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Phantom FDI: A Structural Gravity Analysis Using MREID

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Abstract

Foreign direct investment (FDI) measured by public sources includes investments made by firms for financial and accounting related (or nonproduction-based) reasons, typically concentrated in offshore financial centers (OFCs). Recent studies suggest that profit-shifting may also occur in non-OFC regions. Consequently, many datasets used to understand the economic factors behind a firm's decision to shift production activities acoss countries may still contain such"phantom FDI." Consequently, analytical methods have recently been developed to remove phantom FDI flows and improve the accuracy of FDI measures. In this paper, we apply a structural gravity approach to identify and measure phantom FDI using the new Multinational Revenue, Employment, and Investment Database (MREID). We use this approach to provide estimates of phantom FDI for numerous developed countries in our sample. Our baseline results are then validated using an alternative production-function approach.

JEL Codes: F21, F23, F38
Keywords: Foreign direct investment; phantom FDI; multinational firms; profit shifting; structural gravity; multinational activity; FDI measurement

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1 Introduction

In an effort to capture production-based foreign direct investment (FDI) of multinationals, many FDI datasets allow researchers to isolate FDI flows related to special purpose entities (SPEs). These SPEs are often set up in offshore financial centers (OFCs), but have little impact on "real" economic activity. As a result, researchers often exclude these financial or profit-shifting flows from their analyses, allowing for a more explicit analysis to be conducted on the "real" elements behind FDI flows.

Data sources that provide this level of granularity include the OECD, Eurostat, and the International Monetary Fund's Balance of Payments/International Investment Position (BOP/IIP) data. The United Nations Conference on Trade and Development (UNCTAD) also directly excludes SPEs from their reported FDI data whenever feasible. FDI data without SPEs match "real" indicators of multinational activity (sales, assets).[1]

While identifying and excluding OFCs is a necessary step in capturing production-based FDI, it is not sufficient on its own. Recent research shows that profit-shifting activities might occur through *other* MNE activities (e.g., intangible fixed assets) instead of through non-OFCs (Santacreu and Stewart, 2024). So, the above datasets can still present some phantom (or conduit) FDI even after the exclusion of OFCs(Casella et al., 2024). Given these circumstances, analytical methods continue to be developed to remove conduit FDI flows from bilateral data so that FDI flows can be measured more precisely in economic studies. These methods, as summarized in Casella et al. (2024) and Brandt (2023), generally involve the use of estimation techniques and alternative data to detect and exclude phantom FDI.

This paper contributes to this literature by introducing a well established

[1]The IMF's Coordinated Direct Investment Survey (CDIS) does not offer this distinction.

theoretical approach (structural gravity) to identify and measure "Phantom FDI."[2]. The first contribution focuses on identifying phantom FDI in the outward investment activities of U.S. MNEs in various destination countries. To validate our results, we also use a production-function approach that delivers estimates similar to those using the gravity-equation approach for the U.S. MNEs. A second contribution is an application of our methods to identify inward phantom FDI of a very large set of advanced countries. The third contribution, and one of the advantages of combining our methods with the exhaustive Multinational Revenue, Employment, and Investment Database (MREID) described in Ahmad et al. (2023), is evaluating phantom FDI for multiple measures of FDI: numbers of affiliates, revenues, and investments in total assets, fixed assets, tangible fixed assets, and intangible fixed assets.

2 Literature Background

The identification of phantom FDI can be approached using several methods, each with a distinctive statistical foundation. The most common methods are those proposed by the International Monetary Fund (IMF) and the United Nations Conference on Trade and Development (UNCTAD).

The IMF method, proposed by Damgaard et al. (2024), estimates both real and phantom FDI by utilizing reported data on SPEs. This method incorporates known information to isolate phantom investments. The IMF method uses Orbis data from 2016 to match "real" FDI, interpreted as Multinational Production (MNP), with OECD statistics. This approach assumes that Orbis data reflects the structure and changes in FDI accurately, even if it may not be precise in terms of absolute

[2]The gravity equation is a widely used model in the international trade literature that predicts trade and invetment flows between two countries is related to their economic sizes and the bilateral frictions between them

levels. By relying on these datasets, the method seeks to identify the genuine economic activity underlying FDI flows, distinguishing it from phantom FDI, which is typically designed for tax purposes rather than to generate actual production. They find that phantom FDI has grown at a faster pace than real FDI over the last decade and represents around $15 trillion, almost 40 percent of total global FDI.

In contrast, UNCTAD offers the "implied investment method," as discussed by Bolwijn et al. (2018) and Casella (2019). This approach establishes a direct linear relationship between the logarithm of FDI stock (either inward or outward) and the logarithm of gross domestic product (GDP). The UNCTAD method introduces a distinct analytical approach to derive bilateral FDI stocks by ultimate investors. This method is grounded in a probabilistic Markov framework for tracing FDI flows back to their ultimate sources. Unlike traditional methods, which may rely on reported data or correlations with economic variables like GDP, this approach offers a novel way to map FDI more accurately by capturing the flow of investments across borders through a sequence of intermediate steps. Looking at a dozen recipient countries, the estimated distribution used in Casella (2019) more clearly reflects the reported distribution of ultimate investors than it does for bilateral FDI accounting for direct investors. This indicates that their methodology accounts for the substantial conduit FDI that is normally reflected in bilateral statistics.

Both methodologies, however, are inherently "a-theoretical," as they are based on statistical correlations rather than an underlying economic theory. They integrate empirical data with estimation techniques to differentiate between real economic activity and phantom investments designed for tax optimization or regulatory arbitrage.

Other methods for identifying and analyzing phantom FDI expand upon different analytical frameworks and datasets. The OECD Economic Impact Assessment, as developed by Turban et al. (2020), uses a fully estimated method that diverges from the implied investment approach. Instead, conduit FDI is estimated by extrapolating data from economies that report on ultimate investors. This method employs a set of matrices that map the locations of profit and economic activities of MNEs, offering a comprehensive view of global FDI patterns.

Haberly and Wójcik (2015) apply principal component analysis (PCA) to decompose the global bilateral FDI anomaly matrix into its primary constituent subnetworks. This approach allows for the identification of regional blocks and imperial legacies, helping to map the global offshore FDI network and reveal the structural patterns that contribute to the concentration of FDI in certain regions or countries.

Furthermore, UNCTAD's 2015 World Investment Report introduces an FDI-driven approach through the Offshore Investment Matrix. This method categorizes self-declared SPE countries and tax havens, focusing on identifying the role of these jurisdictions in facilitating offshore investment, thereby offering another perspective on the relationship between FDI and phantom investment. Each of these methodologies provides unique insights into the complexities of global FDI flows and their implications for economic governance.

Focusing on U.S. MNEs, Guvenen et al. (2022) employ a production function approach to reattribute earnings between U.S. parent firms and their respective foreign affiliates. This reattribution method is based on a theoretical model of profit-maximizing firms, wherein the total worldwide earnings of an MNE are distributed among its parent company and affiliates according to their shares of the MNE's total wage bill, physical capital stock, or intangible capital stock. The key innovation in this approach lies in its foundation on economic theory, unlike the other methods that rely more heavily on empirical data correlations. By attributing profits according to these measurable factors, the model allows for a more realistic estimate of where profits are actually being generated, as opposed to where they are reported for tax purposes. This method helps uncover the extent of profit shifting within U.S.

MNEs, providing a clearer picture of the actual economic contributions of both the parent companies and their foreign affiliates.

Their results show that the largest sectors involved in profit shifting are computers, petroleum and chemicals, pharmaceuticals, and Research & Development, largely due to the shifting of intellectual property. They find that R&D intensive industries have experienced faster productivity growth compared to non-R&D intensive industries, suggesting that the decline in productivity is primarily driven by non-R&D-intensive industries. Further, they estimate that 38 percent of the profits reported by US MNEs as being earned abroad can be considered as generated in the US; accordingly, accounting for profit shifting reduces the return on US direct investment abroad.

3 Methodology

3.1 The Gravity Equation for Trade and FDI

We rely on the well-established "structural gravity" framework (cf., Anderson and Van Wincoop (2003), Baier et al. (2017) and Anderson et al. (2019) for the theoratical foundations of structural gravity) to address the phantom FDI issue. Similar to Newton's Law of Gravitation, the gravity model suggests that trade and FDI between two countries is proportional to their economic masses — typically represented by exporter and importer GDPs — and inversely related to the trade costs, which are often captured by geographic distance, tariffs, and other trade barriers. Tinbergen (1962) was the first to use the gravity equation applied to bilateral aggregate trade flows, estimating for a single year using Ordinary Least Squares (OLS) and positive trade flows:

$$\ln TRADE_{ij} = \beta_0 + \beta_1 \ln Y_i + \beta \ln Y_j + \beta_3 \ln Dist_{ij} + \beta_4 EIA_{ij} + \ln \epsilon_{ij} \tag{1}$$

where $TRADE_{ij}$ was the (nominal) bilateral trade flow (in U.S. dollars) from country i to country j, Y_i (Y_j) was nominal GDP in U.S. dollars in country i (j), $Dist_{ij}$ was the bilateral distance in nautical miles between the two countries' economic centers, EIA_{ij} was a dummy variable taking the value 1 if the two countries had an economic integration agreement (EIA) such as a free trade agreement between them and 0 otherwise, and ϵ_{ij} was an error term.

A multitude of studies over subsequent years estimated gravity equations similar to equation (1), especially to find estimates of β_4, the coefficient on the presence or absence of an EIA. Along the way, researchers introduced additional control variables, such as dummies for having a common land border, common official language, and/or common legal origins, or being an island or landlocked.

However, formal theoretical *microeconomic* foundations for the gravity equation did not surface until 1979 with the models in Anderson (1979) and Bergstrand (1985). While focusing on different dimensions of the theoretical foundation for equation (1), both papers provided complementary elements that – once properly synthesized in Anderson and Van Wincoop (2003) – led to what is now referred to as "structural gravity," cf., the Introduction in Bergstrand (2019). A standard structural gravity equation for a given year can be represented as:

$$TRADE_{ij} = \frac{Y_i E_j}{Y^W} \left(\frac{t_{ij}}{\Pi_i P_j} \right)^{1-\sigma} \epsilon_{ij}^T, \tag{2}$$

where Y_i (E_j) is nominal GDP (aggregate expenditures) in i (j), Y^W is world GDP (captured by a constant), t_{ij} is an *ad valorem* measure of bilateral trade costs (which can be replaced by an EIA dummy), and Π_i (P_j) is the outward (inward) multilateral price index of producers (consumers) in country i (j), cf., Baier et al. (2017). This trade gravity equation has become a workhorse for understanding determinants of bilateral trade flows. In the presence of zeros and potential heteroskedasticity, researchers in this area now commonly estimate equation (2) by Poisson pseudo maximum likelihood (PPML), cf., Baier et al. (2017).

A key strength of the structural gravity model is that it is rooted in economic theory and accommodates frictions and policy variables empirically while maintaining a microeconomic foundation. This allows researchers to evaluate the effects of trade agreements, tariffs, or non-tariff barriers on bilateral trade flows by explicitly modeling the costs associated with moving goods between countries. The model's consistent structural form facilitates the estimation of elasticities of bilateral trade with respect to bilateral trade costs, and it is robust to various extensions, such as incorporating multiple sectors, heterogeneous firms, or additional dimensions of trade costs like cultural and institutional differences.

Another key advantage of the gravity equation is its flexibility in accommodating other bilateral flows besides trade, such as FDI and migration, making it a versatile tool for analyzing various forms of bilateral flows between countries. When applied to FDI, the gravity model effectively captures the determinants of cross-border investment flows by accounting for both the size of a pair of economies and the costs associated with one country investing abroad in another country. The first formal theoretical economic foundation for the gravity equation applied to bilateral FDI was Bergstrand and Egger (2007), which solved for a gravity equation using a Knowledge-and-Physical-Capital extension of the Knowledge Capital model of Markusen (2002). Similar to trade flows, larger economies are expected to engage in higher volumes of FDI, while geographic distance, institutional barriers, and other frictions can impede investment. The model can be extended to include additional factors that affect FDI, such as bilateral investment treaties, regulatory environments, or political risk, allowing researchers to assess how these variables influence capital allocation across borders. This adaptability makes the gravity equation a powerful framework for studying FDI in addition to its traditional application to trade.

Anderson et al. (2019) solved for a structural gravity equation for FDI akin to equation (2). Ignoring the transition dynamics in Anderson et al. (2019), the determinants of the (steady state) bilateral FDI from origin country i to affiliates in destination country j in some year (FDI_{ij}) is the gravity equation:

$$FDI_{ij} = \frac{\beta\phi^2\eta_i^2}{1-\beta+\beta\delta_{j,M}}\omega_{ijt}\frac{E_i}{P_i}\frac{Y_j}{M_i}\epsilon_{ij}^F, \tag{3}$$

if $FDI_{ij} = \omega_{ij}M_i > 1$ (and 0 otherwise), where E_i is total expenditures in origin country i (on consumption goods, physical capital investments, and technology capital investments), P_i is a multilateral index of prices in country i on all types of goods, Y_j is a measure of national output in destination country j, M_i is the technology capital stock in i, ω_{ij} is a measure of (policy and non-policy) openness of country j to country i's technology capital, β is the standard time-discount factor, ϕ is the (Cobb-Douglas) share of the global technology capital stock used in production of output, η_i is the share of country i's technology capital as a share of country j's global technology capital stock, and $\delta_{j,M}$ is the technology capital "adjustment cost," analogous to the standard physical capital adjustment costs (in the physical capital accumulation literature).

In empirical analysis, the structural gravity equation is often estimated using data on bilateral trade, FDI, GDP, distance measures between countries, and other bilateral costs discussed above. Recently, Bergstrand and Paniagua (2024) have investigated the partial and general equilibrium effects of various provisions in "deep" trade agreements on bilateral trade, bilateral FDI stocks, and various measures of MNEs' "activities" (i.e., affiliates costs, revenues, employment, and assets) using the structural gravity-equation approach. Overall, the structural gravity equation is a powerful tool for understanding the determinants of FDI patterns and the effects of international policies in a globalized economy. We will use equation (3) as the theoretical gravity equation undergirding the empirical specifications that follow.

3.2 Measuring U.S. Bilateral Outward Phantom FDI

In this section, we focus on explaining how we identify "phantom FDI" from a *single particular* origin country to various destination countries, based upon the methodology identified in the previous section. In this section, we choose the United States (USA) as the origin country (i) and provide a methodology to estimate the values of bilateral phantom FDI to various recipient destinations (j).

Because we have a single origin country, there is no variation in the i variables in equation (3); these variables are subsumed in the constant. Consequently, for our cross-sectional empirical specification in this case, we need only measures of variables that vary across $j = 1, ..., N$ countries in a particular year: Y_j (nominal GDP in j), $\delta_{j,M}$ (technology-capital adjustment-cost factor in j), and ω_{ij} (bilateral variables that either enhance or diminish openness to FDI across the two countries). Consequently, all this suggests the following specification using Poisson pseudo maximum likelihood (PPML) estimation:

$$FDI_{USA,j} = \exp\left(\beta_0 + \beta_1 \ln GDP_j + \beta_2 \omega_{USA,j}\right) \times \epsilon_j, \qquad (4)$$

where $FDI_{USA,j}$ represents a measure of MNE activity of Global Ultimate Owners (GUOs) based in the USA with affiliates in country j. Consistent with equation (3), the RHS includes destination GDP and $\omega_{USA,j}$ where the latter measure of openness is captured by standard gravity-equation variables (log of distance and dummies for common language, common legal origin, island, and landlocked). We also include in $\omega_{USA,j}$ policy-related dummies: membership of j in the World Trade Organization, membership of j in the European Union, a common free trade agreement, and a common bilateral investment treaty. We omit any measure to explicitly capture variation across j in $\delta_{j,M}$, the variable representing the technology-capital adjustment-cost factor because of lack of data on this variable; instead, we assume this factor exhibits little variation across countries and its effect is imbedded in the regression constant.

We denote the predicted value of $FDI_{USA,j}$ as the "Potential FDI" for U.S. outward FDI to country j and refer to it as $\widehat{FDI}_{USA,j}$. Then, we compute the "Phantom FDI" for US outward FDI as:

$$FDI_{USA,j}^{Phantom} \equiv FDI_{USA,j} - \widehat{FDI}_{USA,j}. \tag{5}$$

Hence, any $FDI_{USA,j}$ that exceeds that associated with the Potential FDI based upon the microeconomic founded FDI value is "non-economic" FDI and interpreted as non-productive FDI or phantom FDI.

We also calculate "FDI ratio" for each destination with:

$$FDI_{USA,j}^{Ratio} \equiv \frac{FDI_{USA,j}}{\widehat{FDI}_{USA,j}}. \tag{6}$$

The FDI ratio in equation (6) gives us a ranking of countries with actual FDI higher or lower than the theoretically predicted FDI from the gravity equation. The FDI ratio can be informative; if the predicted value of FDI is very low, the FDI ratio will be very high. Moreover, $FDI_{USA,j}^{Ratio}$ "normalizes" the relative importance of phantom FDI across countires so that the importance of phantom FDI is not distored by the economic sizes of countries.

3.3 Robustness 1: Production-Function Approach

As a first robustness exercise, we will apply a production-function approach to measure U.S. phantom FDI to various destinations (j). The methodology we use is similar to the methodology developed in Guvenen et al. (2022). In this approach, we impute the revenues of each destination's foreign affiliates of U.S. MNEs. We do this by estimating the relationship between revenues of these U.S. foreign affilates with the capital and labor inputs used by these foreign affiliates. Specifically, we use the Cobb-Douglas production function:

$$R^{imp}_{USA,j} = \gamma K^{\alpha}_{j} L^{1-\alpha}_{j}$$

where $R^{imp}_{USA,j}$ represents the imputed revenue for U.S. affiliates in j, K_j denotes the capital stock, and L_j represents labor stock. The parameters α and $1-\alpha$ represent, respectively, the share of income going to capital and to labor, and γ is a constant term representing productivity. This approach estimates revenues based on observable inputs and can be compared to *actual* reported revenues ($R^{act}_{USA,j}$) to identify potential discrepancies associated with phantom FDI. We choose $\alpha = 0.4$ and calibrate $\gamma = 25.933$ to match U.S. domestic revenues and factor endowments. Accordingly, phantom FDI can be represented by:

$$R^{Phantom}_{USA,j} \equiv R^{act}_{USA,j} - R^{imp}_{USA,j}. \tag{7}$$

3.4 Robustness 2: Inward Multilateral Phantom FDI for Non-U.S. Countries

It is also possible to estimate the amount of inward phantom FDI for numerous non-U.S. countries. In this case, we need to first estimate the bilateral phantom FDI across country-pairs. Then, we can aggregate for any destination country j its multilateral phantom FDI (i.e., the sum of bilateral inward phantom FDI values from all $i = 1, ..., N$ origin countries ($i \neq j$)).

Using the same theoretical framework from above, we can estimate for any given year:

$$FDI_{ij} = \exp\left(\alpha + \lambda_i + \lambda_j + \beta\omega_{ij}\right) \times \epsilon_j, \tag{8}$$

where FDI represents a measure of MNE activities of Global Ultimate Owners (GUOs) based in country i with affiliates in country j, ω_{ij} represents the same bilateral variables that we examined earlier between the origin (i) and destination (j) countries, and λ_i (λ_j) represents a country fixed effect for the home (host) country. Again, we will denote the predicted value of FDI_{ij} as the "Potential FDI" for the country-pair ij and refer to it as $\widehat{FDI_{ij}}$:

$$FDI_j^{Phantom} \equiv \sum_{i=1, i\neq j}^{N} \left(FDI_{ij} - \widehat{FDI_{ij}}\right). \tag{9}$$

where $\widehat{FDI_{ij}}$ is the predicted FDI flow from equation (8).

4 Data description

4.1 MREID

For our gravity estimations, we rely on MREID-a novel dataset that captures different dimentions of MNE activities at the country and sector level. As discussed in Ahmad et al. (2023), MREID provides comprehensive and consistent information on international *and domestic* bilateral revenues, costs, employment, numbers of affiliates, and investment variables of MNEs for the pairings of 185 countries, across 25 industries, and (initially) 12 years.[3] Covering a wide range of agriculture, mining, energy, manufacturing and services industries, MREID provides a novel and comprehensive panel of sectoral-level bilateral foreign direct investment (and domestic investment) and foreign affiliate sales activities; we use the term "foreign direct in-

[3]The database is also unique in providing domestic investment data *compatible with* the FDI data.

vestment" (FDI) broadly for now, but also narrow the definition later. Furthermore, MREID distinguishes greenfield investment from merger and acquisition (M&A) investment. MREID currently covers the period 2010-2021, using firm-level data from ORBIS.

We use a search strategy on the Orbis database to overcome several limitations of previous databases.[4] Orbis is Bureau van Dijk's flagship-company database with data from more than 425 million companies worldwide. It focuses on private company information and presents companies' variables in a comparable formats; information is sourced from over 170 different providers but is standardized into comparable cross-country information.[5]

Orbis is a popular resource among economists. Kalemli-Özcan et al. (2015) (revised 2022) were the first to describe the standard benchmark-search strategy to construct nationally representative firm-level data from the Orbis global database. Using this search strategy, Gopinath et al. (2017) studied capital stock (fixed assets), output (sales), and employees. These authors show that Orbis data coverage is comparable to Spanish administrative data. Osnago et al. (2019) used Orbis to construct an FDI dataset for several European countries and were able to distinguish vertical and horizontal FDI. Garcia-Bernardo et al. (2017) used Orbis data to unravel offshore financial centers.

The key variable to foreign identity ownership in Orbis is the variable "Global Ultimate Owner" (GUO), which allows us to bypass some of the offshore issues that plague official FDI statistics of major sources, such as that of the IMF. This variable allows us to track firms that invest in foreign countries. One of the limitations of the Orbis web interface is that the GUO variable is only available for the "current"

[4] Ahmad et al. (2023) provides extensive details on the search strategy.

[5] MREID consists of publicly owned and privately owned corporate firms with assets or sales larger than USD 1 million; hence, most are publicly owned. It excludes banks and state-owned enterprises and banks. FDI requires ownership of 50.01 percent or larger. International generally accepted accounting standards are used.

day. To overcome this limitation, we followed the approach in Kalemli-Özcan et al. (2022) and used the M&A module in Orbis to track these changes over time. With this procedure, we obtained accurate FDI data without accessing historical days; the consequent limitation is a 10-year rolling period.[6]

The dimensions of our database are as follows. MREID (initially) spans 12 years, 2010-2021. It contains financial data of 362,845 parent companies (GUOs) with 1,132,707 domestic and foreign affiliates. Of those, 351,66 are foreign affiliates of 70,661 parent companies, and the rest are domestic affiliates. Raw data from 25 sectors are combined and, after undergoing data cleaning, we have approximately 27,000 raw observations per year at the country-sector (two-digit) level.

MREID has data on FDI for 185 countries; hence, there are potentially 34,410 (=184x185) bilateral FDI "measures" of activity. However, FDI data are characterized by many zeros; hence, the raw MREID database is an unbalanced panel.[7]

4.2 U.S. Outward FDI

We next describe the outward FDI measures of activity of U.S. firms captured in MREID; in Table 1, "affiliates" refers to the number of affiliates. This forms the basis for our benchmark results later. We note that from 2010 to 2019 there has been nearly a doubling of U.S. affiliates as well as a sharp jump in revenues, assets and employment of U.S. multinationals. The global pandemic that began in 2020 saw a decline in the overseas economic activity of U.S. firms as countries imposed stringent measures to stop the spread of the Covid virus.

Figure 1 shows the top destination countries of American outward investment

[6] This procedure allows the construction of a comparable companion dataset recording M&A data. Whenever an affiliate enters the database within the observation period of 2010-2021, it is flagged as a greenfield investment; hence, we also have a second companion database on greenfield investment. We limited our search to affiliates with more than USD 1 million in sales or in total assets in at least one year in the sample. We also implemented criteria to detect exits from the market.

[7] For our estimates, we construct a square dataset including zeros.

Table 1: Annual Outward FDI of U.S. MNEs in MREID

Year	Affiliates	Revenue	Employees	Total Assets	Fixed Assets
2010	50,689	515	682,641	4,069	728
2011	54,127	1,945	3,248,606	7,854	2,614
2012	57,667	3,151	4,572,539	10,313	3,996
2013	61,485	3,408	4,991,396	13,103	4,689
2014	65,787	3,569	5,343,777	13,695	4,881
2015	70,308	3,450	5,998,080	14,143	6,371
2016	74,924	3,624	6,339,269	16,326	7,905
2017	79,878	4,467	6,785,568	19,900	9,415
2018	85,075	5,016	7,192,457	27,228	15,591
2019	90,033	4,965	7,190,422	21,810	10,497
2020	93,377	4,768	7,139,845	23,636	11,390
2021	94,421	2,022	2,966,898	13,041	4,290

Note: Revenues, Total Assets and Fixed Assets in Billions of dollars.

for several variables of the MREID dataset.[8] Most of the American affiliates concentrate in Western Europe. As shown in Figure 1a, the following are the rankings of the top destinations for American affiliates abroad: United Kingdom (1st), Netherlands (2nd), Germany (3rd), and France (7th). Emerging economies like Brazil (4th) and India (6th) also occupy the top list. Even in Orbis data, which mostly captures "real" FDI, tax havens appear to be a significant investment hub for American foreign affiliates. Luxembourg (5th) and Singapore (8th), usually classified as tax havens, appear in relevant positions.

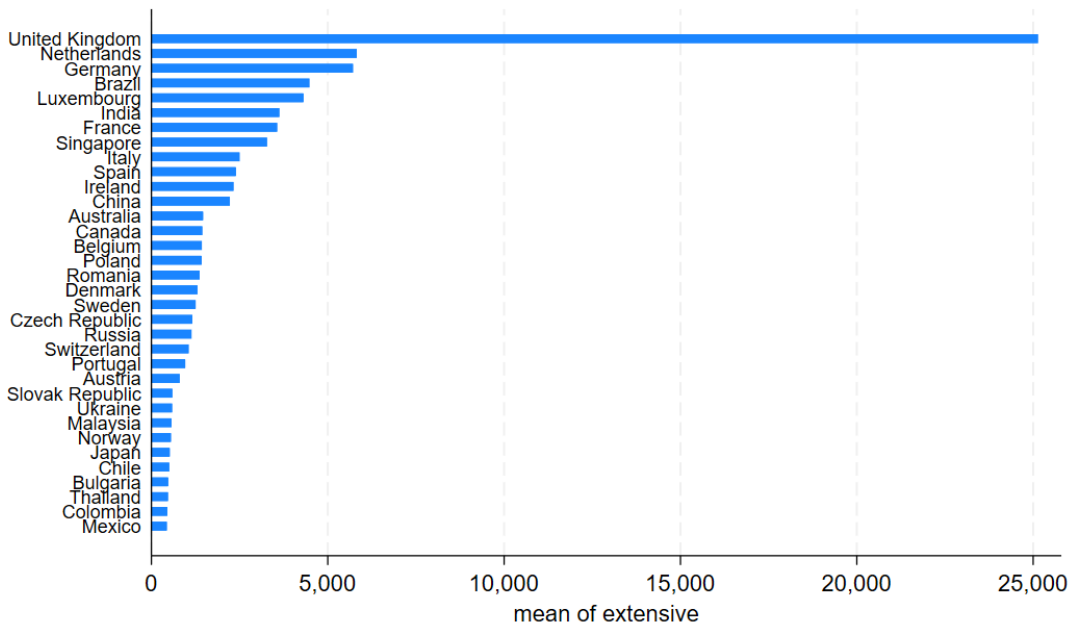
Focusing on revenues in Figure 1b, we observe several interesting traits. Singapore has the second highest concentration of U.S. MNEs' foreign revenues, most of its foreign revenues, only after the United Kingdom (1st). Netherlands (3rd), known for favorable holdings regulations, and Ireland (4th), with one of the lowest corporate tax rates in the EU, follow.

The picture of American assets abroad (total assets in Figure 1c and fixed assets 1d) depicts a similar pattern, with Luxembourg, the Netherlands, Ireland,

[8] The public MREID dataset does not distinguish between tangible and intangible fixed assets.

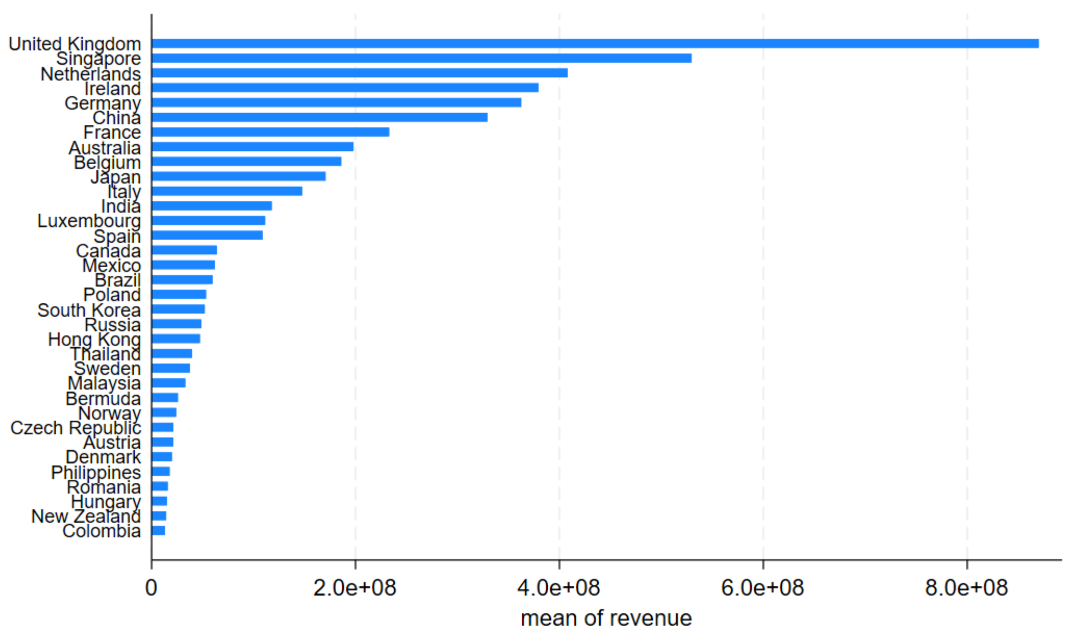
Figure 1: USA's Outward FDI (MREID dataset)

(a) Number Affiliates



a

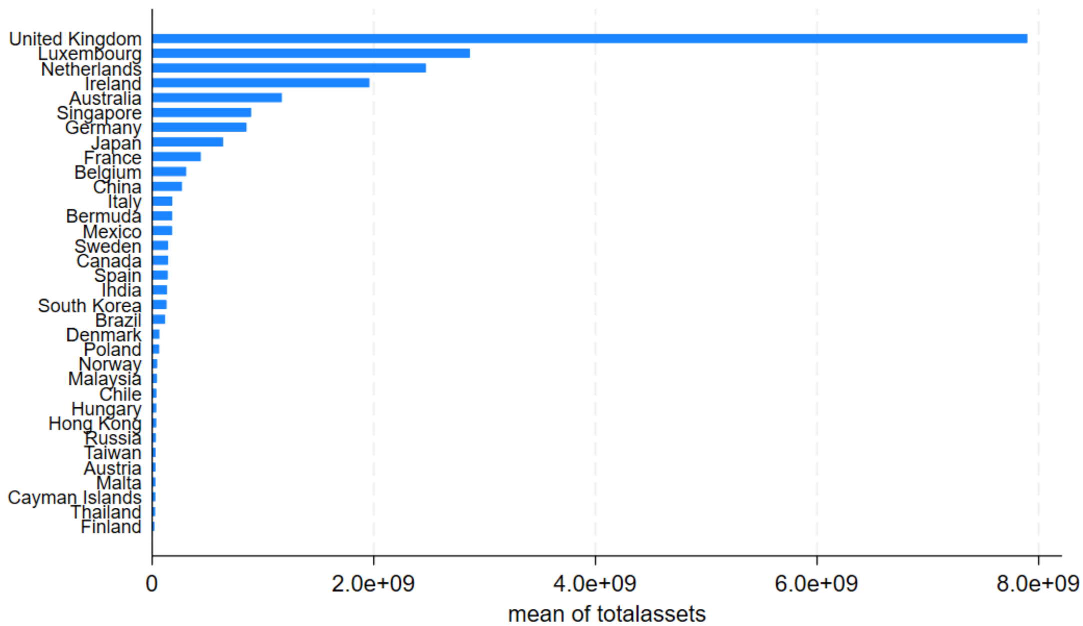
(b) Revenue from affiliates



b

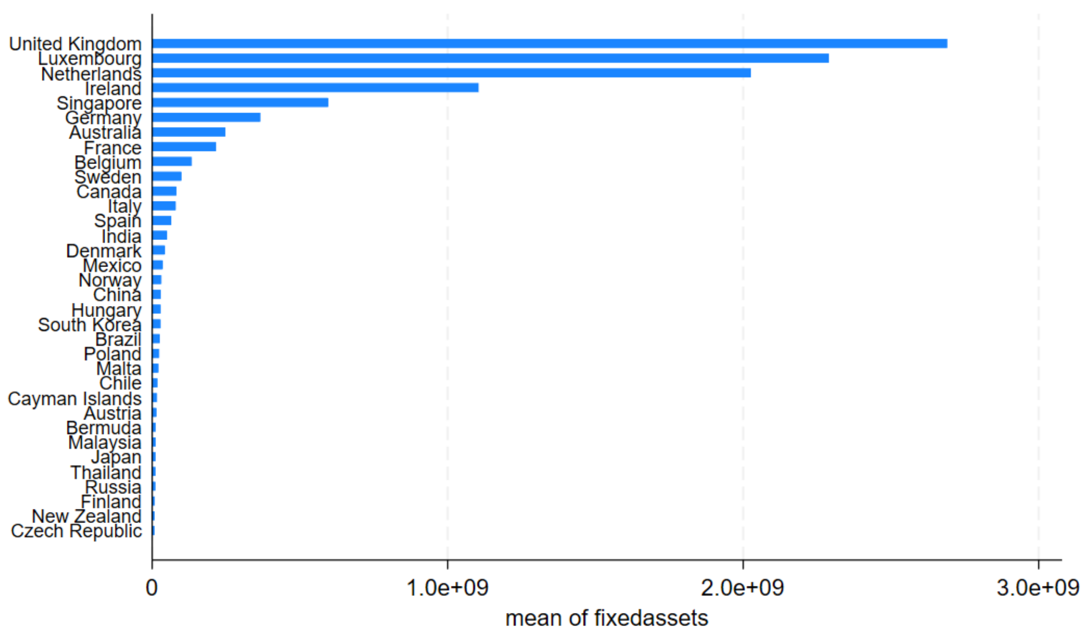
Figure 1: USA's Outward FDI (MREID dataset) (cont.)

(c) Total Assets in foreign countries



c

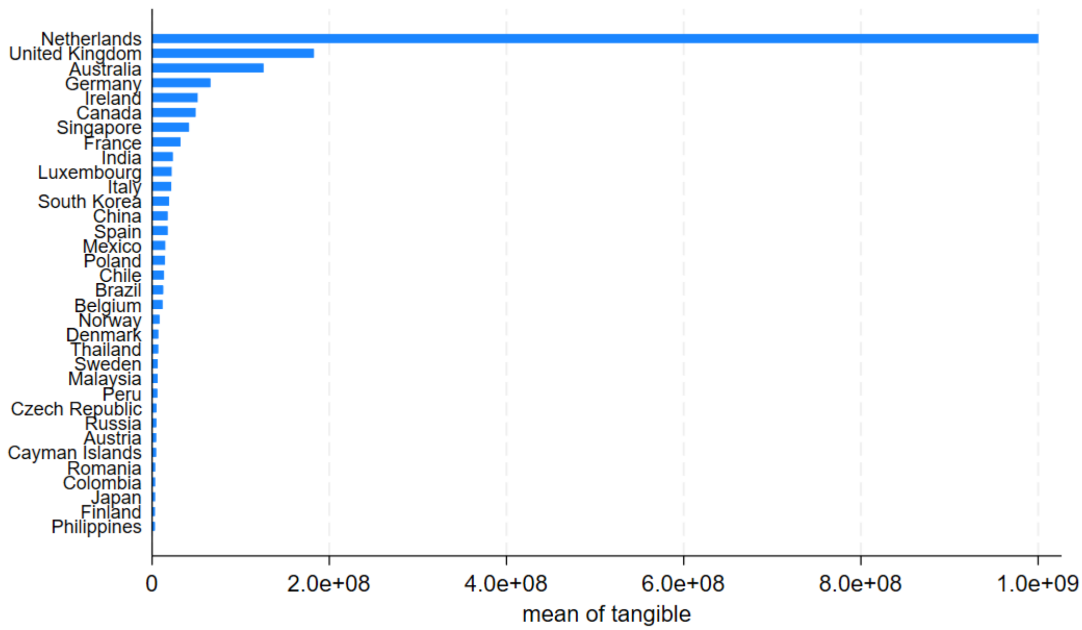
(d) Fixed Assets



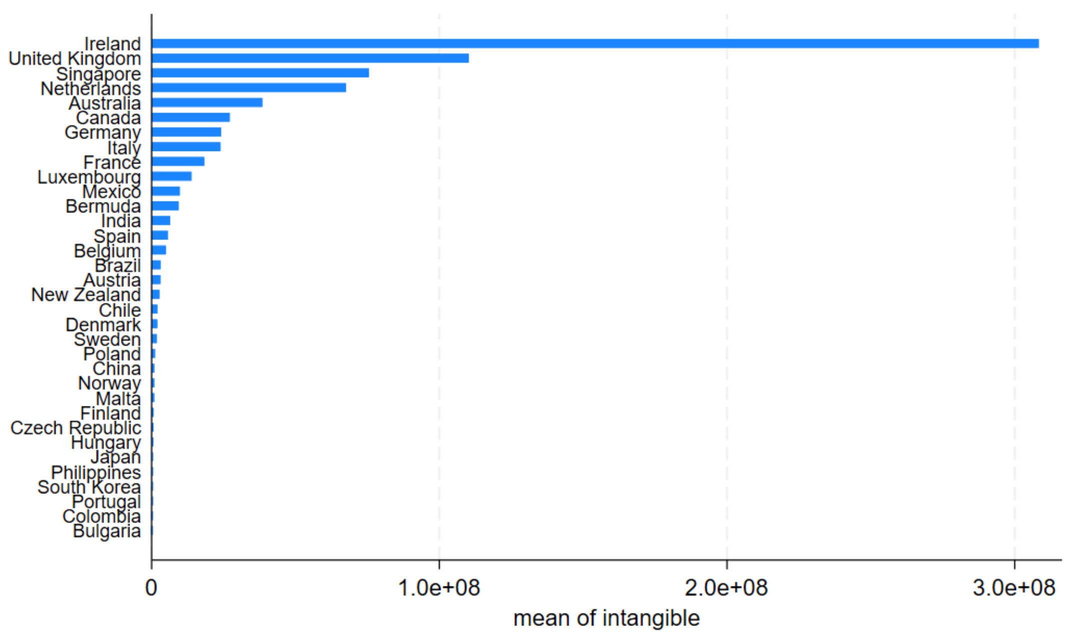
d

Figure 1: USA's Outward FDI (MREID dataset) (cont.)

(e) Tangible Fixed Assets in foreign countries



(f) Inangible Assets in foreign countries



and Singapore occupying the top ranks. When we distinguish between tangible (Figure 1e) and intangible fixed assets (Figure 1f), we observe similar distributions. The Netherlands is the absolute champion in tangible fixed assets, followed by the United Kingdom. Ireland and Singapore (with the United Kingdom between them) lead the country ranking with most of the U.S. foreign intangible fixed assets.

MREID allows us to examine the sectors that are the targets of U.S. MNE activity. Table 2 lists the top 10 country-sectors receiving U.S. investment based on total assets. The main sectors are Finance and Insurance and Management of Companies and Enterprises.

Table 2: Outward FDI of U.S. MNEs by top destinations and sectors

Country	NAICS	Affiliates	Revenue	Employees	Total Assets	Fixed Assets
UK	52	1,497	85	78,209	3,363	174
UK	55	2,239	78	105,788	1,913	854
Luxembourg	55	2,576	36	4,647	1,591	1,334
Netherlands	55	2,029	89	71,602	1,262	1,117
China	52	78	14	29,330	536	494
Japan	52	50	54	13,382	458	2
Ireland	52	385	14	14,962	326	64
UK	56	2,384	67	712,368	302	178
Ireland	55	243	19	14,044	266	206
Germany	55	621	32	92,393	214	128

Notes: Revenues, Total Assets and Fixed Assets in Billions of dollars. All variables averaged over time.
NAICS sectors 55: Management of Companies and Enterprises.
NAICS sectors 52: Finance and Insurance.

4.3 Other Data Sources for Regressions

The gravity regressions use covariates to control for country-pair heterogeneity. For our main regression that estimates U.S. Bilateral Outward FDI, we include the following variables: lnGDP: The log of Gross Domestic Product (GDP) at the destination. lnDistance: the log of the physical distance (weighted by population) between the U.S.A. and the host country. Island: a dummy variable that takes the value of 1 if the host is an island and zero otherwise. Landlocked: a dummy variable that takes the value of 1 if the host is a landlocked country and zero otherwise. Common Legal Origin: a dummy variable that takes the value of 1 if the host is an island and zero otherwise. Common Legal Origin: a binary indicator that takes a value of 0 if the host country does not share a common-origin legal system with the U.S.A. and a value of 1 if it does. Common Language: a dummy variable that takes the value of 1 if the main language at the host is English and zero otherwise. WTO member: a binary indicator that takes a value of 0 if the host country does not pertain to the World Trade Organization and a value of 1 if it does. EU member: a binary variable with the value of 1 if the host country is a member of the European Union and a value of 0 otherwise. FTA: a dummy variable that takes the value of 1 if the U.S.A and the host country have a Free Trade Agreement in force and zero otherwise. BIT: a binary indicator with the value of 1 if the host country has a Bilateral Investment treaty in force with the U.S.A. and zero otherwise.

The source of for all variables, except BIT that came from the UNCTAD is the Dynamic Gravity Dataset (DGD) of the USITC's Gravity Portal (Gurevich and Herman, 2018).

5 Main Empirical Results: U.S. Bilateral Outward Phantom FDI

Table 3 presents gravity-equation coefficient estimates for various measures of U.S. outward FDI activity based upon estimation of equation (4). These various measures of FDI serve as the dependent variables. Each column represents a different FDI measure: number of affiliates, revenues, total assets, fixed assets, tangible fixed assets, and intangible fixed assets. The right-hand-side (RHS) variables include the standard gravity-model independent variables described earlier.

Table 3: Gravity-Equation Coefficient Estimates (U.S. Bilateral Outward FDI)

	(1) Affiliates	(2) Revenues	(3) Total assets	(4) Fixed assets	(5) Tangible fixed	(6) Intangible fixed
lnGDP (destination)	0.7057***	0.7360***	0.4822***	0.2185	0.4754***	0.4717**
	(0.09)	(0.10)	(0.17)	(0.21)	(0.18)	(0.22)
lnDistance	0.0019	0.6906	-0.1522	0.0456	-0.1732	-0.0281
	(0.47)	(0.62)	(0.54)	(0.87)	(0.45)	(0.78)
Island	0.0418	0.1285	1.3039**	-0.2371	0.8254	-0.1861
	(0.31)	(0.54)	(0.59)	(0.84)	(0.52)	(0.98)
Landlocked	0.6787	-0.3597	1.0477	0.9494	-1.7743	-0.5926
	(0.43)	(0.63)	(0.88)	(0.92)	(1.11)	(0.83)
Common Legal Origin	1.0951***	0.6388	0.8742	2.1177**	0.2886	-0.2981
	(0.40)	(0.73)	(0.97)	(1.01)	(0.68)	(1.22)
Common Language	0.3062	0.0647	-0.1205	-0.0551	-1.2690	1.8468*
	(0.34)	(0.49)	(0.92)	(0.99)	(0.95)	(0.96)
WTO member	0.7498	0.0087	-0.3465	-0.0137	0.0896	-2.2579**
	(0.86)	(0.88)	(1.01)	(0.95)	(1.04)	(1.11)
EU member	1.6983***	1.8268***	2.5764***	4.1878***	2.8493***	4.5283***
	(0.32)	(0.34)	(0.50)	(0.81)	(0.62)	(0.81)
FTA	0.4875	1.4415*	1.7662**	3.2050**	2.5970***	2.9064***
	(0.75)	(0.81)	(0.74)	(1.25)	(0.72)	(1.04)
BIT	-0.3432	-1.1001***	-2.8495***	-3.7125***	-2.3713**	-3.0056***
	(0.33)	(0.42)	(0.71)	(0.77)	(1.00)	(0.69)
Observations	111	111	111	111	111	111
R^2	0.808	0.737	0.729	0.638	0.554	0.619

Robust US outward FDI, year 2019

PPML, Robust standard errors in (), clustured by country pair

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

GDP of the destination country has a positive and statistically significant effect in all but one specification, suggesting that U.S. outward FDI tends to flow to larger economies, consistent with our theoretical foundations. Interestingly, the coefficient estimate for distance is insignificant, which is uncommon for most gravity-equation coefficient estimates. However, this is explained by the presence of numerous binary RHS variables reflecting "policy" connections. In particular, the coefficient estimate for whether destination country j is a member of the European Union (EU) is highly correlated with the distance variable. In the Appendix, we show that exclusion of policy-related bilateral variables restores the distance coefficient estimate to standard negative values. This multicollinearity bias is not a concern for our purposes, since our focus is only on the "predicted" FDI value (or potential FDI). As shown in Appendix Table 7, the correlation coefficient between the predicted values of the two specifications, for each of the six measures of activity, is 0.999. We will also see later in the second robustness analysis that distance will have the expected negative effect with a larger cross-section. Common legal origin has a large, positive, and statistically significant effect on FDI measures, as does the membership of the destination country in the EU. Common membership in an economic integration agreement (FTA) has a significant effect; in many FTAs, investment provisions can positively affect bilateral FDI. The negative and statistically significant effects of bilateral investment treaties (BITs) is likely attributable here to the selection into BITs of home countries into host countries with weak institutional protections, and associated low levels of FDI (such as many developing countries). The relatively high R^2 values across specifications indicate that the model explains a substantial portion of the variance in U.S. FDI flows across destination countries.

The results of applying our methodology to identify bilateral outward phantom FDI for U.S. MNEs in foreign countries are summarized in two figures below. Figure 6 reports the value of U.S. outward phantom FDI based upon our model.

Figure 3 reports the FDI "ratios" identified using equation (6). Both figures report the results for the numbers of affiliates, revenues, total assets, fixed assets, tangible fixed assets, and intangible fixed assets for foreign affiliates of U.S. GUOs.

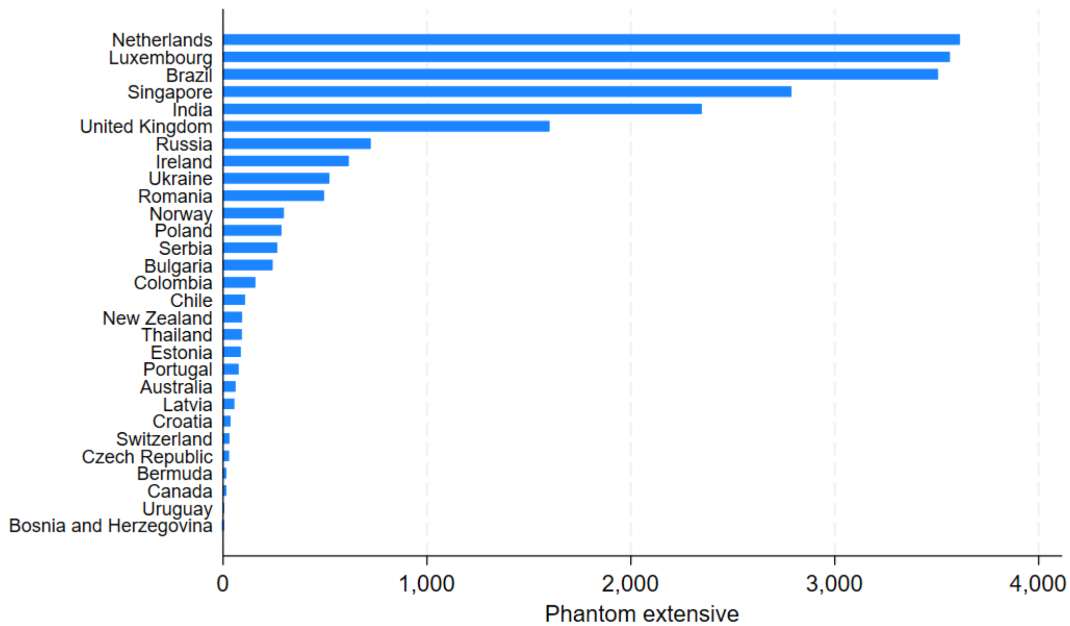
We focus first on Figure 6. Regarding the number of affiliates in Figure 6a, the Netherlands, Luxembourg, Brazil, Singapore and India lead the ranking of phantom outward FDI for the United States. For the first three countries, actual FDI exceeds potential FDI by more than 3,000 affiliates. Note that Ukraine occupies the 9th place, with around 500 more American affiliates than expected.

The values of U.S. outward phantom revenues (Figure 6b), total assets (Figure 6c), fixed assets (Figure 6d), tangible fixed assets (Figure 6e) and intangible fixed assets (Figure 6f) reveal noteworthy characteristics. Phantom FDI revenues from American affiliates abroad is highest in Singapore, Ireland, Netherlands, and Luxembourg. American foreign affiliates' revenues in Singapore exceeds by 400,000 USD million that predicted by the gravity equation. The same countries lead the ranking of phantom FDI for total and fixed assets (Luxembourg, Netherlands, Ireland, and Singapore, in that order for both assets). Tangible fixed assets are dominated by the Netherlands, which has phantom FDI of 800,000 USD million. On the other hand, intangible fixed assets are estimated to be dominated by Ireland, with more than 250,000 USD million in phantom FDI, followed at a large distance by Singapore, Netherlands, Australia, Luxembourg, and Bermuda.

Table 4 provides values of the total FDI and the phantom FDI linked to U.S. foreign affiliates. The table showcases different FDI components, including numbers of affiliates, revenues, total assets, fixed assets, tangible fixed assets, and intangible fixed assets. The first row reports the total FDI across these categories. For instance, U.S. affiliates collectively represent 21,922 units, with total revenues of $1,598,620 million and total assets of $7,993,015 million. Among these assets, $5,265,061 million are fixed assets, while tangible and intangible fixed assets account for $1,098,080

Figure 2: USA's Outward Phantom FDI

(a) Number Affiliates



(b) Revenue from affiliates

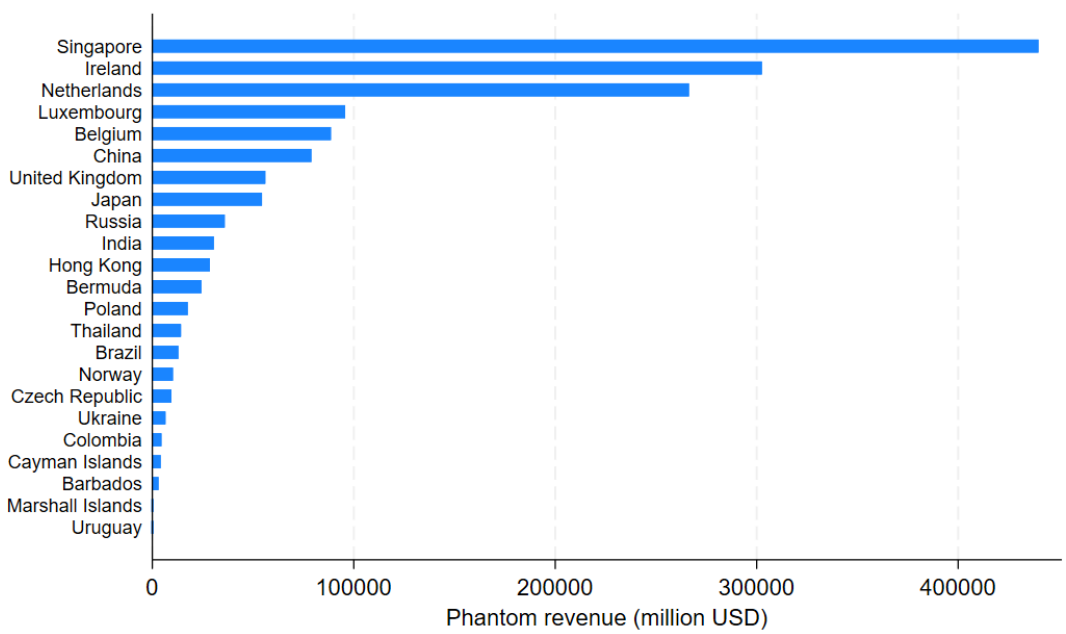
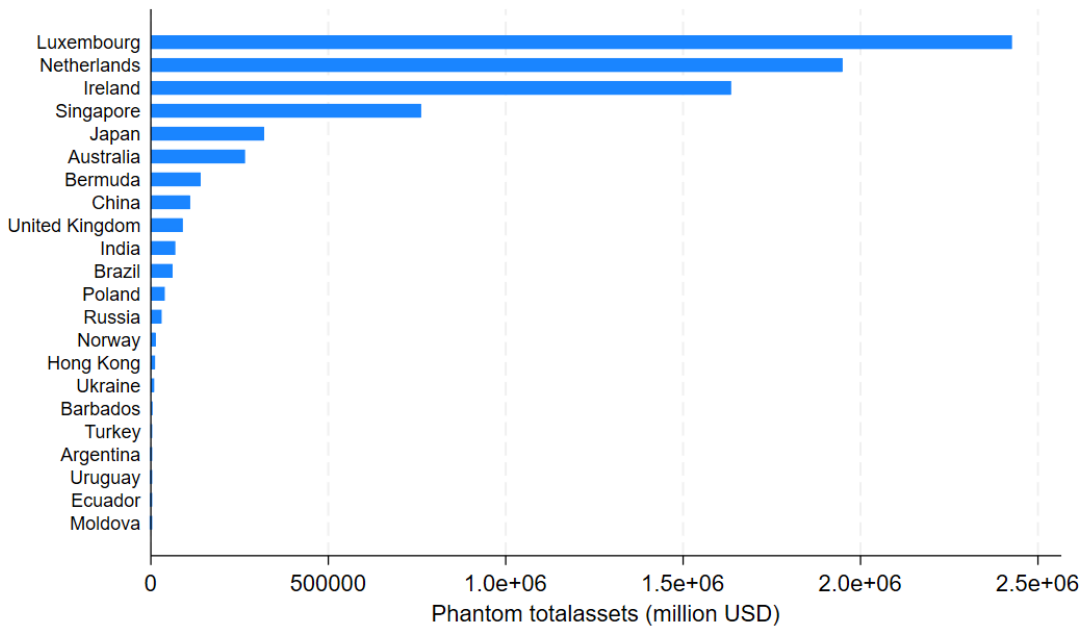


Figure 2: USA's Outward Phantom FDI (cont.)

(c) Total Assets



(d) Fixed Assets

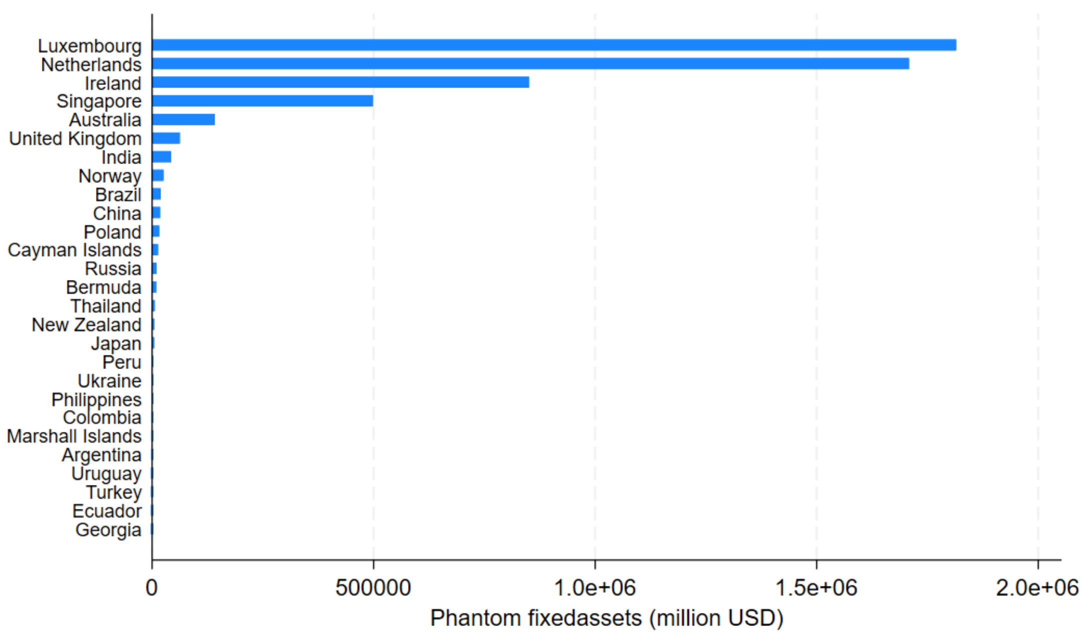
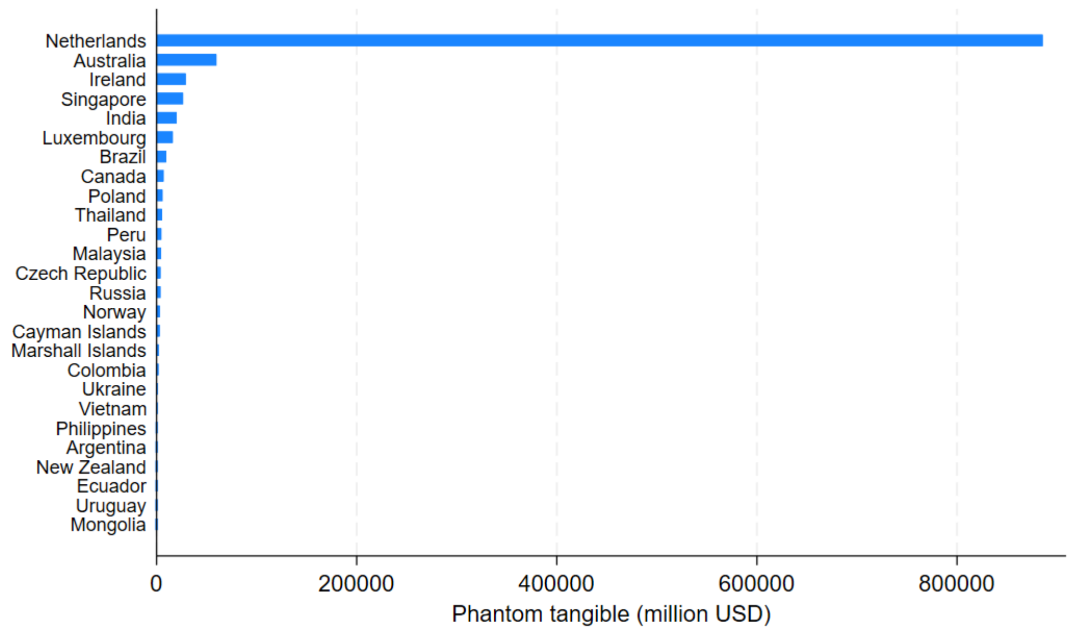


Figure 2: USA's Outward Phantom FDI (cont.)

(e) Tangible Fixed Assets



(f) Intangible Fixed Assets

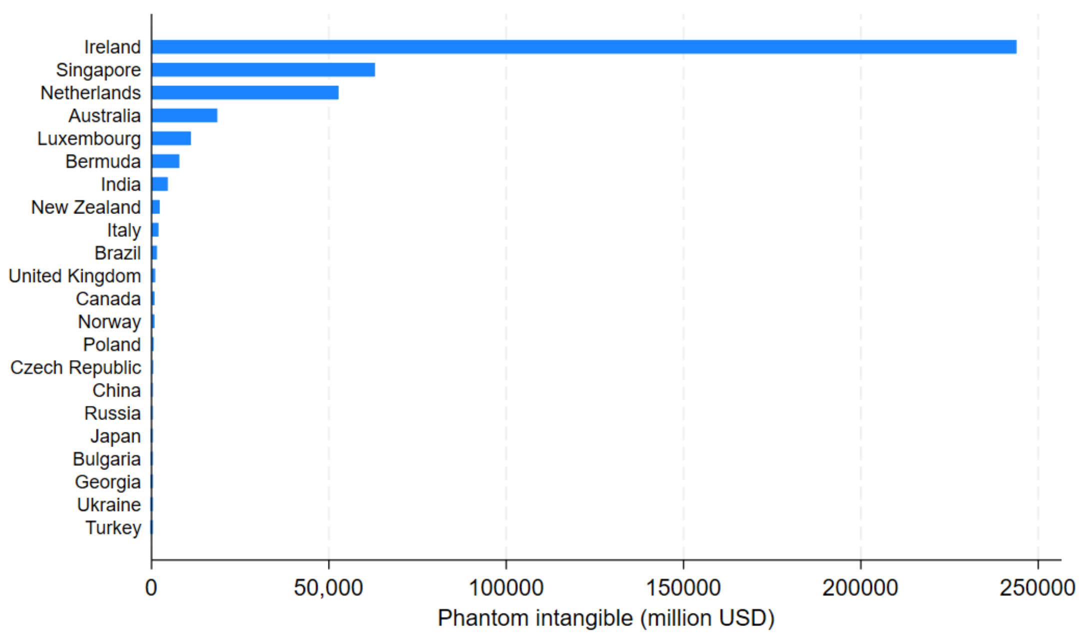


Table 4: Quantification (USA)

	Affiliates	Revenue	Total Assets	Fixed Assets	Tangible	Intangible
Phantom FDI	21,922	1,598,620	7,993,015	5,265,061	1,098,080	411,904
Total FDI	90,213					
Phantom FDI/Total FDI	0.243	0.322	0.366	0.501	0.597	0.535

Notes: Affiliates: number of foreign affiliates. Rest of variables in million USD

million and $411,904 million, respectively.

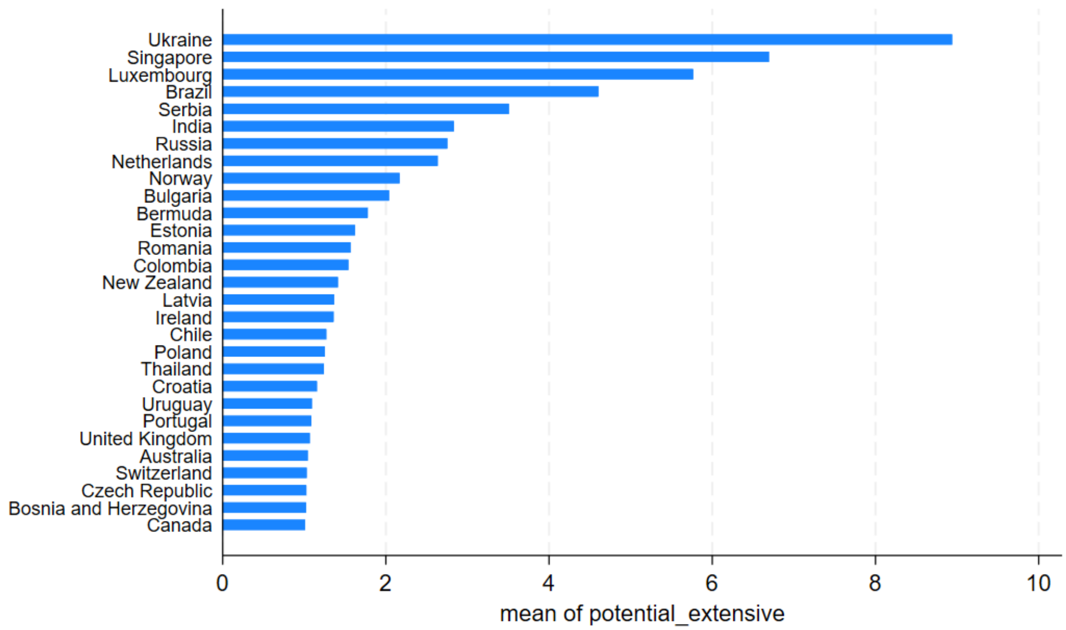
The second row highlights the substantial portion of FDI classified as phantom. The values for phantom FDI in revenues are similar to those reported by Guvenen et al. (2022). The bottom row of the table provides the shares of total FDI that we estimated as phantom FDI. Phantom FDI constitutes a significant share of total FDI across various categories, notably making up 36.6% of total assets, 50.1% of fixed assets, and an even higher proportion of tangible (59.7%) and intangible (53.5%) assets. These figures underscore the pervasive influence of phantom FDI within U.S. outward foreign direct investment, reflecting both tax-motivated structures and strategic financial positioning.

Figure 3 reports the "FDI ratios" for U.S. outward FDI. The ranking and ratios obtained for the number of affiliates in Figure 3a are in line with economic intuition. Ukraine, Singapore, and Luxembourg lead the ranking of the ratio of US foreign affiliates. The number of foreign affiliates in Ukraine, Singapore, and Luxembourg is 9, 7, and 6 times higher than expected from theory, respectively.

U.S. FDI ratios of revenues (Figure 3b), total assets (Figure 3c), fixed assets (Figure 3d), tangible fixed assets (Figure 3e) and intangible fixed assets (Figure 3f) reveal interesting characteristics. Bermuda, Barbados, Luxembourg, Singapore, Ireland, Ukraine, the Cayman Islands, and Russia lead the ranking of FDI ratios for revenues. All these countries have been categorized as tax havens or have beneficial corporate tax conditions. The revenues obtained by American affiliates in Bermuda are nearly 20 times higher than predicted by theory. In the rest of the leading

Figure 3: USA's FDI ratios ($FDI^{Ratio} > 1$)

(a) Number Affiliates



(b) Revenue from affiliates

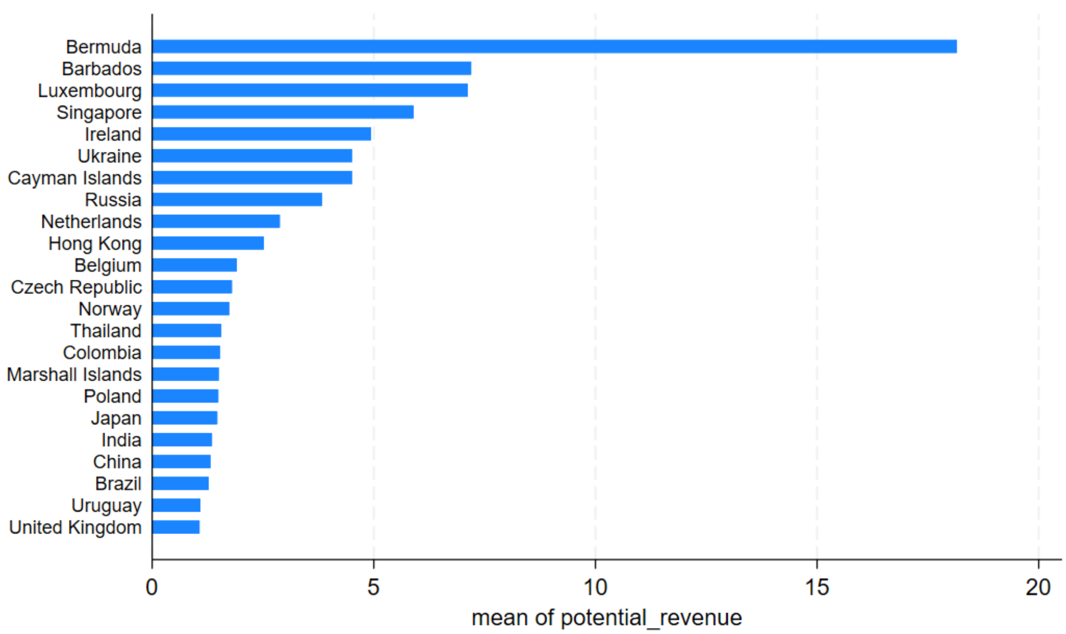
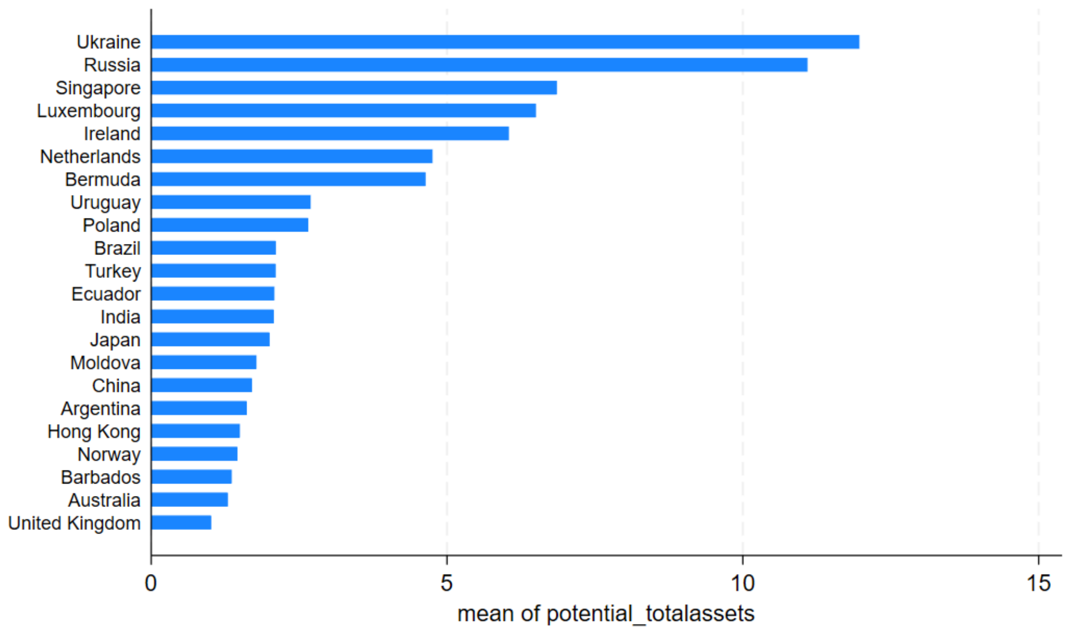


Figure 3: USA's FDI ratios ($FDI^{Ratio} > 1$) (cont.)

(c) Total Assets



(d) Fixed Assets

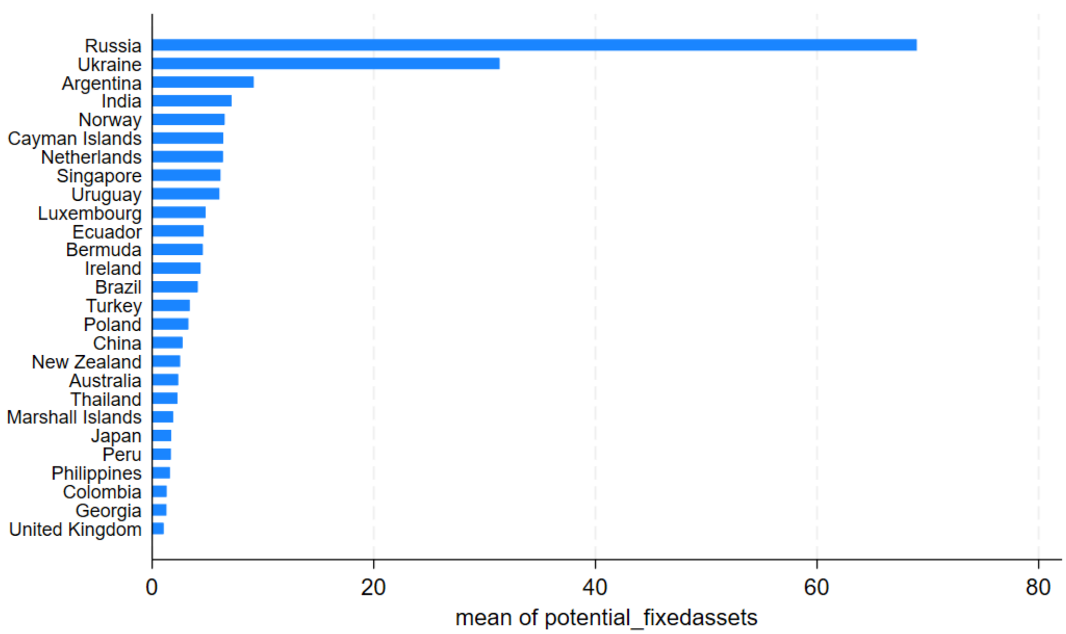
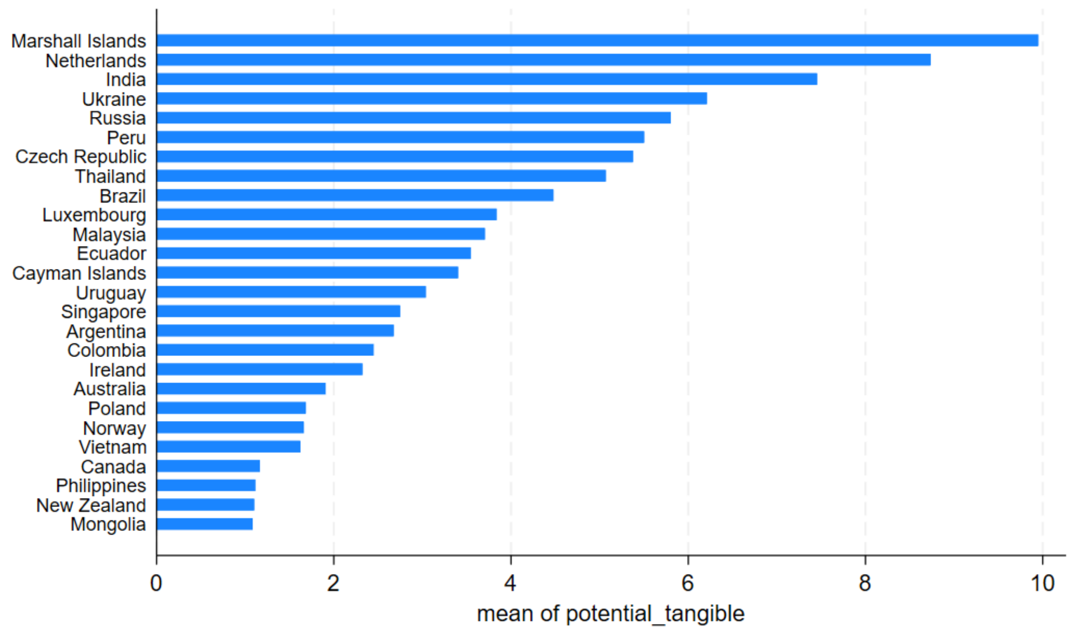
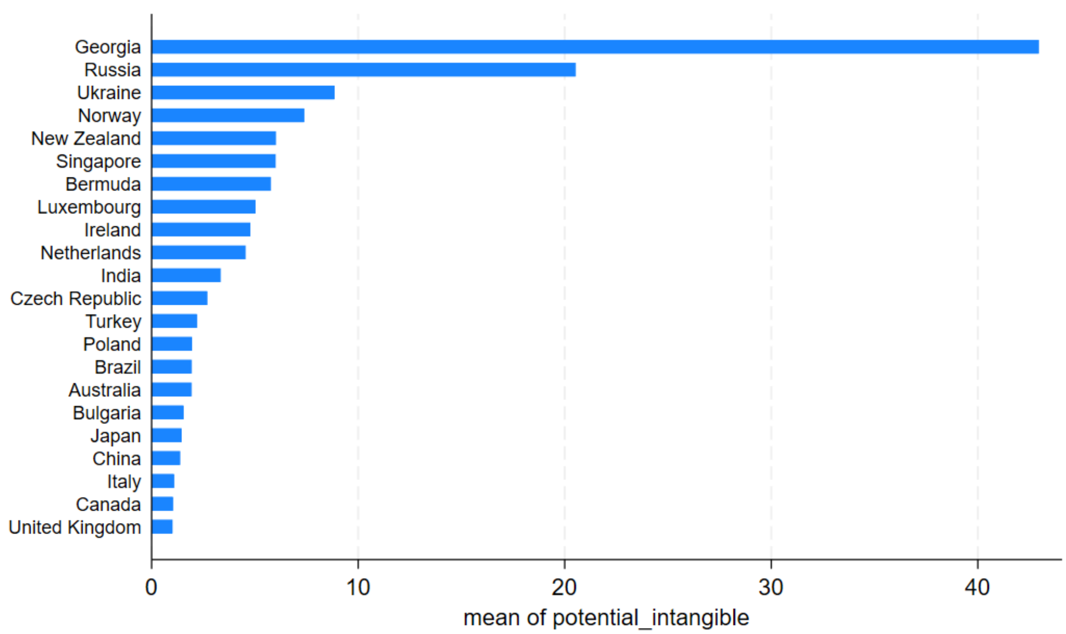


Figure 3: USA's FDI ratios ($FDI^{Ratio} > 1$) (cont.)

(e) Tangible Fixed Assets



(f) Intangible Fixed Assets



countries, US affiliates have around five times higher revenues than expected.

The same countries lead the ranking of total assets (Ukraine, Russia, Singapore, Luxembourg, Ireland) with actual FDI values more than ten times than expected for the two leading countries. Fixed assets are led by Russia, with an actual value of more than 60 times than expected, followed by Ukraine (nearly $\times 40$ times). The rest of the countries in the ranking show much lower ratios regarding fixed assets.

The ranking of FDI ratios of tangible fixed assets is led by the Marshall Islands, followed by the Netherlands, India, Ukraine, and Russia. Another former Soviet Republic, Georgia, leads the intangible asset ranking, followed by Russia, Ukraine and Norway.

The analysis of FDI ratios using our model reveals several important findings regarding the locations where U.S. outward FDI is directed, particularly concerning tax havens and the strategic factors influencing investment flows. First, gravity models successfully identify traditional tax havens such as Bermuda, the Cayman Islands, Barbados, Luxembourg, Singapore, and the Marshall Islands as key destinations for revenue-related FDI. These locations are known for their favorable tax regimes, attracting investments aimed at maximizing profit through tax minimization strategies.

Moreover, when examining the distribution of FDI based on the number of affiliates, total assets, and fixed assets, the data suggest that geo-strategic risks play a significant role. For instance, countries like Ukraine, especially in politically uncertain periods such as 2019, emerge as important considerations for multinational firms. These firms may be motivated by proximity to markets or natural resources but must weigh these benefits against the risks posed by political instability or geopolitical tensions.

The findings regarding tangible fixed assets highlight a diverse set of motivations for FDI. While tax havens continue attracting investment, countries with favorable holding laws, such as the Netherlands, stand out as major destinations. This reflects the importance of tax considerations and the regulatory and legal environment facilitating holding structures, allowing firms to manage their global assets efficiently.

Finally, investments in intangible fixed assets, such as intellectual property, show a complex pattern driven by a mix of political risk and tax considerations. Countries like Russia and Georgia, with higher political risks, attract FDI in intangibles, possibly due to strategic positioning or market potential. Overall, the results of our analysis for U.S. affiliates suggest that most conduit FDI of American affiliates is channeled through the area of Russian influence, as well as tax havens. At the same time, Ireland's tax-friendly policies and traditional tax havens like Bermuda continue to draw intangible investments, emphasizing the role of tax optimization in shaping FDI flows in this category.

6 Robustness

6.1 Robustness 1: Production-Function Approach for USA

The results obtained with the production-function approach reported in Figure 4 are qualitatively and quantitatively similar to those obtained with the gravity-equation approach in section 5. Singapore and Ireland are the leading countries in both cases. The gravity-equation approach seems more conservative regarding Singapore's phantom FDI. The robustness result indicates that American affiliates' actual revenues in Singapore exceed by more than 500,000 USD million the predicted revenues, with the gravity-equation estimate at around 450,000 USD million.

Figure 4: Phantom Revenues (Production-Function Approach)

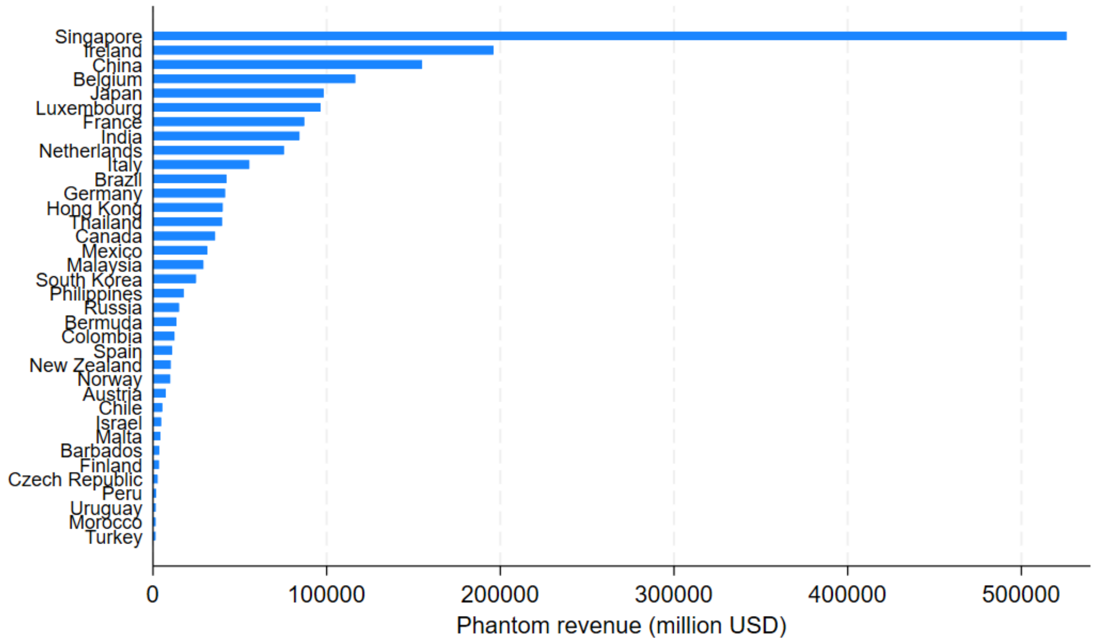


Table 5 quantifies the total revenues from all destinations using the production-function approach and compares the results to those obtained earlier with the gravity-equation approach in section 5. The results confirm that the gravity-equation outcomes are similar, but lower, than those using the production-function approach. The table illustrates that while the total revenue estimates from the production-function approach ($1,906,369 million) are higher than those from the gravity-equation approach ($1,598,620 million), the two methods yield broadly similar outcomes. Notably, the share of phantom FDI, as estimated by the production-function approach (38.4%), is higher compared to the gravity-equation approach (32.2%), confirming the robustness of the gravity model's ability to detect phantom FDI, albeit with slightly more conservative estimates. Another advantage of the gravity approach is that is does not need to chose a parameter to calibrate the function and that it can be applied to many forms of FDI.

Table 5: USA: Gravity-Equation vs. Production-Function Approaches

	Revenues (Gravity)	Revenues (Production Function)
Total FDI	1,598,620	1,906,369
Phantom FDI	514,755	732,045
Phantom FDI Fraction	0.322	0.384

Million USD

6.2 Robustness 2: Inward Multilateral Phantom FDI for Non-U.S. Countries

Section 3 described the methodology for estimating inward multilateral phantom FDI for non-U.S. countries using the gravity equation for a much larger cross-section sample. Table 6 presents the gravity-equation coefficient estimates for various independent variables across six specifications. Each column corresponds to a different outcome variable: number of affiliates, revenues, fixed assets, tangible fixed assets, and intangible fixed assets. The independent variables of interest include traditional gravity model components like geographic distance, commom legal origin, contiguity, colonial history, free trade agreements, and bilateral investment treaties.

The coefficient estimates for distance are negative and statistically significant across all specifications, indicating that greater geographic distance reduces FDI, consistent with the predictions of the gravity model. Contiguity, colonial history, and shared legal origin display various relationships across the dependent variables, with most being positive (as expected). Notably, the variable capturing colonial history has a strong positive impact on tangible fixed assets, suggesting that historical ties may influence specific types of capital allocation.[9] In these results, only fixed asset investments have a statistically significant relationsip with the FTA variable, and it

[9]Note that the variables included in Table 6 are slightly different from those in Table 3 because the host and home country fixed effects are collinear with country-specific variables island and landlocked.

Table 6: Gravity-Equation Coefficient Estimates (All Countries)

	(1) Affiliates	(2) Revenues	(3) Total assets	(4) Fixed assets	(5) Tangible fixed	(6) Intangible fixed
lnDistance	-0.5761***	-0.4003***	-0.3754***	-0.4862***	-0.3703***	-0.3063*
	(0.05)	(0.05)	(0.10)	(0.09)	(0.08)	(0.16)
Common Legal Origin	0.3707**	0.2911	0.3936*	-0.0850	-0.4595	1.2459***
	(0.17)	(0.20)	(0.23)	(0.25)	(0.31)	(0.33)
Contiguity	0.5557***	0.2581	0.4727*	0.0964	0.6769***	-0.0637
	(0.11)	(0.17)	(0.27)	(0.27)	(0.24)	(0.34)
Colony	0.4113***	0.5161***	0.2472	0.1018	1.3021***	-0.4863
	(0.15)	(0.20)	(0.22)	(0.25)	(0.27)	(0.37)
FTA	-0.1139	0.0573	-0.0608	-0.4031*	0.0830	-0.2357
	(0.13)	(0.14)	(0.18)	(0.21)	(0.16)	(0.34)
BIT	0.0035	-0.2467	-0.2502	-0.0572	-0.0187	0.2454
	(0.15)	(0.18)	(0.22)	(0.17)	(0.16)	(0.31)
Observations	3225	3225	3225	3135	3135	3077
R^2	0.888	0.825	0.838	0.883	0.824	0.781

PPML, Robust standard errors in (), clustured by country pair

Cross section, year 2019. Origin and destination country fixed effects included

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

is negative.[10]

The results of applying our gravity-equation methodology to identify phantom FDI on a global scale are reported in Figure 5, which contains the results for the numbers of affiliates, revenues, total assets, fixed assets, tangible fixed assets, and intangible fixed assets.

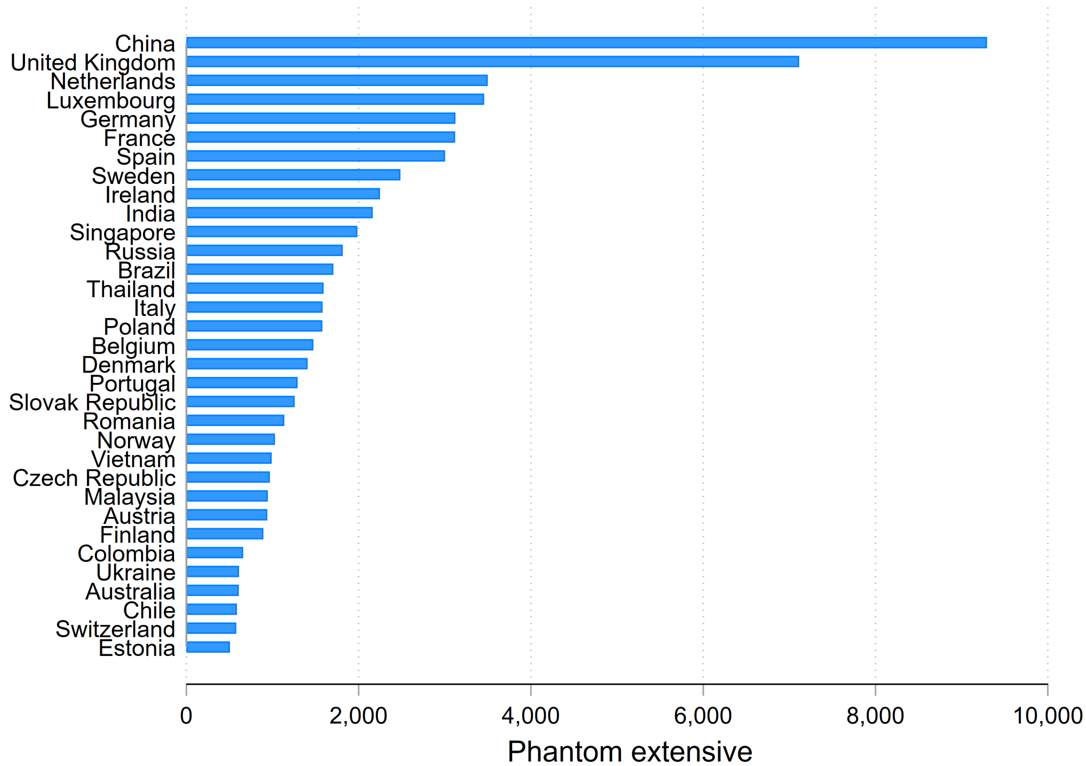
Figure 5 reports the inward multilateral phantom FDI for numerous non-U.S. countries. Regarding the number of affiliates in Figure 5a, China (1st), United Kingdom (2nd), and Netherlands (3rd) lead the ranking of the phantom FDI. The value of phantom FDI suggests, for instance, that the number of foreign affiliates in China exceeds by more than 9,000 affiliates the predicted theoretical value obtained from the gravity equation. However, the value of the phantom FDI is *not* a ratio;

[10]For more evidence of FTAs having negative effects on FDI, see Bergstrand and Egger (2007) and Bergstrand and Paniagua (2024).

thus, small countries are weighted relatively less with this approach.

Figure 5: Inward Phantom FDI of Non-U.S. Countries, 2019

(a) Number Affiliates



(b) Revenue from affiliates

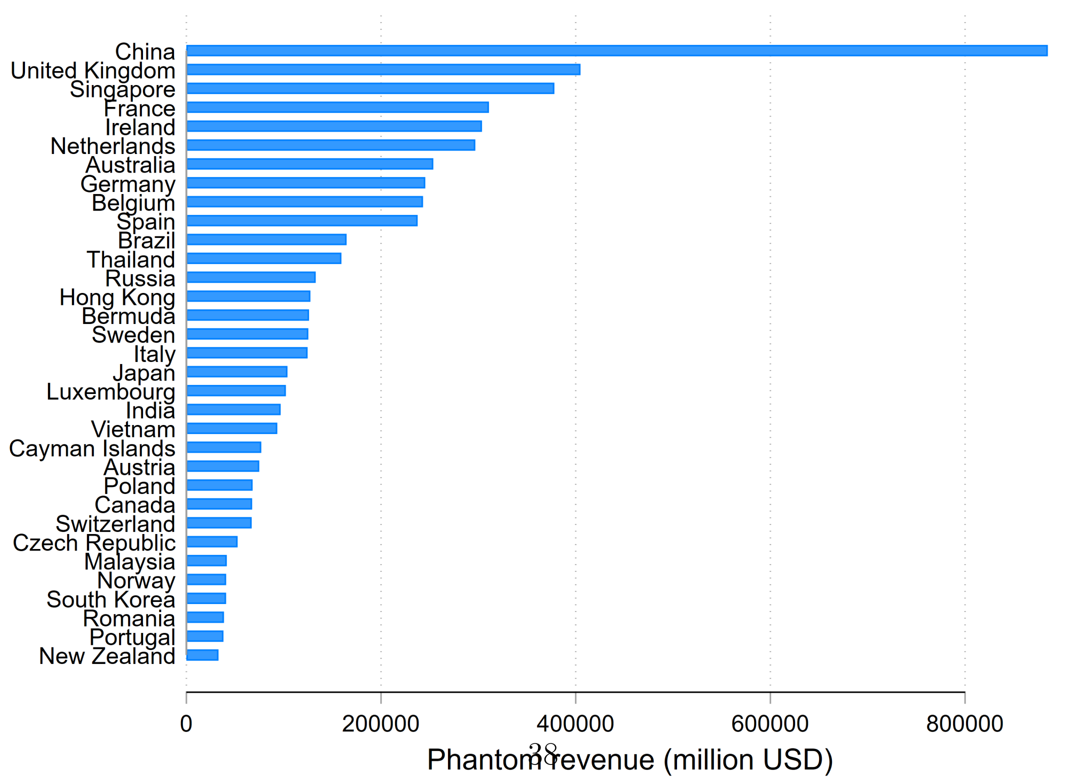
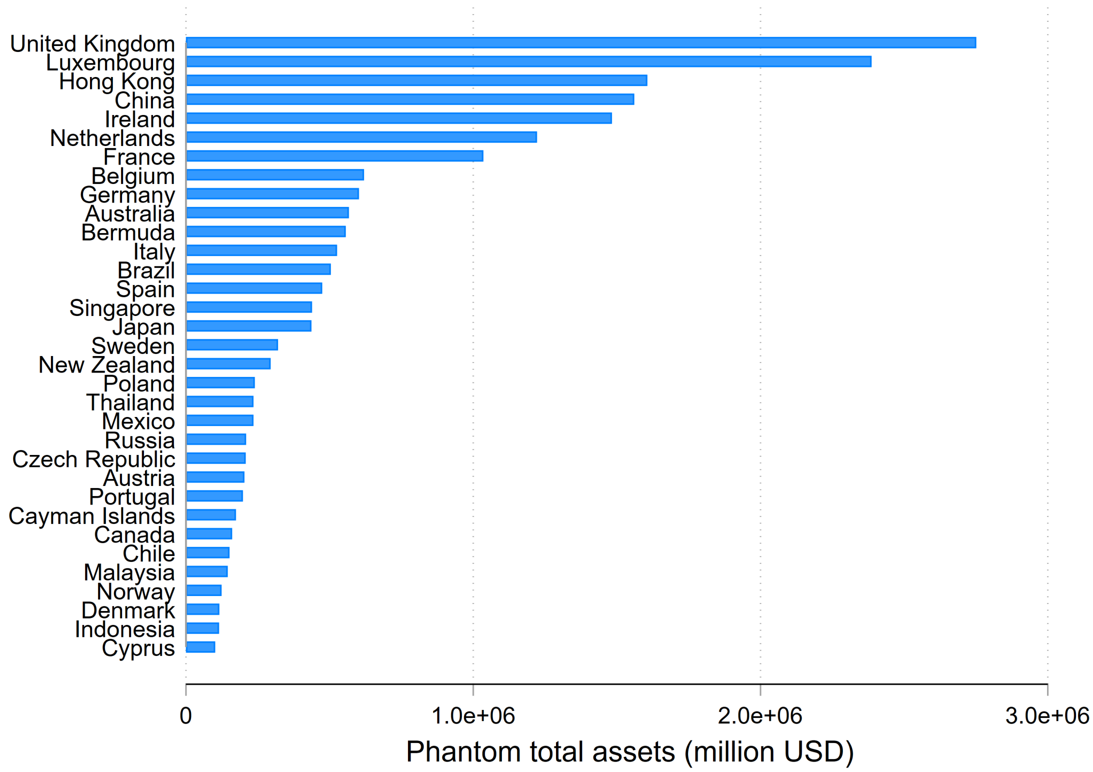


Figure 5: Inward Phantom FDI of Non-U.S. Countries, 2019 (cont.)

(c) Total Assets



(d) Fixed Assets

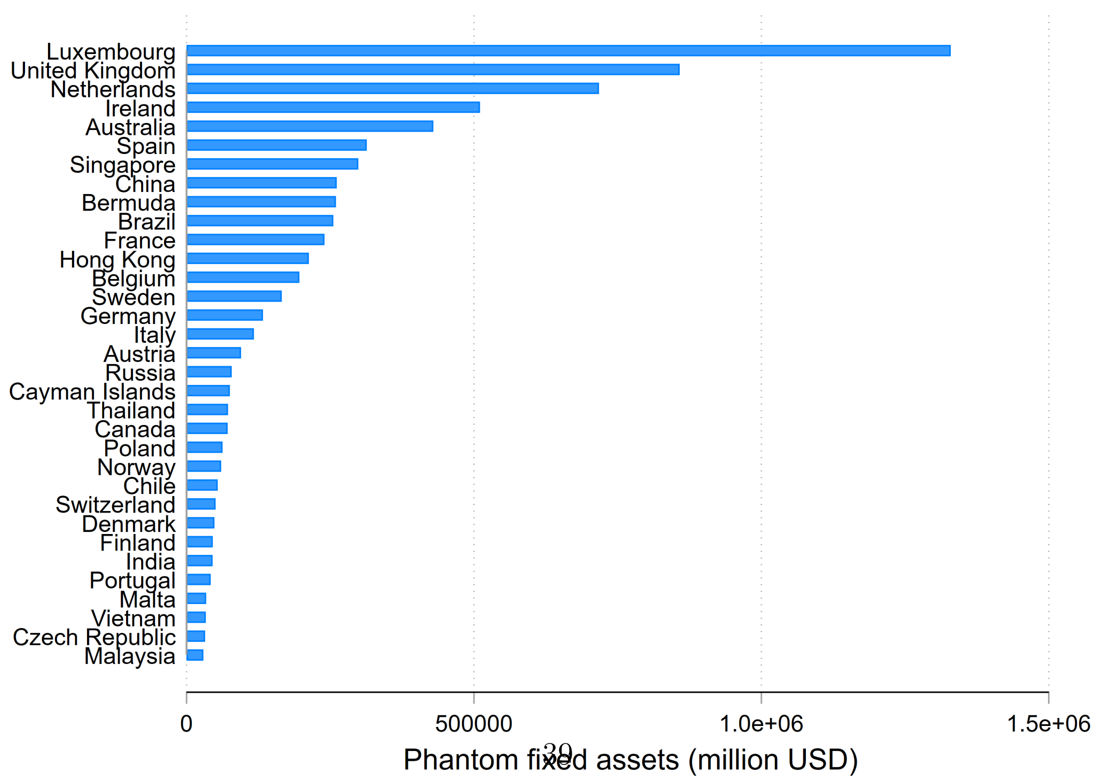
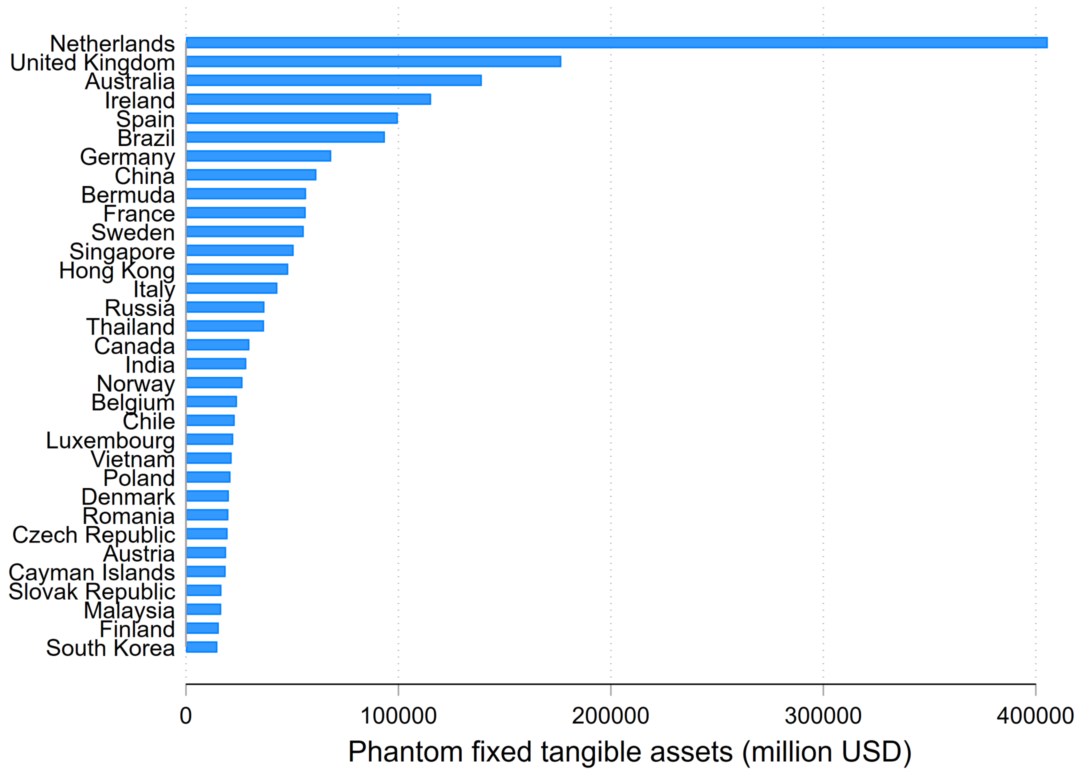
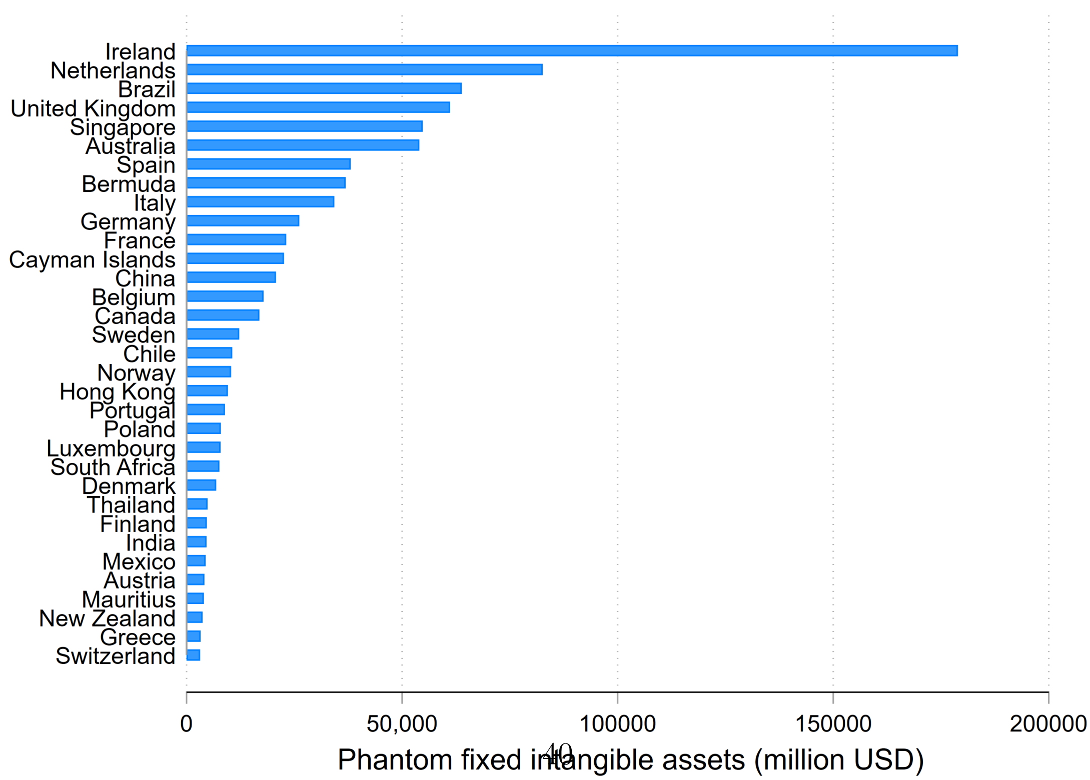


Figure 5: Inward Phantom FDI of Non-U.S. Countries, 2019 (cont.)

(e) Tangible Fixed Assets



(f) Inangible Fixed Assets



The value of phantom FDI of revenues (Figure 5b), total assets (Figure 5c), fixed assets (Figure 5d), tangible fixed assets (Figure 5e) and intangible fixed assets (Figure 5f) show a different picture from the rankings in Figure 5a. China is followed by United Kingdom, Singapore, France and Irelamd in the ranking of phantom FDI by revenues. The revenues of non-U.S. foreign affiliates in China exceed the FDI potential by 800,000 million USD. The United Kingdom, Luxembourg, Hong Kong and China lead the rankings in total assets, and Luxembourg, IK and Netherlands in fixed assets. Netherlands, the UK, and Australia lead the tangible fixed asset ranking. Ireland, Netherlands and Brazil lead the ranking using fixed inatangible assets.

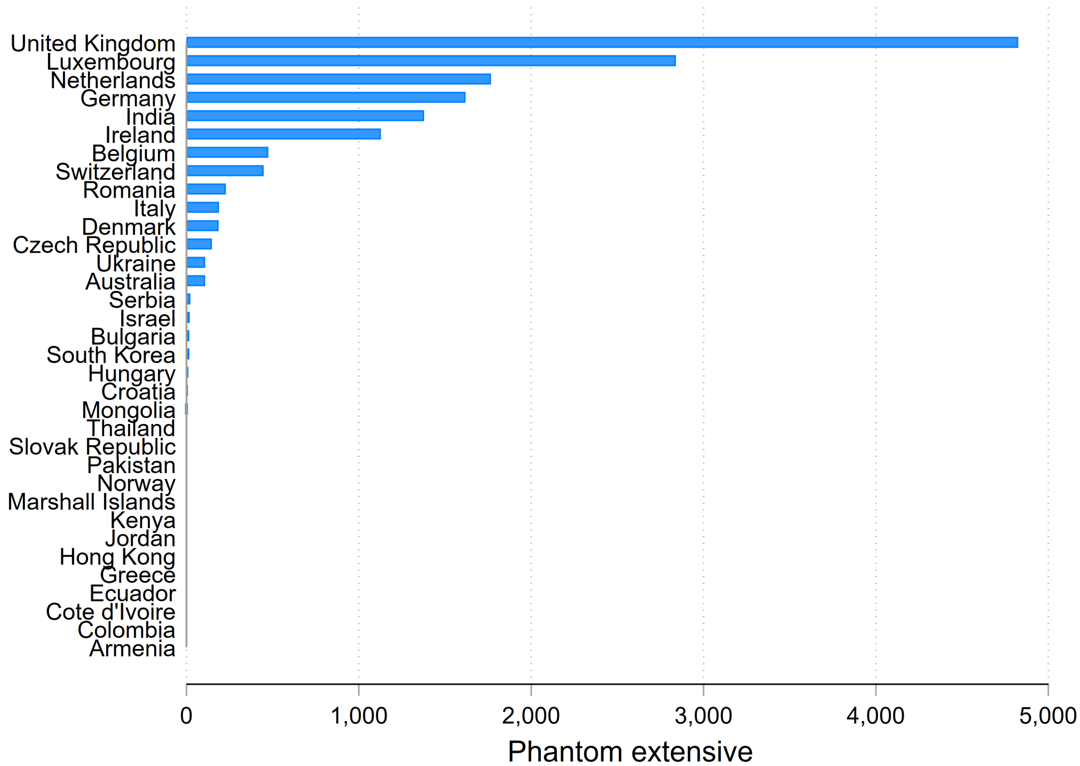
Table 7: Quantification (All countries)

	Affiliates	Revenue	Total Assets	Fixed Assets	Tangible	Intangible
Total FDI						
Phantom FDI						
Phantom FDI/Total FDI	0.228	0.323	0.349	0.285	0.359	0.451

Notes: Affiliates: number of foreign affiliates. Rest of variables in million USD

Figure 6: USA's Outward Phantom FDI (all countries)

(a) Number Affiliates



(b) Revenue from affiliates

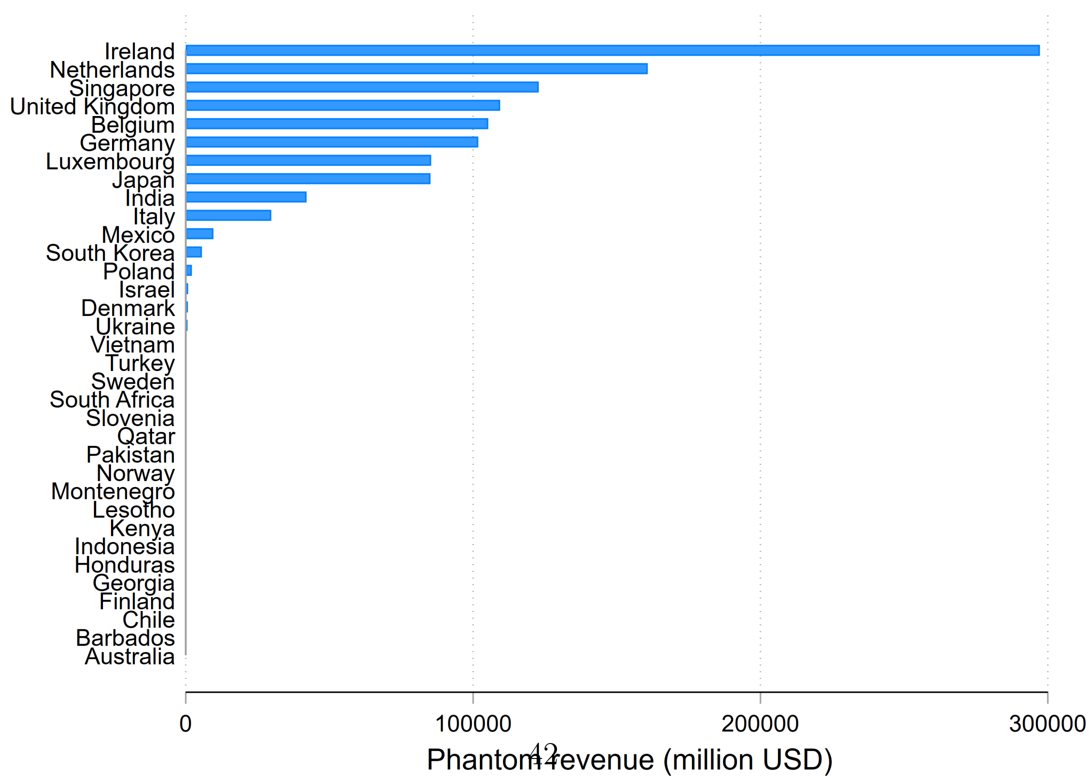
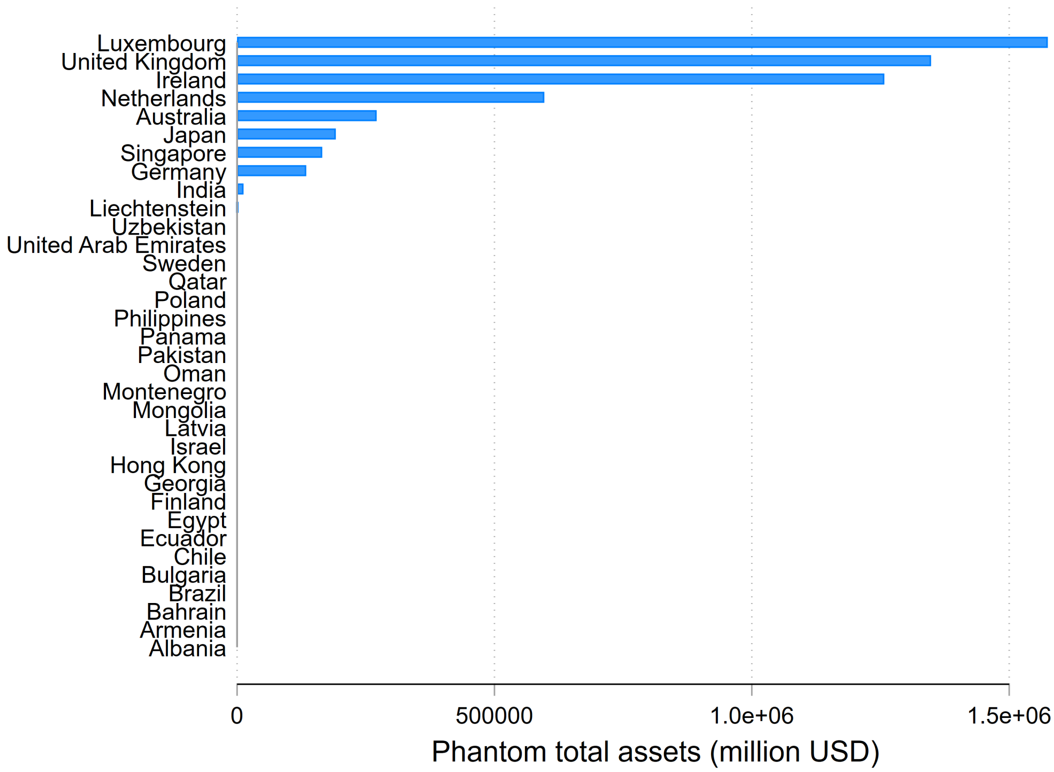


Figure 6: USA's Outward Phantom FDI (cont.)

(c) Total Assets



(d) Fixed Assets

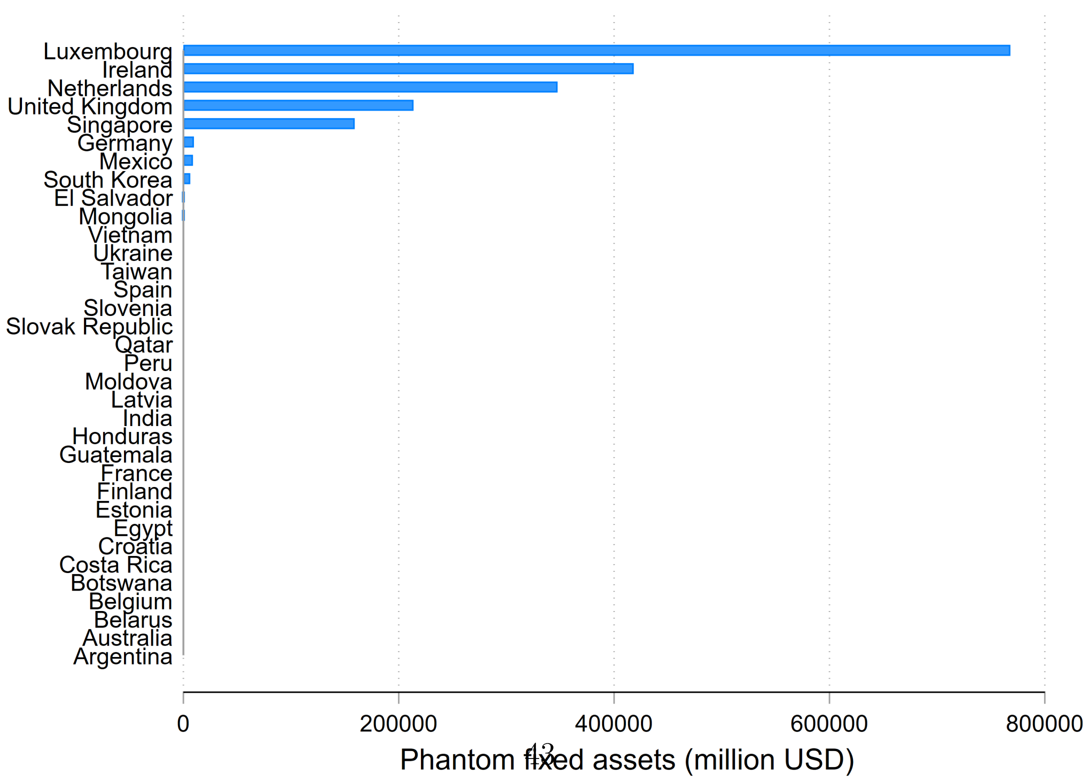
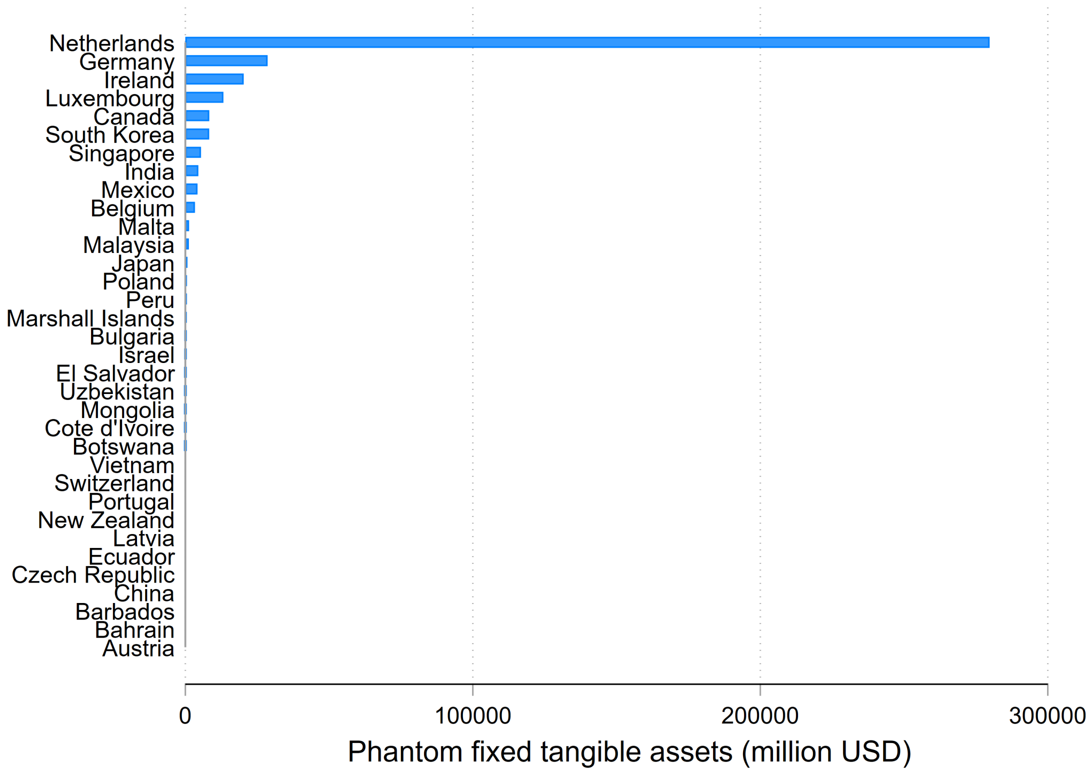


Figure 6: USA's Outward Phantom FDI (cont.)

(e) Tangible Fixed Assets



(f) Intangible Fixed Assets

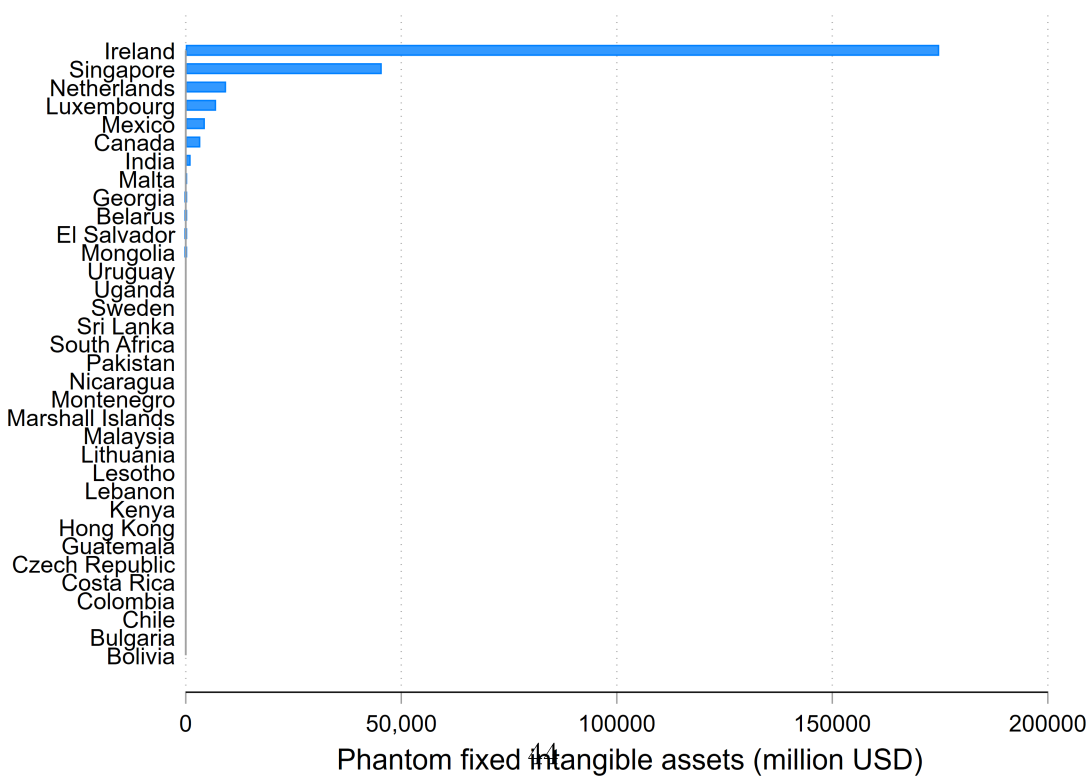


Table 8: Quantification (USA using all countries)

	Affiliates	Revenue	Total Assets	Fixed Assets	Tangible	Intangible
Total FDI						
Phantom FDI						
Phantom FDI/Total FDI	0.178	0.233	0.254	0.184	0.207	0.320

Notes: Affiliates: number of foreign affiliates. Rest of variables in million USD

7 Conclusions

Summarizing, this paper contributes to the literature on foreign direct investment (FDI) by applying the gravity equation to identify and quantify the presence of phantom FDI, which refers to investment flows motivated by tax avoidance rather than genuinely "productive" economic activity. Our findings demonstrate that the gravity-equation approach identifies several key tax havens, such as Bermuda, the Cayman Islands, Barbados, Luxembourg, Singapore, and the Marshall Islands, particularly in the context of revenues. Furthermore, the analysis reveals that geostrategic risks, as present in countries like Ukraine, play a significant role in shaping FDI flows related to numbers of affiliates, total assets, and fixed assets. This underscores the importance of political and geographical considerations in addition to tax factors.

Moreover, the results indicate that tangible fixed assets are influenced by a mix of tax advantages, geo-strategic factors, and favorable holding laws, with the Netherlands standing out as a key destination. Intangible assets, meanwhile, are driven by political risks (e.g., Russia and Georgia), tax-friendly policies (e.g., Ireland), and traditional tax havens (e.g., Bermuda), highlighting the diverse factors influencing these investment decisions.

Overall, this study suggests that the gravity-equation framework – founded upon well established theoretical foundations – is useful in identifying phantom FDI flows. This provides a valuable framework for policymakers and researchers to better understand the underlying drivers of FDI and the potential distortions caused by tax-avoidance and related strategies.

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A Sensitivity Analysis

The coefficient estimates of the policy variables reported in Table 3 might be biased, as this cross-section analysis does not control adequately for endogeneity bias, cf., Baier and Bergstrand (2007). However, the aim of this analysis is to predict accurately FDI, rather than to estimate unbiased effects of policy interventions. Nonetheless, as a sensitivity analysis, we provide here the gravity-equation estimates for U.S. outward FDI *without* the potentially endogenous policy-related variables. As shown in the bottom panel of Table 9, the predicted values of FDI from both specifications are highly correlated for all six values of the dependent variable (0.9999). Consequently, comparison of the results reported in Table 3 and those reported in

Table 9: Sensitivity Analysis: Restricted Model and Correlations

	(1) Affiliates	(2) Revenues	(3) Total assets	(4) Fixed assets	(5) Tangible fixed	(6) Intangible fixed
lnGDP	0.7053***	0.7324***	0.5847***	0.4791***	0.5517***	0.5758***
	(0.10)	(0.08)	(0.11)	(0.11)	(0.11)	(0.10)
lnDistance	-0.7471**	-0.2782	-1.0589**	-1.3208*	-1.2253	-0.6463*
	(0.35)	(0.45)	(0.49)	(0.70)	(0.80)	(0.35)
Island	0.2444	0.3634	1.2606**	0.5775	0.2974	0.2631
	(0.46)	(0.34)	(0.50)	(0.59)	(0.96)	(0.58)
Landlocked	0.7064	-0.4498	1.2063	1.3012	-1.6339	-1.0213
	(0.46)	(0.68)	(0.92)	(0.95)	(1.01)	(0.97)
Common Legal Origin	1.9260***	0.9659**	1.8395***	2.3577***	1.3562	0.4432
	(0.49)	(0.42)	(0.66)	(0.90)	(1.26)	(0.54)
Common Language	-0.3969	-0.0787	-0.5662	-1.0605	-1.5025	0.9725
	(0.39)	(0.45)	(0.75)	(0.99)	(1.33)	(0.76)
Correlation	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999
Observations	111	111	111	111	111	111
R^2	0.678	0.572	0.554	0.364	0.358	0.282

Robust US outward FDI, year 2019. Correlations with the predicted values of the unrestricted regressions
PPML, Robust standard errors in (), clustured by country pair
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 9 suggest that the potentially endogenous policy-related variables did not bias the *predictions* from the gravity equation. The correlation of the predictions are close to one in all cases. Interestingly, the coefficient of distance is now negative and statistically significant for the numbers of affiliates, total assets, fixed assets, and intangible fixed assets.