The effect of inward and outward Foreign Direct Investment on productivity across the Organisation for Economic Cooperation and Development (OECD) countries

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Executive summary

This study examines the impact of Foreign Direct Investment on total factor productivity growth using a panel dataset of 34 OECD from 2000 to 2018. This studies key contribution is providing a contemporary, 21st century analysis of the productivity growth effects of both inward and outward FDI for a larger sample of OECD countries than previously examined. Drawing on Multinational Enterprise (MNE) theory, this study hypothesises that FDI—both inward and outward—can positively influence TFP growth through knowledge transfer mechanisms. A panel two-way fixed effects methodology is employed to control for unobserved country- and time-specific factors in estimation. Empirical results show a positive relationship between FDI and TFP growth with the effects of outward FDI larger in both magnitude and statistical significance compared to those of inward FDI. Specifically, a 1pp increase in inward FDI flows as a share of GDP leads to a 0.062pp increase in TFP growth: with a one-year lag to take effect. Additionally, a 1pp increase in outward FDI flows as a share of GDP leads to a 0.108pp increase in TFP growth: with a one-year lag to take effect. The study's findings are relevant to OECD policymakers, as TFP growth—a key driver of long-term economic growth—is at historically low levels across member countries. Promoting FDI may be one tool to help revive TFP growth, with a stronger case for supporting domestic firms in expanding abroad compared to the more common policy tool of attracting the investments of foreign MNEs.

AI Statement

I acknowledge the use of generative AI in drafting this paper. However, the work reported remains my own.

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1. Introduction

Since the 1990's, global foreign direct investment (FDI) flows have increased significantly. According to UNCTAD (2025) data, global FDI flows increased from US$204.89 billion in 1990 to US$1.29 trillion in 2022. FDI has long been viewed as a crucial driver of productivity growth in both developing and developed nations. Endogenous growth theory posits that FDI by MNEs is a positive force for long-run economic growth with it promoting the dissemination and integration of productivity-improving technologies and ideas across countries (Romer, 1986).

Empirical literature on the FDI-productivity relationship has primarily focused on the productivity effects within host economies. Early theories of MNEs suggest that MNEs possess certain knowledge-based ownership advantages, enabling them to compete with domestic firms in the host economy and profit from their foreign operations (Dunning, 1988). As a result, through IFDI, MNEs facilitate the cross-border transfer of productivity-improving assets which benefit both MNEs and domestic firms, leading to efficiency improvements within the host economy. However, later theories propose that MNEs engage in FDI not only to exploit their ownership advantage but also to seek productivity-improving assets from abroad, which are then transferred back to the home economy (Fosfuri & Motta, 1999). This asset-seeking motivation behind global FDI flows instead highlights the positive impact of outward FDI on domestic productivity growth.

This paper will add to the literature by providing an up-to-date analysis of the effects of both inward FDI (IFDI) and outward FDI (OFDI) on total factor productivity (TFP) growth using a panel of 34 OECD countries from 2000 to 2018. While extensive research has been conducted on the impacts of IFDI and OFDI individually, the impacts of both IFDI and OFDI are rarely analysed together.

The findings of this study hold significant relevance for policymakers in OECD countries. Since the 1970s, TFP growth in these countries has been on a declining trajectory, largely due to structural challenges such as aging populations, diminishing returns from education, and high levels of public and private debt. Additionally, recent geopolitical tensions and trade protectionist policies are expected to further exacerbate the downward pressure on TFP growth (OECD, 2024). Thus, there is a growing demand for strategic planning and policies to help revive TFP growth across the OECD, and this study evaluates whether IFDI and OFDI promotion could be an effective tool for this purpose.

The study is organised as follows. Section 2 reviews economic theory and empirical research. Section 3 discusses data and variables used. Section 4 details the empirical methodology employed. Section 5 presents analysis results and robustness checks. Section 6 discusses limitations and future research. Section 7 concludes with policy recommendations.

2. Literature review

2.1 Theory

Most researchers reference the theory of the MNE to explain the relationship between FDI and productivity growth. As theorised by Dunning (1988) in his eclectic paradigm, control over foreign operations requires the possession of certain knowledge-based ownership advantages. These advantages are production-related intangible assets such as technologies, managerial and organisational capabilities which are exclusively held by the MNE. These advantages make the costly establishment of foreign facilities economically viable as MNEs can achieve higher marginal profitability or lower marginal costs compared to competitors in the host economy (Dunning, 1988). As found by the theoretical work of Helpman et al. (2004), only the most productive domestic firms engage in foreign activities, reinforcing the ownership advantage concept. Thus, Dunning's Ownership paradigm supports the idea that IFDI involves the transfer productivity-improving assets from home to host countries.

However, the possession of a firm-specific advantage as a prerequisite for FDI has been challenged. Dunning & Nurala (1995) propose the strategic-asset-seeking motivation for FDI, whereby firms invest abroad to obtain or strengthen their ownership advantages, rather than merely exploiting them. Firms investing abroad can acquire advanced technologies and capabilities from domestic firms in the host economy which are transferred back to the home production base where goods or services can be produced more efficiently (Blomström & Kokko, 1998). Fosfuri & Motta (1999) construct a formal model and show that it can be economically viable for an MNE to operate a foreign subsidiary without possessing an ownership advantage. This is because the decrease in production costs from implementing new technologies into the operations of all its subsidiaries can exceed the fixed costs of establishing and operating these subsidiaries. Fosfuri & Motta (1999) conclude that OFDI is an important channel for acquiring technological knowledge from abroad.

Once MNEs facilitate the cross-border transfer of knowledge, whether for knowledge exploiting or seeking purposes, the public good nature of this knowledge—being nonexcludable and non-rivalrous in nature—leads to positive knowledge externalities from MNEs to domestic firms. The theoretical models posit three primary channels for productivity spillovers. Firstly, employees of MNEs who have upgraded their technological or managerial skills may transfer these skills to domestic employers through worker mobility (Fosfuri et al. 2001). Secondly, domestic firms may be forced to use their existing resources more efficiently to compete with MNEs. Lastly, domestic firms can increase the efficiency of their own operations by simply observing and imitating MNE processes (Blomström & Kokko,1998). Therefore, not only can FDI drive country-level TFP growth through the direct presence of productive MNEs, but also through indirect effects whereby domestic firms also benefit from efficiency improvements.

2.2 Empirical evidence

In the 1990s, global FDI growth accelerated (IMF, 2003). Subsequently, there was a surge in literature exploring the FDI-productivity relationship. While most studies to date support the theoretical notion of a positive relationship, several empirical challenges have emerged, questioning the a priori prediction that FDI is always productivity-improving.

This paper categorises its review of empirical literature on the FDI-productivity relationship into three strands: studies focused on IFDI effects, studies focused on OFDI effects, and studies where both are included in the same analytical framework.

2.2.1 Inward FDI

The earliest studies focusing on the IFDI-productivity relationship primarily used cross-sectional data to examine horizontal productivity spillovers—the impact of IFDI on domestic firms operating within the host industry. The pioneering studies of Caves (1974) and Blomström & Persson (1983) find that higher shares of foreign subsidiaries within an industry are positively associated with the labour productivity of domestic firms in Australia and Mexico, respectively. However, the conclusions of early cross-sectional studies have been challenged for not controlling for time-invariant industry-specific effects, leading to bias in parameter estimates (Görg & Strobl, 2001).

To prevent the effect of IFDI on productivity growth from being confounded by unobserved unit-specific factors, studies since the 1990s have primarily used panel data analysis. For example, Li & Tanna (2018) uses a panel of 51 developing countries to investigate the impact of IFDI flows on TFP growth from 1984-2010. They use a system Generalized Method of

Moments (GMM) approach to control for potential upward bias in estimates due to the bidirectional relationship where IFDI is attracted to countries with high TFP growth. They found that for a 1 percentage increase in IFDI flows as a percentage of GDP, there is a 0.20 percentage point increase in TFP growth, with a one-year lag for the effect to materialise. To test the robustness of their results, they employed a two-way fixed effects model, which produced consistent results. A positive effect was also captured by Woo (2009) who focused on the relationship using panel data from both developed and developing countries from 1970–2000. They use a country-fixed effects approach to overcome omitted variable bias due to country time-invariant factors and report a positive, statistically significant relationship between IFDI flows as a percentage of GDP and TFP growth.

A separate strand of literature argues that economic and social conditions of the host economy determine the extent to which positive spillovers arise from IFDI. Baltabaev (2013) found that IFDI positively impacts TFP growth, with a larger effect in countries further from the technological frontier. This is because, the smaller the technological gap between MNEs and domestic firms, the smaller the efficiency gains possible from imitating MNE technologies. Although Roy (2016) found that the gap cannot be too large that domestic firms are not able to understand and adopt complex, profitable technologies. Using a panel of 69 countries, Borensztein et al. (1998) found that a minimum threshold stock of human capital is required for the domestic workforce to learn new production methods. Alfaro et al. (2004) conclude that spillovers are positively related to the development of financial markets as it enables firms with high external finance dependencies to fund new technologies. Thus, we'd expect for OECD countries, with typically strong educational systems and well-functioning financial markets, a positive relationship between IFDI and TFP growth.

However, some studies found that the mere existence of firm-specific advantages of MNEs can negatively impact the host economy. Aitken et al. (1999) used industry-level data for Venezuela and entity fixed effects to account for foreign investment being drawn to inherently productive sectors. They found that a 10% increase in foreign presence (measured by the proportion of employees in foreign enterprises) correlates with a 2.67% reduction in average TFP. This is explained by a short-run negative competition effect whereby MNEs, with lower marginal costs, divert demand from domestic firms, forcing them to produce less with higher unit costs. Koning (2001) observed similar negative effects in Central and

Eastern European countries, where the negative competition effect from IFDI outweighed positive technological spillovers, resulting in net productivity declines in the host economies.

2.2.2 Outward FDI

Research on the effects of OFDI on home country productivity is less developed at the aggregate level compared to IFDI, especially for developed countries.

The first group of studies found a positive relationship between OFDI and productivity. Zhao et al. (2010) argued that the relationship between OFDI and TFP growth depends on two elasticities: technological efficiency and technological progress. Using various panel data techniques, the study found that a 1% increase in China's OFDI stock into eight developed economies led to a 0.55% increase in TFP. Furthermore, three-fifths of this TFP increase were driven through the acquisition of knowledge which improved the efficiency of existing technologies in the Chinese economy, while two-fifths was due to accessing new, more advanced technologies. Other studies, using various econometric techniques and examining different countries, have also found a positive relationship. Herzer (2011) employed cointegration techniques on a panel of 33 developing countries between 1980-2005 and found a 1% increase in the OFDI stock is associated with a 0.024% increase in TFP. Departing from the commonly employed panel data techniques, Herzer (2012) used time series cointegration analysis and found a significant positive relationship between OFDI and TFP in Germany.

However, a body of literature has found a negative or insignificant relationship between OFDI and productivity, primarily explained by the strong interdependence between domestic and foreign investment. For financially constrained firms, foreign investment often substitutes domestic investment, reducing domestic capital accumulation and innovation output, thus lowering productivity growth in the home economy (Stevens & Lipsey,1992). For example, Ashraf et al. (2024) found an insignificant relationship between OFDI flows and home countries' TFP across 85 countries between 2003-2017 using a system GMM approach. However, they reported significant heterogeneity by FDI mode. Greenfield OFDI, whereby production displacement is more prevalent, reported negative effects, while mergers and acquisitions, motivated by acquiring high-value intangible assets from abroad, reported positive effects. This is reinforced by Castellani & Pieri (2015) who also found a negative relationship between greenfield OFDI and productivity growth in 262 EU regions, supporting the presence of a displacement effect.

2.2.3 Inward FDI & Outward FDI

There are few studies exploring the productivity effects of OFDI and IFDI within the same analytical framework, revealing mixed results.

Porterie & Lichtenberg (2001) studied the comparative productivity effects of IFDI and OFDI using panel data from 13 developed countries between 1971-1990. They found that OFDI has a positive effect on domestic TFP through accessing the R&D capital stock in target countries; by contrast, IFDI has no such effect. The authors conclude that MNEs engage in FDI primarily to acquire the host country's technological base rather than to exploit and diffuse their own technological advantages internationally. However, this study is limited to examining whether a country's R&D capital stock embodied in FDI flows lead to R&D spillovers and does not capture wider productivity effects from FDI.

Bitzer & Gorg (2005) built on this initial research using total FDI stock measures to capture broader productivity spillovers. They analysed an unbalanced panel of 17 OECD countries from 1973-2000 using Feasible Generalized Least Squares (FGLS) with country and time fixed effects. They found a 1% increase in IFDI stock leads to a 0.013% increase in TFP, while a 1% increase in OFDI stock leads to a 0.005% decrease in TFP. However, this study was limited since it did not control for a number of other important factors driving productivity, such as trade openness and inflation, leading to potential omitted variable bias. Additionally, the FDI stock data used included transactions made for tax purposes, without filtering out those involving real, productive activities in the host economy, leading to potential downward bias in estimates.

Examining the evidence in this area, there remains to be a conclusive view of the impact of both IFDI and OFDI on productivity growth, which forms a strong part of the motivation for this study. While the focus of most studies explored examines the productivity effects of a single FDI measure, this study will analyse and compare the productivity effects of both IFDI and OFDI by including both measures simultaneously in the empirical analysis. Although related to Bitzer & Gorg (2005), this study aims to addresses the key limitations identified in their analysis.

Additionally, this study provides a contemporary analysis of the relationship between FDI and productivity for a larger sample of OECD countries. The period from 2000-2018 differs significantly from the 1973-2000 timeframe examined by Bitzer & Gorg (2005). Notably, the period from 2000 to 2018 includes years following the global financial crisis characterised by economic recovery, as well as years marked by significant global technological advancements and increased absorptive capacities in OECD countries, potentially influencing the productivity effects associated with FDI.

3. Data

3.1 Panel details

To analyse the FDI-productivity growth relationship, a balanced panel spanning 19 years from 2000 to 2018[1] (T = 19) has been constructed. The panel consists of 34 out of the 38 countries which were OECD members as of May 2025 (N=34). Four OECD countries with missing data, specifically Belgium, Luxembourg, Italy and Ireland were excluded from the final dataset to maintain a balanced panel, ensuring consistency in the number of observations per country. At the time of this research, 2018 was the most recent year for which data for all variables used in the analysis was available. Panel data is selected, instead of cross-sectional or time-series data, as it helps to control for omitted variable bias from time-invariant, country-specific effects. Failure to control for such effects may lead to inconsistent estimates (Görg & Strobl, 2001).

3.2 Variable selection

Linking back to the theories of MNEs, FDI facilitates the cross-border transfer of knowledge, which can be applied to the production processes of both MNEs and domestic firms, enabling greater output to be produced with the same factor inputs. These efficiency gains are reflected in TFP growth. Therefore, the dependent variable in this study is human capital-adjusted TFP growth, sourced from the World Bank. This variable is expressed in log-difference form which approximates the annual growth rate of TFP. Since this TFP measure is adjusted for human capital, it captures the portion of annual economic growth not attributable to increases in labour, capital, or human capital inputs (measured by the years and quality of schooling).

The two independent variables of interest are IFDI flows/GDP and OFDI flows/GDP, sourced from UNCTAD. IFDI net inflows represent inward investments by non-residents, while OFDI net outflows represent outward investments by residents to external economies. Net FDI flows can be negative when disinvestment offsets gross flows. UNCTAD is the chosen source for FDI data because, unlike other sources, it excludes cross-border investments into special purpose entities. These investments are made into legal entities

[1] Data for all variables was collected before 2000 to avoid losing observations when using lagged variables discussed in section 4.1

established by MNEs in countries with favourable tax regimes for holding activities, without involving any physical production. Since this "phantom FDI" (Damgaard et al., 2024) should not stimulate productivity growth, its inclusion in the FDI data would create a downward bias in the estimated FDI-productivity growth relationship. The FDI-to-GDP ratio was used to control for the economic size of each country.

There are a number of drivers of TFP growth, beyond just FDI. It is important to control for as many observable variables which may drive TFP growth to minimise omitted variable bias and strengthen the robustness of the results.

Following common practices in growth literature, a variable measuring the distance to the technological frontier (DFT) is included to account for convergence effects. These effects occur when countries that are further behind the technological leader experience faster growth by imitating existing technologies at a lower cost, while the technological leader's growth depends on the more costly discovery of new technologies (Barro, 1997). The importance of controlling for convergence effects in this study is reinforced by OECD evidence showing that productivity levels across OECD countries converged from 2000 to 2022, aligning with the study period used in this paper (OECD, 2024). DFT is calculated as the ratio of the technology level in the 'leader' country to that of the OECD country under consideration. Following the approach of Baltabaev (2013), the United States (US) is assumed to be the technological leader, with DFT calculated as the ratio of US labour productivity to a country's labour productivity ($LP_{USA,\ t}/LP_{it}$). The DTF variable is lagged by one year to account for the time it may take for countries to adopt frontier technologies.

Trade openness, measured as the ratio of the sum of exports and imports to GDP, controls for a country's participation in the global trading system. Openness to trade can give a country better access to advanced technologies in use abroad and enhances their catching-up process through the adoption of these technologies (Keller, 2004). Additionally, increased openness to imports increases a country's accessibility to a wider variety of capital goods, increasing efficiency. Amirkhalkhaki & Dar (2019) found that trade openness positively impacts TFP growth using a panel of OECD countries.

Endogenous growth theories suggest that innovation drives productivity growth by developing new, efficient technologies that replace older, less productive ones through 'creative destruction' (Aghion & Howitt,1992). R&D expenditure is a common proxy used for innovation however this variable could not be used due to missing data observations and the desire for the dataset to be balanced. Therefore, patent applications normalised by population size was chosen as a proxy for innovation output. Patents enable firms to reap the private benefits from their innovations and have long been considered a reliable proxy for measuring innovation in the growth literature (Eaton & Kortum,1996).

The final control variable is inflation, measured as the annual change in the GDP deflator. Inflation can lower TFP growth by distorting price signals, leading to inefficient resource allocation and lower productivity growth. Additionally, high inflation increases business uncertainty, reducing incentives for firms to invest in productivity-improving capital and technologies. A full list of variables and their sources are outlined in table 1.

Table 1: Variables (covering 19 years, across 34 countries)

Variable	Notation	Description	Source	Summary statistics
Dependant variable				
Total factor productivity growth	tfp	Human capital-adjusted TFP (in log difference)	World Bank	Mean: 0.004 Maximum: 0.12 Minimum: -0.13 Standard Deviation: 0.02 Observations: 646
Independent variables				
Inward FDI	ifdi	Net Inward Foreign Direct Investment flows as a proportion of GDP	UNCTAD	Mean:0.03 Maximum: 0.32 Minimum: -0.14 Standard Deviation: 0.04 Observations: 646
Outward FDI	ofdi	Net Outward Foreign Direct Investment flows as a proportion of GDP	UNCTAD	Mean: 0.02 Maximum: 0.47 Minimum: -0.24 Standard Deviation: 0.05 Observations: 646
Distance to frontier	dtf	GDP per hour worked in the US divided by GDP per hour worked in country (i).	PWT (v10.01)	Mean: 1.89 Maximum: 5.71 Minimum: 0.524 Standard Deviation: 1.01 Observations: 646
Trade openness	to	Sum of exports and imports as a proportion of GDP	World Bank	Mean: 0.83 Maximum: 1.89 Minimum: 0.20 Standard Deviation: 0.36 Observations: 646
Innovation	ivn	Patent applications per million people	Our World in Data	Mean: 307.2 Maximum: 3280 Minimum: 1.33 Standard Deviation: 324.6 Observations: 646
Inflation	inf	Annual change in GDP deflator (in ratio)	World Bank	Mean: 0.03 Maximum: 0.21 Minimum: -0.057 Standard Deviation: 0.04 Observations: 646

3.3 Correlation matrix

Table 2 presents the correlation coefficients and their statistical significance for all variables. As hypothesised, both IFDI and OFDI are positively correlated with TFP growth, yielding significant correlation coefficients of 0.090 and 0.128, respectively. The correlation direction for other independent variables is also as hypothesised. However, correlation does not imply causation. To robustly test the causal effect of these variables on TFP growth, econometric techniques outlined in section 4 are used.

Table 2: Correlation matrix

	Δ Ln (tfp)	ifdi	ofdi	dtf	to	ivn	inf
Δ Ln (tfp)	1.00						
ifdi	0.090***	1.00					
ofdi	0.128**	0.29***	1.00				
dtf	0.089**	0.161***	-0.218***	1.00			
to	0.187***	0.185***	0.048	-0.036	1.00		
ivn	0.072*	0.020	0.006	-0.179***	-0.033	1.00	
inf	-0.050	0.198***	-0.070*	0.356***	-0.075*	-0.198***	1.00
****p<0.01,**p<0.05,*<0.1*							

4. Methodology

4.1 Model selection

This section sets out the process undertaken to arrive at the final model used to analyse the effect of FDI on TFP growth. To begin, a simple pooled OLS is run with the specification:

$$\Delta \mathrm{Ln}(\mathrm{tfp}_{it}) = \beta_0 + \beta_1 \mathrm{ifdi}_{it} + \beta_2 \mathrm{ofdi}_{it} + \sum \beta_i x_{it} + \varepsilon_{it}$$

where i = 1, 2, 3…N; t = 1, 2, 3…T, i is the country, t is the year, x is the vector of controls, and ε_{it} is the error term. However, POLS is limited because it does not control for time-invariant differences between countries such as cultural, geographical, or institutional characteristics, which impact TFP growth and may be correlated with the independent variables. Given the presence of country-specific, time-invariant factors, pooled OLS produces biased and inconsistent parameter estimates.

A logical progression is to decompose the error term, ε_{it}, into a country-specific part, α_i, and an idiosyncratic part, u_{it}, to estimate a model capturing unobserved heterogeneity across countries. Two distinct models can be used for this purpose: random effects (RE) and fixed effects (FE). The RE is more efficient, but its consistency relies on the assumption that the country-specific error term, α_i, is random and uncorrelated with dependant/independent variables in the model. The consistency of the FE does not rely on this assumption.

Given the consistency-efficiency trade-off between these two specifications, the Hausman test was conducted to determine which model should be used. The null hypothesis is that RE is preferred, with the alternative that FE is preferred. The test statistic (22.293) exceeded the critical value, meaning the null hypothesis was rejected and entity FE is preferred.

Next, time fixed effects are introduced to prevent the independent variables' impact on TFP growth from being confounded by common economic cycles or shocks occurring across countries. Given the tendency for the macroeconomic variables used to fluctuate with business cycles and global economic shocks, it is important to control for such common year-specific disturbances. The Wald test on time effects was conducted and the test statistic exceeded the critical value (408.157) meaning the null hypothesis that the coefficients for the years are jointly equal to zero was rejected. Hence, the use of time fixed effects was appropriate.

FDI is unlikely to have a contemporaneous effect on TFP growth. Li & Tanna (2018) found that the positive effect of IFDI on productivity growth becomes statistically significant after one year using a panel of 51 developing countries. Similarly, Rai et al. (2018) identified a positive effect of OFDI on home country productivity growth with a one-year lag, using Canadian province level data. Thus, to capture potential non-contemporaneous effects, one-year lagged FDI variables are modelled.

Accordingly, a two-way FE model is employed using the following specification:

$$\Delta \mathrm{Ln}(\mathrm{tfp}_{\mathrm{it}}) = \beta_0 + \beta_1 \mathrm{ifdi}_{\mathrm{it}} + \beta_2 \mathrm{ifdi}_{\mathrm{it}-1} + \beta_3 \mathrm{ofdi}_{\mathrm{it}} + \beta_4 \mathrm{ofdi}_{\mathrm{it}-1} + \sum \beta_{\mathrm{i}} \mathrm{x}_{\mathrm{it}} + \alpha_{\mathrm{i}} + \lambda_{\mathrm{t}} + \mathrm{u}_{\mathrm{it}}$$

where α_i is the fixed entity effects, λ_t is the fixed time effects and u_{it} is the idiosyncratic term which varies independently across countries and time, assumed uncorrelated with the independent variables thereby satisfying the OLS classical assumption of a zero conditional mean.

One empirical challenge in identifying the causal effect of FDI on productivity is the potential reverse causality and endogeneity between IFDI, OFDI, and TFP productivity. While this study outlines how FDI may impact productivity, inherently more productive countries, such as those with strong institutions or within proximity to major trade routes, may attract more MNEs aiming to maximise their investment returns (Görg & Strobl, 2001). Additionally, only firms above a certain productivity threshold can overcome the high costs of establishing foreign facilities, leading to more OFDI from countries with higher average firm productivity (Herzer, 2012). Using TFP growth instead of TFP levels, along with country-fixed effects in this study, helps mitigate potential upward bias in estimates due to higher IFDI and OFDI occurring in inherently more productive countries by removing between-country variations. However, it is possible that upward bias in estimates remains for the within-country effects.

To help inform whether endogeneity due to reverse causality is present, a Dumitrescu-Hurlin causality test was conducted. While Granger causality cannot establish direct causation, it tests whether past TFP growth predicts future IFDI and OFDI flows. The null hypothesis states no Granger causality for any country in the panel, while the alternative suggests Granger causality for at least one country. Table 3 shows that both IFDI and OFDI Granger cause TFP growth, but not vice versa. This supports a unidirectional relationship, suggesting that upward bias in estimates due to a two-way relationship between the variables is unlikely in this study. Therefore, in line with Woo (2009) estimation continues with a two-way FE approach, noting that any endogeneity will lead to an overestimation of FDI effects, although this is expected to be marginal.

Table 3: Dumitrescu-Hurlin Panel Causality

Null hypothesis	Z-bar stat
ifdi $\neq>$ ΔLn(tfp)	2.184***
ΔLn(tfp) $\neq>$ ifdi	-1.060
ofdi $\neq>$ Δ Ln(tfp)	4.624***
ΔLn(tfp) $\neq>$ ofdi	-0.694
****p<0.01,**p<0.05,*<0.1*	

4.2 Robustness tests

Before proceeding with the two-way FE specification, several robustness tests were conducted. The correlation matrix in section 3.3 show that some independent variables are correlated at the 1% significance level, thus multicollinearity is suspected and tested for. Multicollinearity can inflate standard errors and undermine the statistical significance of coefficients. To test for multicollinearity, Variance Inflation Factors (VIF) were calculated. A variable is considered highly collinear if its VIF exceeds 10, which occurs when the R^2 of the auxiliary regression exceeds 0.90. Within-entity VIF was calculated to isolate potential multicollinearity from within-country variations, independent of between-country variations controlled for using FE estimations. The VIFs reported in table 4 show that multicollinearity is not a problem for this specification, so no variables were eliminated.

Table 4: Variance Inflation Factors

Variable	Overall VIF	Within-entity VIF
ifdi	1.813	2.401
$\mathbf{ifdi_{it-1}}$	1.912	2.012
ofdi	2.561	2.673
$\mathbf{ofdi_{it-1}}$	2.439	2.472
$\mathbf{dtf_{it-1}}$	1.614	1.742
to	1.556	1.569
ivn	1.922	2.851
inf	1.075	1.172

Next, due to the time-series element in this paper's methodology, testing for non-stationarity is important to ensure no statistically spurious relationships. Stationarity is tested using the Im–Pesaran–Shin panel unit root test. This test assumes variation in the autoregressive parameters across all cross-sections, which is appropriate given the diverse economic structures of the OECD countries studied. The null hypothesis states that all series in the panel have unit roots, while the alternative suggests that at least one series does not. The IPS test includes a constant (drift) term due to the likelihood that macroeconomic variables are influenced by underlying economic fundamentals rather than being purely stochastic. Table 5 shows that the dependent variable, log-difference TFP, is stationary. Additionally, all independent variables were stationary in levels, so no further transformations were required.

Table 5: IPS Stationarity Test

Variable	IPS test with constant (IPS t-bar stat)
Δ Ln (tfp)	-3.643***
ifdi	-3.781***
ofdi	-3.428***
dtf	-2.172***
to	-1.739*
ivn	-1.820***
inf	-3.210***
****p<0.01,****p<0.05,**<0.1	

Finally, a Groupwise Distribution-Free Wald test for heteroskedasticity, Durbin Watson test for autocorrelation and Pesaran's (CD) test for cross-sectional dependence was conducted on the final model. The Wald test statistic (148.295) was greater than the critical value, hence the null hypothesis that the residuals are homoscedastic was rejected. Therefore, heteroskedasticity was present. The Durbin Watson test statistic (1.636) was less than the lower critical value, hence the null hypothesis of no autocorrelation was rejected. Therefore, positive autocorrelation was present. Lastly, the Pesaran CD test statistic (-0.876) was lower than the critical value, hence the null hypothesis of no cross-sectional dependence is not rejected. Therefore, cross-sectional dependence was not present.

Under the presence of heteroskedasticity and autocorrelation, the two OLS assumptions of constant variance of the error terms and zero correlation between the error terms are violated. To address this, Arellano robust standard errors were applied to the final model. These standard errors are robust to both cross-sectional heteroskedasticity and serial correlation of arbitrary form (Arellano, 1987). This step ensured the best, linear and unbiased parameters could be estimated.

5. Results

5.1 Final model summary

This section will present and interpret the findings and statistical relevance of the FDI variables and control variables from the final model utilising the two-way FE methodology with robust standard errors as discussed in section 4. The results from the final model can be seen in Table 6, which indicates overall statistical significance of the model reporting an F-statistic (7.598) which exceeds the critical value, thus the null hypothesis that all regression coefficients are zero is rejected. The R^2 of the model is 0.438, hence the independent variables explain approximately 43.8% of the variation in TFP growth.

Table 6: Two-way Fixed Effects – Robust Standard Errors

5.2 Inward FDI

As shown in Table 6, the estimated coefficient for the one-year lagged IFDI variable is 0.062. This means that if IFDI flows as a share of GDP increase by 1 percentage point, the growth rate of TFP would increase by 0.062 percentage points. For instance, if the OECD average of IFDI flows as a share of GDP increased from 3% to 4%, TFP would grow by approximately 0.062% due to IFDI alone in the following year. This coefficient is significant at the 5% level, indicating a less than 5% probability that this observed relationship is due to random

	Dependant variable - Δ Ln (tfp)	
	Coefficient	**Std. error**
Constant	-0.028**	0.014
$\mathbf{ifdi_{it}}$	0.013	0.026
$\mathbf{ifdi_{i,t-1}}$	0.062**	0.025
$\mathbf{ofdi_{it}}$	0.024	0.034
$\mathbf{ofdi_{i,t-1}}$	0.108***	0.037
$\mathbf{dtf_{i,t-1}}$	0.118***	0.030
$\mathbf{to_{it}}$	0.066	0.040
$\mathbf{ivn_{it}}$	-0.008	0.005
$\mathbf{inf_{it}}$	-0.005***	0.001
No. observations	646	
LSDV R-squared	0.503	
Within R-squared	0.438	
F-stat	7.598	
Groupwise heteroskedasticity	148.295	
Durbin Watson	1.636	
Pesaran's (CD) test	-1.458	
****p<0.01, **p<0.05, *<0.1*		

chance. A positive relationship is found between the non-lagged IFDI and TFP growth, however this coefficient is not statistically significant.

This result supports the hypothesis that IFDI positively impacts TFP growth. This supports the theoretical prediction that through IFDI, MNEs possessing some firm-specific advantage facilitate the cross-border transfer of productivity-improving assets. As the overall effect is positive, it is likely that any negative externalities associated with IFDI, such as the negative competition effect identified by Aitken et al. (1999), are overwhelmed by the positive knowledge externalities.

This finding also strengthens the results of Bitzer & Gorg (2005) who report a positive relationship between IFDI and TFP when analysing a sample of 17 OECD countries. The current study demonstrates that even when accounting for other factors influencing TFP, such as trade openness and inflation, expanding the sample to a larger number of OECD countries and analysing the effect in a more recent time period, IFDI continues to play a key role in promoting TFP growth.

However, the statistical insignificance of the non-lagged IFDI variable suggests that the impact of IFDI on productivity growth takes one year to materialise, aligning with the findings of Li & Tanna (2018). A possible explanation for this is that the transmission of knowledge from MNEs to domestic firms is not instantaneous. For example, through the worker mobility spillover channel, employees may require training to learn new technologies before they can move and transfer their knowledge to domestic firms. Additionally, domestic firms may lack the resources to immediately implement new production techniques. It is unlikely, in most cases, that technological development can be done at a zero cost. When internal financing is not possible, access to external finance may be required before domestic firms can invest to improve their productive capacity.

While the one-year lagged IFDI coefficient is positive, it is modest in size and may be considered small in terms of economic significance. Additionally, it is smaller in size compared to those reported in the reviewed empirical evidence. For example, Li & Tanna (2018) and Woo (2009) both utilise panel approaches and control variables similar to this study and report positive, statistically significant coefficients between 0.18-0.20. However, these results were derived using panel data primarily comprised of developing countries. In contrast, this study's panel comprises 34 OECD countries, 29 of which are classified as high-income economies[2]. These countries are likely to be at or near the global technological frontier, already utilising some of the world's most advanced technologies. Therefore, in line with the theory of Balatabaev (2010), new technologies introduced by MNEs may not be significantly more advanced than existing ones, limiting their capacity to contribute to further productivity growth compared to within developing countries at a lower starting point in terms of technical capability.

[2] Colombia, Costa Rica, Mexico, Turkey, and Chile are categorised as upper-middle-income countries by the World Bank

5.3 Outward FDI

As shown in Table 6, the estimated coefficient for the one-year lagged OFDI variable is 0.108. This means that if OFDI flows as a share of GDP increase by 1 percentage point, the growth rate of TFP would increase by 0.108 percentage points. For example, if the OECD average of OFDI flows as a share of GDP increased from 2% to 3%, TFP would grow by approximately 0.108% due to OFDI alone in the following year. This coefficient is significant at the 1% level, indicating a less than 1% probability that this observed relationship is due to random chance. A positive relationship is found between the non-lagged OFDI and TFP growth, however this result is not statistically significant.

This result supports the hypothesis that OFDI positively impacts TFP growth. These findings are in line with several studies who found a similar positive relationship between OFDI and TFP (Zhao, et al, 2010) (Herzer, 2011) (Herzer, 2012). It aligns with the theoretical prediction that firms establishing foreign facilities abroad acquire productivity-improving assets which are later transferred back to the home economy. Although academics such as Ashraf et al. (2024) have identified a negative displacement effect from OFDI, this result suggests that this effect is outweighed by the positive knowledge externalities. Similar to IFDI, results suggest that the TFP growth effects of OFDI occur after one year. This delay is expected due to the time required for MNEs to establish their foreign operations, internally disseminate the acquired capabilities across their subsidiaries, and for knowledge to be transferred to domestic firms through productivity spillovers.

Interestingly, the positive OFDI coefficient contrasts with the negative -0.005 reported by Bitzer & Gorg (2005). This difference may be due to the greater absorptive capacities of OECD countries in the 2000-2018 period compared to the 1973-2000 period examined by Bitzer & Gorg. Higher levels of human capital, as theorised by Borensztein et al. (1998), enable workers to better learn and absorb complex technologies introduced by MNEs. Since 2000, significant human capital developments have occurred in OECD countries. For example, between 2000-2019, the average enrolment rate in tertiary education increased from 49.88% to 76.88% in OECD countries (Solarin et al. 2024). With a more educated workforce, the positive spillover effects from OFDI may have increased, potentially causing the positive impacts to outweigh any negative displacement effects found by Bitzer & Gorg (2005).

5.4 IFDI compared to OFDI

In line with Porterie & Lichtenberg (2001), this study reports an OFDI coefficient which is larger in both size and statistical significance compared to IFDI. This suggests that outward foreign investments have a greater positive impact on TFP growth in OECD countries than inward investments. One possible explanation is that asset-sourcing motivations behind FDI dominate asset-exploiting motivations. It is plausible that MNEs, particularly those from emerging or developing economies, primarily invest to acquire the high-value intangible assets present across developed OECD countries. Fosfuri & Motta (1999) argue that these MNEs do not need a firm-specific advantage for their investments to be economically viable, limiting positive productivity spillovers in host OECD economies. Conversely, through OFDI, MNEs can target destination countries where technologies are in use that are not currently available in their home country. By transferring these technologies to their home subsidiaries, productivity spillovers greater than those possible through IFDI can be achieved.

5.5 Control variables

The direction and magnitude of the coefficients on the control variables align with theoretical expectations. The coefficient of DTF is positive and significant at the 1% level, with a value of 0.118. This finding can be compared to Baltabaev (2013), who reported a DTF coefficient of 0.125. Thus, OECD countries further from the technological frontier (the US) experience faster TFP growth compared to countries closer to the frontier, evidencing a convergence effect among OECD countries.

As hypothesised, the coefficient of inflation is negative and significant at the 5% level, with a value of -0.005. Thus, a 1 percentage point increase in inflation (e.g., from 3% to 4%) results in a 0.005 percentage point decrease in TFP growth. This decrease is marginal compared to the negative, statistically significant coefficients ranging from -0.01 to -0.02 reported by Li & Tanna (2018) in their study of developing countries. One reason for this difference may be that developed countries, such as those in the OECD, typically have stronger monetary institutions with well-established inflation targets. This means firms are more likely to expect price stability to be restored, reducing business uncertainty and mitigating the negative effects of inflation on TFP growth.

Innovation and trade openness did not show statistical significance in the model however these variables improved the overall model fit and were therefore not removed. These variables are still important factors of TFP growth but are not highlighted within this study.

5.6 Robustness checks

Various checks were undertaken to assess the validity of the previous regressions conducted (Table 6). The first check assessed the impact of outliers. Outliers can inflate the variance of variables, increase standard errors, and reduce the statistical significance of coefficients. To address this, observations that deviated by more than three standard deviations from the mean of key variables[3] (TFP growth, IFDI, and OFDI) were excluded from the sample. Even when removing the outliers, hence filtering out large, short-term fluctuations in both TFP growth and FDI flows, the model outputs were consistent with the final specification.

A second test used labour productivity growth (measured by the log-difference in GDP per hour worked) as the dependent variable to assess the sensitivity of results using an alternative productivity measure. The model outputs were largely consistent, showing a positive, one-year lagged effect of both IFDI and OFDI flows. Interestingly, the coefficient for one-year lagged IFDI increased in both magnitude and significance. This could be attributed to the labour productivity measure capturing the positive effects of capital deepening from IFDI, such as the increase in machinery and equipment, which the TFP growth measure does not capture. Despite this, the size of the lagged OFDI coefficient remained larger than the lagged IFDI coefficient.

A final check involved running separate estimations for the years before and after the financial crisis period (2007-2009). The post-crisis period was characterised by lower consumer demand, reduced business confidence, and decreased credit supply across OECD countries (Andre & Gal, 2024), potentially reducing domestic firms' incentives and ability to invest in MNE technologies. As expected, the coefficients for one-year lagged IFDI and OFDI variables were slightly larger in the pre-crisis sample compared to the full and post-crisis samples. However, the smaller number of observations in the pre-crisis (238) and post-crisis (306) periods made the results less robust. Despite this, the direction of both lagged FDI variables remained as hypothesised, and the OFDI coefficient remained greater in size and statistical significance compared to IFDI.

6. Limitations & future research

As with all research, it is important to acknowledge the limitations. First, caution is required when interpreting the results as evidence of causality due to potential endogeneity bias. A bidirectional relationship between FDI and productivity may exist, as discussed in section 5.

[3] The chosen threshold was informed through a graphical inspection of the data

Results show that FDI impacts productivity growth non-contemporaneously, with only lagged FDI coefficients being positive and statistically significant. It is less likely that current productivity shocks affect past FDI decisions, reducing the likelihood of upward bias in the lagged FDI coefficients. However, FDI decisions can still be influenced by expectations, such as MNEs investing in countries with forecasted high productivity growth. If forecasted TFP growth influences MNEs' investment decisions, the reported coefficients may overestimate the true effects of FDI. Future research could use alternative estimations like GMM to address potential endogeneity from reverse causality and lend further credibility to the results of this study.

Another limitation is that this study does not identify which mode of FDI is most beneficial to TFP growth. Due to the lack of access to granular data, this study's definition of FDI includes greenfield investments, mergers and acquisitions, and joint ventures. However, as Ashraf et al. (2024) found, the net productivity effects of different FDI modes can vary. Given the potential heterogeneity in productivity effects by FDI mode, future research should analyse these effects separately. This would help guide the evidence-based allocation of investment promotion resources towards the types of FDI projects most beneficial to TFP growth.

7. Conclusion

This paper contributes additional evidence to the literature on the impact of inward and outward FDI on TFP growth by analysing a panel of 34 OECD countries from 2000 to 2018. Specifically, it aims to examine and compare the effects of both inward and outward FDI on TFP growth by incorporating both FDI measures within the same estimation equation.

The earliest theories of MNEs suggest that the firms need a firm-specific advantage to establish foreign facilities. MNEs introduce advanced technologies and capabilities to the host economy, which domestic firms then access and imitate, leading to more efficient production (Blomström & Kokko,1998). Thus, this research hypothesised that IFDI would positively impact TFP growth. Results from the two-way FE model support this, showing that if IFDI flows as a share of GDP increase by 1 percentage point, the growth rate of TFP would increase by 0.062 percentage points, with a one-year lag to take effect. This positive relationship aligns with the empirical findings of Bitzer & Gorg (2005), Li & Tanna (2018) and Woo (2009).

Later theories of MNEs suggest that firms also engage in FDI to acquire knowledge from abroad, thereby increasing the efficiency of operations in both their foreign and home subsidiaries. Productivity spillovers then arise with domestic firms also benefitting from efficiency improvements (Fosfuri & Motta, 1999). Thus, this research hypothesised a positive relationship between OFDI and TFP growth. Results from the two-way FE model support this, showing that that if OFDI flows as a share of GDP increase by 1 percentage point the growth rate of TFP would increase by 0.108 percentage points, with a one-year lag to take effect. This positive relationship aligns with the empirical findings of Zhao et al. (2010), Herzer (2010) and Herzer (2012).

This study finds that FDI in both directions leads to positive TFP growth, supporting both asset-exploiting and asset-seeking motivations behind FDI. This contrasts with the findings of Potterie & Lichtenberg (2001) and Bitzer & Gorg (2005) which support the notion that one motivation dominates. However, this study shows that productivity effects from OFDI are greater than those from IFDI, suggesting that firms may be more inclined to internationalize to seek new assets rather than exploit existing ones.

The findings of this paper have several policy implications. First, promoting both IFDI and OFDI could help revive TFP growth in OECD countries, justifying the increased allocation of government resources towards FDI promotion. However, the marginal effects of IFDI on TFP growth compared to OFDI should be noted. Traditionally, governments have placed greater emphasis on creating a favourable business environment to attract IFDI, and governments in OECD countries are no exception. OECD governments use various costly incentives, such as tax credits and direct grants, to promote inward investment, with increased productivity being a key policy objective behind these incentives (OECD, 2024). This finding, however, provides rationale for governments to direct additional resources to help domestic firms overcome the barriers to expanding overseas. For instance, government-led training programs could address domestic firms' incomplete information regarding foreign legal and regulatory frameworks. Additionally, matchmaking programs could connect prospective investors with investment opportunities, particularly in foreign high-technological regions where access to cutting-edge technologies is likely.

Although the limitations and suggestions for further research have been acknowledged, it is hoped that this paper makes a credible addition to the existing literature. It provides an up to date, 21st-century assessment of the productivity effects of both IFDI and OFDI, aiding policymakers across the OECD in understanding the effectiveness of both IFDI and OFDI promotion in potentially reviving TFP growth.

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