to unaffiliated parties is associated most strongly with the higher bi-exporter goods-export growth.

These results suggest that goods intensive in the usage of R&D may be more likely to be bundled with rights related to various types of business IP (industrial patents, trademarks, computer software, etc.).

6.2 Impacts on Foreign Affiliates' Services Sales

The evidence thus far suggests that the higher bi-exporter goods-export growth is associated with exporting services directly to the goods buyers in the destination markets. Multinationals can also rely on their foreign affiliates in a destination market to provide services to their goods buyers (mode 3, commercial presence, of supplying services). We do not have information on the individual buyers of MNEs' foreign affiliates, however, we can distinguish foreign affiliates' services sales to local or other non-US destinations.[33] We explore whether

[32]The affiliated and unaffiliated bi-exporting exporters are not mutually exclusive categories. Bi-exporters may be selling services through both modes.

[33]The local market refers to the country where the foreign affiliate is located.

foreign affiliates' services sales growth differed at bi-exporting than mono-exporting U.S. parents in response to the financial crisis. We effectively restrict our analysis sample to U.S. parents only that have foreign affiliates in the destinations where it exports goods. We estimate the following specification:

$$\begin{aligned}\Delta_{DHS} SvcSales_{icy} = &\beta_1 \Delta \ln GDP_{cy} \times MNE^{SVC}_{ic,2007} \times Post \\ &+ \beta_2 \Delta \ln GDP_{cy} \times MNE^{SVC}_{ic,2007} + \beta_3 MNE^{SVC}_{ic,2007} \times Post \\ &+ \beta_4 MNE^{SVC}_{ic,2007} + \alpha_{iy} + \alpha_{cy} + \varepsilon_{icy}, \end{aligned} \tag{6}$$

where the post period indicator, *Post*, is post-2008Q3. Δ_{DHS} denotes a growth rate measure introduced by Davis, Haltiwanger and Schuh (1998), henceforth, DHS growth rate and defined as:

$$\Delta_{DHS} X_t \equiv \frac{X_t - X_{t-1}}{0.5(X_t + X_{t-1})}.$$

Unlike using changes in logarithms, as we have used for measuring goods-export growth, the DHS growth rate enables decomposing the total change as follows:

$$\Delta_{DHS} X_t = \sum_{j \in J} \Delta_{DHS} X^j_t.$$

We decompose the growth in foreign affiliates' services sales into those destined for local and all other non-U.S. markets.[34] We do this separately for sales to unaffiliated parties and overall services sales. Applying the decomposition to the outcome variable defined in Equation 6 allows us to decompose the coefficient β_1 into $\sum_{j \in J} \beta^j_1$.

We present the results in Table 11 displaying the DDD coefficient captured by β_1 in Equation 6.[35]. The first three columns focus on sales to unaffiliated parties. If MNEs rely

[34]Specifically,

$$\Delta_{DHS} X^j_t \equiv \frac{X^j_t - X^j_{t-1}}{0.5(X_t + X_{t-1})} \qquad \text{and} \qquad \sum_{j \in J} X^j_t = X_t.$$

Note that we do not report results for sales to the U.S. market. However, this can be inferred by subtracting the coefficient on the total measure from the coefficients on the local and other measures.

[35]All terms in Equation 6 are included in the regressions but suppressed for display purposes.

on their foreign affiliates to facilitates services sales for buyers of their goods exports, then we would expect to find an impact on foreign affiliates' sales to unaffiliated parties rather than sales to the parent MNE or its other foreign subsidiaries. Across all three columns, the DDD coefficient is negative and statistically significant. Column (1) shows that a 1pp decline in GDP growth is associated with a 5.6pp higher growth in foreign affiliates' services sales at bi-exporting than mono-exporting MNEs. The decomposition in columns (2) and (3) indicate that 90% (i.e., $\frac{4.995}{5.568} \times 100$) of this growth is driven by growth in sales to local markets.

The last three columns focus on overall services sales. This measure includes both affiliated and unaffiliated services sales. We find in column (4) that growth in overall services sales by foreign affiliates was higher at bi- than mono-exporting MNEs during the financial crisis. The decomposition in columns (5) and (6) indicate that over 90% (i.e., $\frac{5.659}{6.245} \times 100$) of this growth is driven by growth in sales to local markets.

Overall, these results suggest that bi-exporting MNEs experienced higher foreign affiliate services sale growth consistent with the idea that foreign affiliate services sales are complementary to bi-exporters' services exports in a given destination market.

6.3 Impacts on U.S. Employment

We find that bi-exporting MNEs had higher goods-export growth than mono-exporting MNEs during the financial crisis. We now explore whether bi-exporting MNEs experienced differential growth in their U.S. employment motivated by evidence of within-firm reorganization of domestic employment during the financial crisis (e.g. Siemer (2019)). We examine a firms' quarterly employment growth by estimating the following specification:[36]

$$\begin{aligned}\Delta_{DHS} Emp_{iq} = &\sum_{\tau=8}^{12} \beta_{1,\tau} Exposure_{iy} \times MNE_{i,2007}^{SVC} \times Post_{\tau} \\ &+ \beta_2 Exposure_{iy} \times MNE_{i,2007}^{SVC} + \beta_3 MNE_{i,2007}^{SVC} \times Post \\ &+ \beta_4 Exposure_{iy} \times Post + \beta_5 Exposure_{iy} + \alpha_i + \alpha_q + \varepsilon_{iq} \end{aligned} \tag{7}$$

where $Post_{\tau}$ is equal to 1 if quarter $q = \tau$ and 0 otherwise. Quarters are indexed beginning in the first quarter of our sample period, 2007Q1. Therefore, $q = 8$ denotes 2008Q4 and $q = 12$ denotes 2009Q4. The post period indicator, $Post$, is post-2008Q3.

[36] We measure the annual rate of employment growth at a quarterly frequency similar to our measure of goods-export growth as defined in Equation 5.

We construct a measure of a firm's exposure to the financial crisis as follows:

$$Exposure_{iy} = \sum_{c \in C_i} \left\{ (\Delta \ln GDP_{cy} - \Delta \ln GDP_{c,y-1}) \frac{1}{3} \sum_{y=2005}^{2007} \frac{Exports_{icy}}{Exports_{iy}} \right\},$$

where C_i is the set of countries to which firm i exported goods in 2007. Thus, for each year in our sample we take country c's change in annual GDP growth and weight it by firm i's average share of goods exports to country c over the pre-crisis period 2005–2007. We then define a firm's exposure to the crisis as the sum of this value across all export destinations. This can be interpreted as a weighted average of the changes in GDP growth of the countries to which a firm exports goods. One unit of this exposure measure multiplied by 100 is roughly an average percentage-point change in annual GDP growth. In Table A-1 we report that the average firm in our sample faced a -1.9pp GDP growth across its set of export destination countries.

Our measure of a firm's "exposure" to the financial crisis is an aggregation of its trading partners' *changes* in GDP growth rather than their GDP growth in a given year, thus capturing a country's GDP growth trajectory. We illustrate the intuition with an example. Suppose Country A experienced a decline in GDP growth rate from 10% to 5% and Country B experienced a smaller decline in GDP growth of 2% to 1%, before and after the financial crisis. Our exposure measure will capture that a firm who exports to Country A will be more "exposed" to the financial crisis than a firm who exports to Country B because of the larger adverse effect of the financial crisis on Country A's GDP growth. In contrast, using levels of the countries' GDP growth rates would have counted firms exporting to Country B as being more exposed than those exporting to Country A (despite Country A's GDP growth declining more than Country B's).

We present the results in Table 12 displaying the DDD coefficient captured by β_1 in Equation 7.[37] We use a quarterly indicator for the post-period to trace the timing of the impact. The first two columns present results for overall employment growth as the outcome. We measure the growth rate as changes in logarithmic values in column (1) and DHS growth rates in column (2). We find that results are very similar using either growth rate measure. The results indicate that bi-exporting MNEs experienced higher (approximately 3pp) employment growth than mono-exporting MNEs in the quarters during the crisis compared to the same difference in the pre-crisis quarters in response to a 1pp decline in GDP growth.

[37] All terms in Equation 7 are included in the regressions but suppressed for display purposes.

Since the DHS growth rates enable decomposition of the overall growth rate, as discussed in Section 6.2, we use this measure in the remaining columns.

We decompose employment growth into growth in manufacturing, services, and all other sectors in which the firm operates.[38] Looking at columns (3), (4), and (5) we can see that the higher employment growth at bi-exporting MNEs is driven by growth in the services and other sectors. Notably, there is no difference with mono-exporters in employment growth in the manufacturing sector.

We further decompose growth in services employment into growth in professional services (NAICS 54) and information (NAICS 51) and all other services sectors in columns 6 and 7, respectively.[39] We find that the positive services employment growth differential between bi- and mono-exporting MNEs is driven by growth in employment in the professional and technical services and information sectors.

7 Concluding Remarks

World trade experienced a precipitous, sudden, and synchronized decline between the fourth quarter of 2008 and the second quarter of 2009—a period described as the Great Trade Collapse. The decline was the sharpest and deepest three quarter decline in past forty years since the second World War (Baldwin, 2009). While the decline in global trade during the 1930s Great Depression was larger, the decline during the Great Trade Collapse was steeper. Also, past trade contractions were not as synchronized across countries (Bems, Johnson and Yi, 2012). The overall decline in U.S. merchandise exports, between 2007 and 2009, by multinational exporters was orders of magnitudes lower than non-multinational exporters.

In this paper, we use newly available links between the universe of U.S. employer firms and comprehensive surveys on U.S. multinational and services trading firms to better understand this aggregate pattern. We begin our analysis by comparing the goods-export growth, between 2007 and 2009, of MNEs to observationally equivalent non-MNEs constructed using propensity score matching. In a triple-difference framework, we find that a 1pp decline in GDP growth is associated with a 0.6pp higher growth in goods-exports at MNEs than non-MNEs during the financial crisis. Notably, we find that while the export growth of MNEs that only export goods is not statistically different from non-MNEs; MNEs that also export

[38] Manufacturing is defined as the two-digit sector NAICS 31–33. We define "services" sectors as NAICS 51, 52, 53, 54, 55, 56, 61, 62, 71, 72, and 81. "Other" sectors are NAICS 11, 21, 22, 23, 42, 44–45, and 48–49.

[39] Sectors 51 (Information) and 54 (Professional and Technical Services) correspond most closely to the set of services products collected on the BE-120/125.

services to the same destination experience 1.4pp higher goods-export growth than matched non-MNE exporters.

We proceed to explore our main hypothesis: services exports to the same destination boosted the demand for goods during the 2008–2009 global financial crisis. We use a more restrictive control group consisting only of multinational firms. We focus the comparison between MNEs that also export services to the same destination where it sell goods and MNEs that only export goods. We find that bi-exporting MNEs experienced 1.1pp higher goods-export growth than mono-exporting MNEs in response to a 1pp decline in GDP growth during the crisis. The sale of rights to business-related intellectual property (patents, trademarks, computer software, etc.) to unaffiliated parties is mainly driving this relationship. These results are consistent with services exports increasing the demand for goods.

Our results have two important implications. First, firm-level responses to the Great Trade Collapse can be potentially informative about trade responses to the COVID-19 pandemic which has been called the "Greater Trade Collapse" (Baldwin and Evenett, 2020). Although the trade collapse due to the pandemic is driven by simultaneous demand and supply shocks, the suddenness, severity, and synchronicity bear close resemblance to the 2008–2009 shock. Thus, our results suggest that firms that export both goods and services may fare better during the pandemic in the absence of contemporaneous firm-level data.[40]

Second, export promotion programs (EPA) are traditionally focused on promoting goods exports and have been found to be especially effective when exporters face high trade barriers abroad (Lederman, Olarreaga and Payton, 2010). While services trade between high-income countries do not face many barriers, they can be especially high in fast-growing Asian countries like China, India, Indonesia, Malaysia, Philippines, and Thailand, as well as in the Middle East (Borchert, Gootiiz and Mattoo, 2014). Our results suggest that expanding the scope of EPAs to integrate programs promoting services trade would potentially expand the markets for both goods and services exporters.

[40]The LFTTD is available with a processing lag of two years. Schott (2009) offers an example of relying on insights from the 1997 Asian Financial Crisis to infer trade responses during the Great Trade Collapse.

References

Alfaro, Laura and Maggie Xiaoyang Chen, "Surviving the Global Financial Crisis: Foreign Ownership and Establishment Performance," *American Economic Journal: Economic Policy*, 2012, *4* (3), 30–55.

Alviarez, Vanessa, Javier Cravino, and Andrei A. Levchenko, "The Growth of Multinational Firms in the Great Recession," *Journal of Monetary Economics*, 2017, *85*, 50–64.

Antrás, Pol and Stephen R. Yeaple, "Multinational Firms and the Structure of International Trade," in Gita Gopinath, Elhanan Helpman, and Kenneth Rogoff, eds., *Handbook of International Economics*, Vol. 4, Oxford, UK: North-Holland, 2014, chapter 2, pp. 55–130.

Ariu, Andrea, "Crisis-proof Services: Why Trade in Services Did Not Suffer During the 2008-2009 Collapse," *Journal of International Economics*, 2016, *98*, 138–149.

_ **, Florian Mayneris, and Mathieu Parenti**, "One Way to the Top: How Services Boost the Demand for Goods," *Journal of International Economics*, 2020, *123*, 103278.

_ **, Holger Breinlich, Gregory Corcos, and Gordano Mion**, "The Interconnections between Services and Goods Trade at the Firm-Level," *Journal of International Economics*, 2019, *116*, 173–188.

Baldwin, Richard, *The Great Trade Collapse: Causes, Consequences and Prospects*, VoxEU Ebook No. 27, Center for Economic Policy Research, 2009.

_ **and Simon Evenett**, *COVID19 and Trade Policy: Why Turning Inward Won't Work*, VoxEU Ebook, Center for Economic Policy Research, 2020.

Bems, Rudolfs, Robert C. Johnson, and Kei-Mu Yi, "The Great Trade Collapse," 2012. NBER Working Paper 18632.

Benguria, Felipe and Alan M. Taylor, "After the Panic: Are Financial Crises Demand or Supply Shocks? Evidence from International Trade," *American Economic Review: Insights*, 2020, *4* (2), 509–526.

Berlingieri, Giuseppe, Luca Marcolin, and Emanuel Ornelas, "Service Offshoring and Export Experience," 2021. CEPR Working Paper 1775.

Bloom, Nicholas, Steven J. Davis, Lucia Foster, Brian Lucking, Scott Ohlmacher, and Itay Saporta-Eksten, "Business-Level Expectations and Uncertainty," 2021. NBER Working Paper 28259.

Borchert, Ingo and Aaditya Mattoo, "Services Trade - The Collapse that Wasn't," in Richard Baldwin, ed., *The Great Trade Collapse: Causes, Consequences and Prospects*, London, UK: VoxEU Ebook No. 27, Center for Economic Policy Research, 2009, chapter 17, pp. 151–158.

_ , **Batshur Gootiiz, and Aaditya Mattoo**, "Guide to the Services Trade Restrictions Database," 2012. mimeo.

_ , _ , **and** _ , "Policy Barriers to International Trade in Services: Evidence from a New Database," *World Bank Policy Review*, 2014, *28* (1), 162–188.

Breinlich, Holger, Anson Soderbery, and Greg C. Wright, "From Selling Goods to Selling Services: Firm Responses to Trade Liberalization," *American Economic Journal: Economic Policy*, 2018, *10* (4), 79–108.

Bruner, Jennifer and Alexis N. Grimm, "A Profile of U.S. Exporters and Importers of Services, 2017," *Survey of Current Business*, 2019, *99* (12), 138–149.

Chow, Melissa, Teresa C. Fort, Christopher Goetz, Nathan Goldschlag, James Lawrence, Elisabeth Ruth Perlman, Marth Stinson, and T. Kirk White, "Redesigning the Longitudinal Business Database," 2021. U.S. Census Bureau Center for Economic Studies Working Paper 21-08.

Crozet, Matthieu and Emmanuel Milet, "Should Everybody be in Services? The Effect of Servitization on Manufacturing Firm Performance," *Journal of Economics and Management Strategy*, 2017, *26* (4), 820–841.

Davis, Steven, John Haltiwanger, and Scott Schuh, *Job Creation and Destruction*, MIT: The MIT Press, 1998.

Dharmapala, Dhammika and James R. Hines, "Which Countries become Tax Havens?," *Journal of Public Economics*, 2009, *93*, 1058–1068.

Dyreng, Scott and Michelle Hanlon, "Tax Avoidance and Multinational Firm Behavior," in C. Fritz Foley, James R. Hines, and David Wessel, eds., *Global Goliaths: Multinational Corporations in the 21st Century Economy*, Washington, DC: Brookings Institution Press, 2021, chapter 10, pp. 361–435.

Foley, C. Fritz, James R. Hines, Raymond J. Mataloni Jr., and David Wessel, "Multinational Activity in the Modern World," in C. Fritz Foley, James R. Hines, and David Wessel, eds., *Global Goliaths: Multinational Corporations in the 21st Century Economy*, Washington, DC: Brookings Institution Press, 2021, chapter 1, pp. 1–32.

Fort, Teresa C., Justin Pierce, and Peter K. Schott, "New Perspectives on the Decline of US Manufacturing Employment," *Journal of Economic Perspectives*, 2018, *32* (2), 47–72.

Francois, Joseph and Bernard Hoekman, "Services Trade and Policy," *Journal of Economic Literature*, 2010, *48*, 642–692.

Goldschlag, Nathan and Javier Miranda, "Business Dynamics Statistics of High Tech Industries," *Journal of Economics and Management Strategy*, 2020, *29* (1), 3–30.

Grover, Arti and Aaditya Mattoo, "Why Do Manufacturing Firms Sell Services? Evidence from India," 2021. World Bank Policy Research Working Paper 9701.

Jenniges, Derrick, Raymond Mataloni, Sarah Stutzman, and Yiran Xin, "Strategic Movement of Intellectual Property within U.S. Multinational Enterprises," in Nadim Ahmad, Brent Moulton, J. David Richardson, and Peter Van De Ven, eds., *The Challenges of Globalization in the Measurement of National Accounts*, Chicago, IL: University of Chicago Press, 2018.

Jensen, J. Bradford, *Global Trade in Services: Fear, Facts, and Offshoring*, Washington, DC: Peterson Institute for International Economics, 2011.

Kamal, Fariha and Wei Ouyang, "Identifying U.S. Merchandise Traders: Integrating Customs Transactions with Business Administrative Data," 2020. U.S. Census Bureau Center for Economic Studies Working Paper 20-28.

_ **, Jessica McCloskey, and Wei Ouyang**, "Multinational Firms in the U.S. Economy: Insights from Newly Integrated Microdata," 2020. mimeo.

Lakhani, Karim R., Marco Iansiti, and Kerry Herman, "GE and the Industrial Internet," *Harvard Business School Case Study 614032*, 2015, pp. 1–42.

Lederman, Daniel, Marcelo Olarreaga, and Lucy Payton, "Export Promotion Agencies: Do They Work?," *Journal of Development Economics*, 2010, *91* (2), 257–265.

Mann, Michael, "Measuring Trade in Services by Mode of Supply," 2019. Bureau of Economic Analysis Working Paper 2019-7.

Rubin, Donald B., "Using Propensity Scores to Help Design Observational Studies: Application to the Tobacco Litigation," *Health Services and Outcomes Research Methodology*, 2001, *3* (2), 169–188.

Schott, Peter K., "US Trade Margins During the 2008 Crisis," in Richard Baldwin, ed., *The Great Trade Collapse: Causes, Consequences and Prospects*, London, UK: VoxEU Ebook No. 27, Center for Economic Policy Research, 2009, chapter 15, pp. 127–142.

Siemer, Michael, "Employment Effects of Financial Constraints during the Great Recession," *Review of Economics and Statistics*, 2019, *101* (1), 16–29.

U.S. Bureau of Economic Analysis, "A Guide to BEA's Direct Investment Surveys," `https://www.bea.gov/sites/default/files/2018-04/a-guide-to-bea-direct-investment-surveys.pdf` 2018. (accessed November 23, 2020).

_ , "Table 2.1. U.S. Trade in Services, by Type of Service," `https://apps.bea.gov/iTable/iTable.cfm?reqid=62&step=9&isuri=1&6210=4` 2020. (accessed December 2, 2020).

Table 1. GDP Growth (%), Top 15 Trading Partners

Country	2006-2007	2007-2008	2008-2009
Canada	2.05	1.00	-2.97
Mexico	2.27	1.14	-5.43
China	13.31	9.21	8.98
Japan	1.64	-1.10	-5.57
United Kingdom	2.40	-0.28	-4.34
Germany	2.93	0.96	-5.86
South Korea	5.64	2.97	0.79
France	2.40	0.25	-2.92
Taiwan	6.31	0.70	-1.58
Belgium	3.61	0.45	-2.04
Brazil	5.89	4.97	-0.13
Australia	3.77	3.59	1.92
India	7.38	3.04	7.57
Italy	1.48	-0.97	-5.43
Israel	5.61	2.95	0.92

Notes: This table displays the annual GDP growth for the top 15 export partners of the U.S., excluding tax havens. The countries are ranked by U.S. export value in 2007. These countries accounted for 70% of total U.S. exports in 2007.
Source: Authors' calculations using country-level GDP from the World Bank (except for Taiwan, which was obtained from the Federal Reserve Economic Database).

Table 2. Propensity Score Model

	$MNE_{i,2007}$	$MNE^{SVC}_{i,2007}$
Log Sales per Worker	0.414***	-0.044*
	(0.015)	(0.026)
Log Number of HS4 Products	0.138***	0.246***
	(0.019)	(0.032)
Log Number of Countries	0.115***	-0.014
	(0.017)	(0.029)
Log Exports	-0.008	0.093***
	(0.009)	(0.016)
Observations[a]	9,800	5,200

Notes: * p<10%; ** p<5%; *** p<1%. Robust standard errors in parentheses. Column (1) displays results from estimating Equation (1) using a probit model on the sample of goods exporters in 2007. The dependent variable is a firm's multinational status in 2007, $MNE_{i,2007}$. Column (2) displays results from estimating Equation (2) using a probit model on the sample of MNE goods exporters in 2007. The dependent variable is an MNE's services exporting status in 2007, $MNE^{SVC}_{i,2007}$. All explanatory variables are measured as of 2007. Column (2) additionally includes an indicator variable, $Parent_i$, but we do not report the coefficient.

[a] Observation counts rounded to comply with Census Bureau disclosure avoidance rules.

Source: Authors' calculations using 2007 LFTTD, LBD, BE-11, BE-12, BE-120.

Table 3. Balance Tests

Panel A: Matching to non-MNE Goods Exporters			
	Mean		t-tests
	$MNE_{i,2007}$	$non\text{-}MNE_{i,2007}$	$p\text{-}value$
Log Sales per Worker	6.047	6.048	0.948
Log Number of HS4 Products	2.642	2.620	0.366
Log Number Countries	2.215	2.228	0.614
Log Exports	15.50	15.40	0.050
Firm Count	5,200	4,200	
Panel B: Matching to MNE Goods Only Exporters			
	Mean		t-tests
	$MNE_{i,2007}^{SVC}$	$MNE_{i,2007}^{non\text{-}SVC}$	$p\text{-}value$
Log Sales per Worker	6.040	6.005	0.404
Log Number of HS4 Products	3.524	3.469	0.319
Log Number Countries	2.993	2.938	0.329
Log Exports	17.22	17.02	0.085
Firm Count	900	900	

Notes: This table displays the means and p-values associated with t-statistics of differences in the means across columns of the variables shown in Panels A and B that are used in the propensity score models defined in Equations (1) and (2), respectively. Panel A displays balance tests where the treatment group is multinational goods exporters and the control group is non-multinational goods exporters. Panel B displays balance tests where the treatment group is multinationals that export both goods and services and the control group is multinationals that only export goods.
Source: Authors' calculations using 2007 LFTTD, LBD, BE-11, BE-12, BE-120.

Table 4. Multinational Goods-Export Growth
Control Group: Non-Multinational Goods Exporters

	(1)	(2)	(3)	(4)
$\Delta GDP \times MNE_{i,2007} \times I(> 2008Q3)$	-0.587*			
	(0.343)			
$\Delta GDP \times MNE_{i,2007} \times I(> 2007Q4)$			-0.771**	
			(0.319)	
$\Delta GDP \times MNE_{i,2007}$ ×Quarterly Indicator				
×2008$Q1$				-0.279
				(0.569)
×2008$Q2$				-1.250*
				(0.743)
×2008$Q3$				-0.413
				(0.640)
×2008$Q4$		-1.104*		-1.336**
		(0.562)		(0.608)
×2009$Q1$		-0.848**		-1.078***
		(0.351)		(0.362)
×2009$Q2$		-0.320		-0.552
		(0.476)		(0.468)
×2009$Q3$		-0.578		-0.807
		(0.547)		(0.503)
×2009$Q4$		-0.317		-0.546
		(0.462)		(0.483)
Fixed Effects	firm-quarter, country-quarter, firm-region			
Observations[a]	645,000	645,000	645,000	645,000

Notes: * p<10%; ** p<5%; *** p<1%. Robust standard errors in parentheses clustered at the country level. This table displays results from estimating Equation (5). The dependent variable is a firm's arm's-length goods-export growth at the country-quarter level.
[a] Observation counts rounded to comply with Census Bureau disclosure avoidance rules.
Source: Authors' calculations using 2006-2009 LFTTD.

Table 5. Multinational Goods-Export Growth: Role of Services Trade
Control Group: Non-Multinational Goods Exporters

	Multinationals that export:	
	Goods Only	Goods and Services
$\Delta GDP \times MNE_{i,2007} \times I(> 2008Q3)$	-0.403	-1.430***
	(0.375)	(0.506)
Fixed Effects	firm-quarter, country-quarter, firm-region	
Observations[a]	586,000	175,000

Notes: * p<10%; ** p<5%; *** p<1%. Robust standard errors in parentheses clustered at the country level. This table displays results from estimating Equation (5). The dependent variable is a firm's arm's length goods-export growth at the country-quarter level.
[a] Observation counts rounded to comply with Census Bureau disclosure avoidance rules.
Source: Authors' calculations using 2006-2009 LFTTD.

Table 6. Multinational Goods-Export Growth
Control Group: Multinational Goods-Only Exporters

	(1)	(2)
$\Delta GDP \times MNE^{SVC}_{ic,2007} \times I(> 2008Q3)$	-1.097*	
	(0.575)	
$\Delta GDP \times MNE^{SVC}_{ic,2007}$ ×Quarterly Indicator		
×2008$Q4$		-1.144
		(1.038)
×2009$Q1$		-0.188
		(0.820)
×2009$Q2$		-2.031***
		(0.773)
×2009$Q3$		-1.643**
		(0.777)
×2009$Q4$		-0.499
		(0.715)
Fixed Effects	firm-quarter, country-quarter, firm-region	
Observations[a]	185,000	185,000

Notes: * p<10%; ** p<5%; *** p<1%. Robust standard errors in parentheses clustered at the country level. This table displays results from estimating Equation (3). The dependent variable is a firm's arm's-length goods-export growth at the country-quarter level.
[a] Observation counts rounded to comply with Census Bureau disclosure avoidance rules.
Source: Authors' calculations using 2006-2009 LFTTD.

Table 7. Multinational Goods-Export Growth, Identification Checks

	Multinational Control Group				
	—Treated in alternate c—		—Goods-Only—		
$\Delta GDP \times MNE^{SVC}_{ic,2007} \times I(> 2008Q3)$	-1.247**	-0.290	-0.953	-0.666	-0.533
	(0.625)	(0.470)	(0.702)	(0.645)	(0.589)
$\Delta GDP \times MNE^{SVC}_{ic,2007} \times I(> 2008Q3)$ ×Services Trade Restrictiveness Indicator					
Mode 1, All Industries		-3.162***			
		(1.041)			
Mode 4, All Industries			-0.227		
			(1.145)		
All Modes, Professional Services				-2.982**	
				(1.182)	
All Modes, All Industries					-1.386
					(1.134)
Fixed Effects	firm-quarter, country-quarter, firm-region				
Observations[a]	156,000	164,000	164,000	164,000	164,000

Notes: * p<10%; ** p<5%; *** p<1%. Robust standard errors in parentheses clustered at the country level. This table displays results from estimating Equation (3) interacted with indicators of whether a country has low barriers to services trade. See Section 3.4.2 for a description of the restrictiveness indicators. The dependent variable is a firm's arm's-length goods-export growth at the country-quarter level.
[a] Observation counts rounded to comply with Census Bureau disclosure avoidance rules.
Source: Authors' calculations using 2006-2009 LFTTD.

Table 8. Multinational Employment Share (%) by Broad Sectors, 2007

Broad Sectors	Multinationals that export: Goods and Services	Goods Only
Ag., Mining, Utilities, Construction	1.58	3.00
Manufacturing	16.64	33.19
Wholesale, Retail, Transportation	32.35	34.02
Information	11.88	1.30
Finance, Insurance, Real Estate	7.78	4.24
Professional, Scientific, Technical Services	7.94	3.85
Management & Administrative	10.98	16.13
Other Services	10.85	4.26

Notes: This table displays employment in eight broad sector classifications as a share of total employment at multinationals that export both goods and services (column 1) and multinationals that only export goods (column 2). "Ag., Mining, Utilities, Construction" groups NAICS 11, 21, 22, and 23; "Manufacturing" groups NAICS 31-33; "Wholesale, Retail, Transportation" groups NAICS 42, 44-45, and 48-49; "Information" is NAICS 51; "Finance, Insurance, Real Estate" groups NAICS 52 and 53; "Professional, Scientific, Technical Services" is NAICS 54; "Management & Administrative" groups NAICS 55 and 56; "Other Services" groups NAICS 61, 62, 71, 72, and 81.
Source: Authors' calculations using 2007 LBD.

Table 9. Multinational Employment Share (%) by Advanced Technology Products, 2007

Advanced Technology Product	Multinationals that export: Goods and Services	Goods Only
Advanced Materials	6.54	4.85
Aerospace	4.87	1.28
Biotechnology	4.28	3.45
Electronics	5.02	3.34
Flexible Manufacturing	1.03	2.17
Information & Communications	10.82	5.62
Life Sciences	10.97	6.68
Nuclear	3.42	2.42
Optoelectronics	7.28	3.82
Weapons	1.99	2.13
Total ATP share in Manufacturing	56.22	35.76

Notes: This table displays employment in ten advanced technology product (ATP) categories as a share of total employment in the manufacturing sector by multinationals that export both goods and services (column 1) and multinationals that only export goods (column 2).
Source: Authors' calculations using 2007 LBD.

Table 10. Multinational Goods-Export Growth, Types of Services
Control Group: Multinational Goods-Only Exporters

	All	—Unaffiliated—		—Affiliated—	
$\Delta GDP \times MNE^{SVC}_{ic,2007} \times I(> 2008Q3)$		-1.659*		-0.984	
		(0.870)		(1.010)	
$\Delta GDP \times MNE^{SVC}_{ic,2007}$ × Service Type Share					
Business IP	-1.886**		-3.828***		-1.152
	(0.768)		(1.304)		(0.804)
Media IP	-2.414		-2.960		-0.969
	(2.538)		(2.349)		(4.564)
BUSINESS	-1.307		-0.855		-1.818
	(1.536)		(1.894)		(2.032)
TELECOM	0.253		0.140		0.106
	(1.731)		(2.461)		(2.176)
OTHER	0.566		-0.007		3.050
	(1.756)		(1.857)		(2.380)
Fixed Effects	firm-quarter, country-quarter, firm-region				
Observations[a]	185,000	77,500	77,500	150,000	150,000

Notes: * p<10%; ** p<5%; *** p<1%. Robust standard errors in parentheses clustered at the country level. This table displays results from estimating Equation (3). See Section 3.2.2 for a description of the broad services categories. The dependent variable is a firm's arm's-length goods-export growth at the country-quarter level.

[a] Observation counts rounded to comply with Census Bureau disclosure avoidance rules.

Source: Authors' calculations using 2006-2009 LFTTD.

Table 11. Affiliate Services Sales Growth and Services Exporting Multinationals
Control Group: Multinational Goods-Only Exporters

	Unaffiliated			Total		
	All	Local	Other	All	Local	Other
$\Delta GDP \times MNE^{SVC}_{ic,2007} \times I(> 2008Q3)$	-5.568**	-4.995**	-0.667*	-6.245***	-5.659**	-0.688
	(2.349)	(2.168)	(0.337)	(2.248)	(2.197)	(0.670)
Fixed Effects	firm-year, country-year					
Observations[a]	3,500	3,500	3,500	3,500	3,500	3,500

Notes: * p<10%; ** p<5%; *** p<1%. Robust standard errors in parentheses clustered at the country level. This table displays results from estimating Equation (6). The dependent variable is a firm's arm's length goods-export growth at the country-quarter level.
[a] Observation counts rounded to comply with Census Bureau disclosure avoidance rules.
Source: Authors' calculations using 2006-2005 and 2008-2009 BE-11 and 2007 BE-10.

Table 12. Employment Growth and Services Exporting Multinationals
Control Group: Multinational Goods-Only Exporters

$\Delta Exposure \times MNE^{SVC}_{i,2007}$ ×Quarterly Indicator	Total (Log)	Total	Manufacturing	Services	Other	Services 51 & 54	Services All Others
×2008Q4	-4.558***	-3.091***	0.302	-2.691***	-0.702	-2.044***	-0.646
	(1.742)	(1.078)	(0.719)	(0.583)	(0.643)	(0.373)	(0.467)
×2009Q1	-4.159***	-3.210***	-0.416	-1.462***	-1.332***	-0.953***	-0.508*
	(1.112)	(0.688)	(0.459)	(0.373)	(0.411)	(0.238)	(0.298)
×2009Q2	-3.905***	-3.022***	-0.480	-1.420***	-1.122***	-0.879***	-0.541*
	(1.112)	(0.688)	(0.459)	(0.373)	(0.411)	(0.238)	(0.298)
×2009Q3	-3.903***	-3.020***	-0.479	-1.420***	-1.122***	-0.879***	-0.541*
	(1.112)	(0.688)	(0.459)	(0.373)	(0.411)	(0.238)	(0.298)
×2009Q4	-3.947***	-3.050***	-0.508	-1.420***	-1.123***	-0.879***	-0.541*
	(1.112)	(0.688)	(0.459)	(0.373)	(0.411)	(0.238)	(0.298)
Fixed Effects				firm, quarter			
Observations[a]	20,500	20,500	20,500	20,500	20,500	20,500	20,500

Notes: * p<10%; ** p<5%; *** p<1%. Robust standard errors in parentheses clustered at the firm level. This table displays results from estimating Equation (7). The dependent variable is a firm's employment growth at the quarter level.
[a] Observation counts rounded to comply with Census Bureau disclosure avoidance rules.
Source: Authors' calculations using 2006-2009 CBPBR.

A Appendix

A.1 Heterogeneity by Multinational Status

We explore differences in goods-export growth by multinational ownership status. We compare U.S. parent multinationals (domestic MNE) to U.S. affiliates of foreign parents (foreign MNE). Domestic MNEs, in 2007, accounted for 72% of goods trade by all multinational firms.[41] In Table A-2, column (1) only includes U.S. parents and their matched non-MNE controls and column (2) only includes the U.S. affiliates of foreign parents and their matched non-MNE controls. The DDD coefficient is negative for both domestic and foreign MNEs but statistically significant in the sample of domestic MNEs. The DDD coefficient on the sample of domestic MNEs is also much larger (almost 5 times) than on the sample of foreign MNEs.

A.2 Quarterly GDP

Our main measure of exposure to the financial crisis is 12-month changes in GDP measured on an annual basis. However, export growth varies at the firm-country-quarter level. We re-estimate Equations (3) and (5) using 12-month changes in GDP measured on a quarterly basis. As noted in Section 3.4.1, we only have this information for a very limited set of countries. Nonetheless, we find that our baseline results in Tables 4 and 6 are robust to using quarterly GDP information as shown in Table A-3. In columns (1) and (2), the treatment group is multinational goods exporters, $MNE_{i,2007}$, and the control group is matched non-MNE goods exporters. In column (3), the treatment group is multinational bi-exporters, $MNE^{SVC}_{ic,2007}$, and the control group is matched MNE mono-exporters. The results are statistically significant across columns (1) and (2) in the fourth quarter of 2008. In column (3), we find that the effect is statistically significant in the second and third quarters of 2009.

[41] Calculated using BEA official statistics.

Table A-1. Summary Statistics

Variable	mean	sd
Exported services type as a share of total:		
- Business-related Intellectual Property	0.348	0.438
- Media-related Intellectual Property	0.015	0.112
- Business Services	0.501	0.445
- Telecommunication	0.099	0.257
- Other	0.037	0.166
Goods-export growth	-0.013	1.399
Financial crisis exposure	-0.019	0.017
U.S. employment growth:		
- Total	-0.031	0.300
- Manufacturing	-0.028	0.204
- Services	-0.004	0.154
- Other	0.001	0.172
Foreign affiliates' services sales growth:		
- Total	0.123	0.975
- To all unaffiliated parties	0.089	0.859
- To local unaffiliated parties	0.091	0.798
- To other unaffiliated parties	0.003	0.196

Notes: This table displays the mean and standard deviation (sd) of selected firm-level variables. "Exported services type as a share of total" displays a firm's exported services in five broad categories as a share of its total exported services where the categories are as defined in Section 3.2.2.
Source: Authors' calculations using 2007 LBD, BE-11, BE-12, BE-120, and 2006-2009 LFTTD.

Table A-2. Goods-Export Growth and Heterogeneity by Multinational Status
Control Group: Non-Multinational Goods Exporters

	Type of Multinational	
	Domestic	Foreign
$\Delta GDP \times MNE_{i,2007} \times I(> 2008Q3)$	-0.751**	-0.162
	(0.321)	(0.488)
Fixed Effects	firm-quarter, country-quarter, firm-region	
Observations[a]	450,000	346,000

Notes: * p<10%; ** p<5%; *** p<1%. Robust standard errors in parentheses clustered at the country level. This table displays results from estimating Equation (5). The dependent variable is a firm's arm's length goods-export growth at the country-quarter level.
[a] Observation counts rounded to comply with Census Bureau disclosure avoidance rules.
Source: Authors' calculations using 2006-2009 LFTTD.

Table A-3. Multinational Goods-Export Growth, Quarterly GDP

Treatment MNE:	$MNE_{i,2007}$		$MNE^{SVC}_{ic,2007}$
Matched Control:	—Non-MNE—		—Goods-Only MNE—
$\Delta GDP \times MNE$ ×Quarterly Indicator			
×2008Q1	-0.179		
	(0.597)		
×2008Q2	-0.748		
	(0.976)		
×2008Q3	0.271		
	(0.930)		
×2008Q4	-2.074***	-2.008***	-1.391
	(0.533)	(0.481)	(1.105)
×2009Q1	-0.961	-0.894	-0.260
	(0.604)	(0.567)	(0.738)
×2009Q2	-0.695	-0.625	-2.140***
	(0.647)	(0.732)	(0.767)
×2009Q3	-0.858	-0.793	-1.921**
	(0.562)	(0.622)	(0.848)
×2009Q4	0.342	0.409	-0.570
	(0.604)	(0.500)	(0.739)
Fixed Effects	firm-quarter, country-quarter, firm-region		
Observations[a]	457,000	457,000	131,000

Notes: * p<10%; ** p<5%; *** p<1%. Robust standard errors in parentheses clustered at the country level. This table displays results from estimating Equation (5) in columns (1) and (2) and Equation (3) in column (3). The dependent variable is a firm's arm's length goods-export growth at the country-quarter level.

[a] Observation counts rounded to comply with Census Bureau disclosure avoidance rules.

Source: Authors' calculations using 2006-2009 LFTTD, 2007 BE-11, 2007 BE-12.

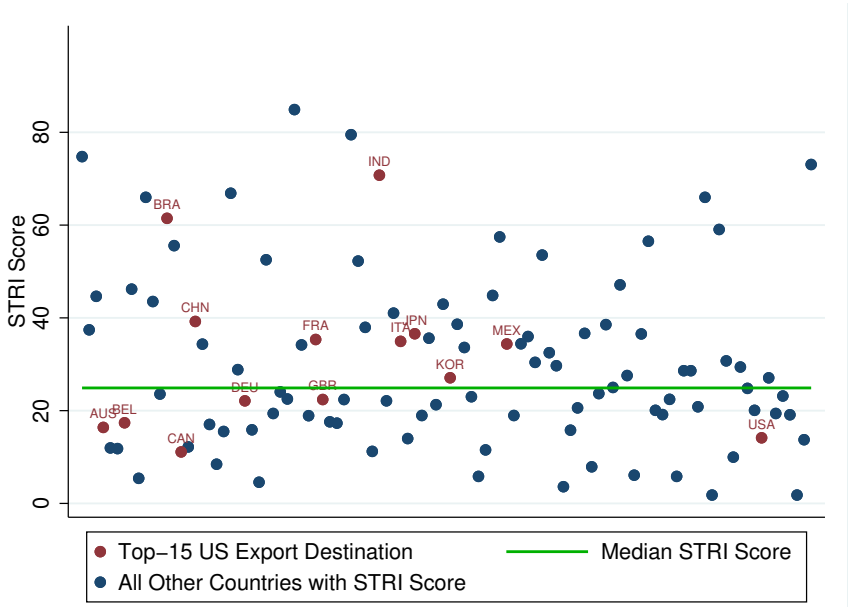
Table A-4. U.S. Services Exports by Detailed Product Category, 2007

Product	Share of Total (%)	Share of Broad Category (%)
Business-related IP Services:		
- Industrial Processes	7.4	44.9
- Computer Software	5.9	35.9
- Trademarks	2.4	14.3
- Franchise Fees	0.8	4.9
Total	**16.5**	**100.0**
Media-related IP Services:		
- Film and Television	2.9	87.3
- Books and Sounds Recording	0.3	9.2
- Broadcasting and Recording	0.1	3.5
Total	**3.4**	**100.0**
Business Services:		
- Management and Consulting	5.4	32.2
- R&D Testing	3.2	19.0
- Architectural and Engineering	2.3	13.9
- Operational Leasing	1.4	8.7
- Legal	1.3	8.0
- Advertising	0.8	5.0
- Construction	0.6	3.4
- Mining	0.5	3.1
- Other	0.4	2.4
- Educational and Training	0.2	1.4
- Trade-related	0.2	1.2
- Accounting	0.2	1.0
- Sports and Performing Arts	0.1	0.8
Total	**16.7**	**100.0**
Telecommunication Services:		
- Telecommunication	1.7	40.7
- Computer and Data Processing	1.5	36.2
- Database and Other Information	0.9	23.1
Total	**4.1**	**100.0**
Other Services	**2.3**	**100.0**

Notes: This table displays the share of 2007 U.S. services exports by five broad services product categories as defined in Section 3.2.2. The first column reports percentages as a share of total U.S. services exports. The second column reports percentages as a share of the total exports in a broad services product category. "Other Services" includes maintenance and repair; auxiliary insurance; market research and public opinion polling; trade exhibition and sales convention; waste treatment and depollution; agriculture, forestry, and fishing; audiovisual production; health; and heritage and recreational services.

Source: Authors' calculations using public-use statistics on services trade published by U.S. Bureau of Economic Analysis (2020).

Figure 1. Services Trade Restrictiveness: Mode 1, All Industries

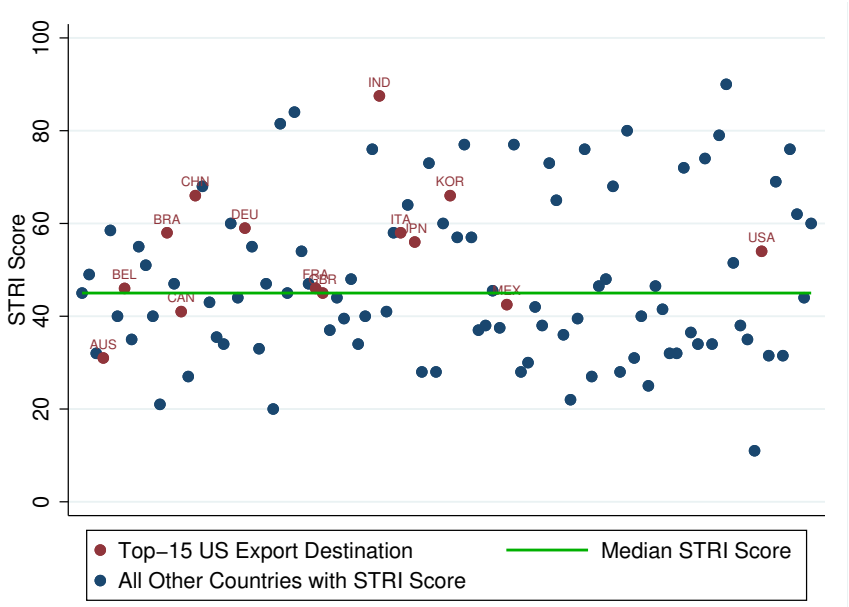


Notes: This figure plots the STRI score based on all industries using mode 1 supply.
Source: Author's calculations using World Bank's STRD.

Figure 2. Services Trade Restrictiveness: Mode 4, All Industries

Notes: This figure plots the STRI score based on all industries using mode 4 supply.
Source: Author's calculations using World Bank's STRD.

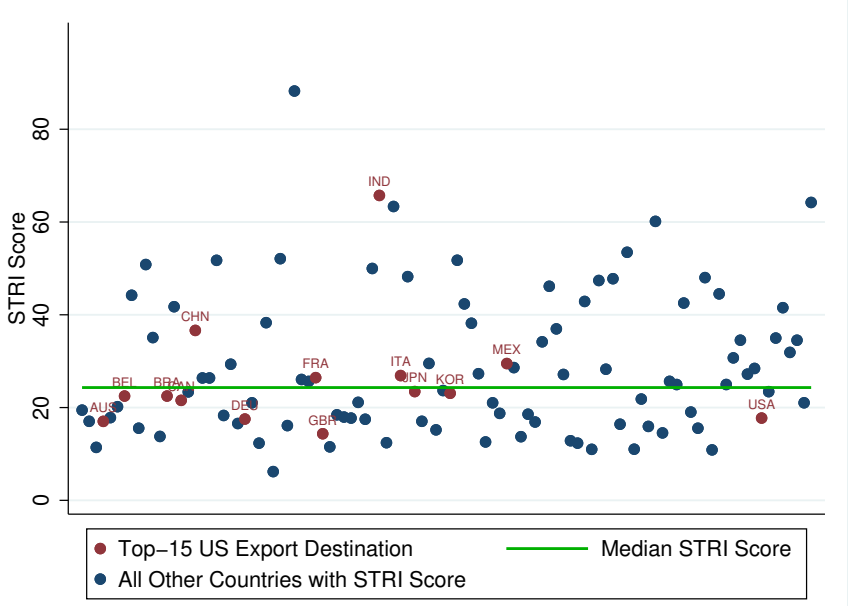
Figure 3. Services Trade Restrictiveness: All Modes, Professional Services



Notes: This figure plots the STRI score based on the professional services industry using all modes of supply.

Source: Author's calculations using World Bank's STRD.

Figure 4. Services Trade Restrictiveness: All Modes, All Industries



Notes: This figure plots the STRI score based on all industries using all modes of supply.

Source: Author's calculations using World Bank's STRD.