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The impact of inward FDI on output growth volatility: a country-sector analysis

Abstract

While existing literature points to a positive impact of FDI on host countries' growth, little is known about how inward FDI contributes to economic volatility in the host country. In this paper, we investigate the FDI-output growth volatility nexus focusing on manufacturing sectors of OECD countries over the period 1990 to 2015. We document a positive and statistically significant relationship between inward FDI stock and sectoral output volatility. We also show that the impact of inward FDI stock in downstream activities on volatility is larger compared to that of inward FDI stock in upstream activities which is not significant. Additionally, we find that the positive relationship between FDI and volatility is stronger in high capital-intensive industries. These results are robust to the use of a measure of FDI targeting practices.

JEL classifications: E32, F15, F36, O16

Keywords: inward FDI, Volatility, FDI targeting, spillover

1 Introduction

Most countries around the globe compete fiercely to attract foreign direct investment (FDI). FDI may take the form of a "cross-border investment where a resident or corporation based in one country owns a productive asset located in a second country" (Oatley, 2012). FDI features prominently in economic studies because of its significant role in the growth process of economies. The extant existing literature points to a positive impact of FDI on host countries' growth, however, little is known about how inward FDI contributes to economic volatility in the host country. Understanding the FDI- output growth volatility nexus is relevant especially for policy making as economic volatility generally discourage investments, at least, in the case of risk-averse investors. Moreover, cross-country studies point at the existence of a robust correlation between macro-economic volatility and growth, which seems to reflect the negative impact of the former on the latter (Ramey and Ramey, 1995; Hnatkovska and Loayza, 2004; Norrbin and Yigit, 2005; Lin and Kim, 2014).

Existing literature has studied the role of trade openness, financial openness, geographic and institutional factors, product characteristics on output volatility at both country and sectoral levels. At the country level, trade openness, financial integration and geographical and institutional characteristics (see Malik et al., 2009; Balavac et al. 2016; Easterly et al., 2001) have been largely explored. Also, production complexity (Koren and Tenreyro, 2007; di Giovanni and Levchenko, 2011) and product specialization have been found to play a significant role on sectoral volatility. However, scant attention has been, instead, devoted to the role of FDI so far.

There are several different channels by which FDI may affect output volatility. The net effect, however, largely depends on Multinational Enterprises (MNEs) business activities in the host country, their operational relationship with domestic firms (backward and forward linkages) and the economy of the host country in question. As pointed out in Kerner (2014), FDI in this way can be thought of as a financial phenomenon relating to the cross-border movements of capital between parent MNEs and their foreign affiliates. Such notion of FDI defined in Oatley (2012) and used in this paper can involve the construction of an existing or new plant or factory.

MNEs may be less risk averse and invest in more risky projects (Kalemli-Ozcan et al., 2014), thus presenting a higher output volatility risk which can also be transferred to their local suppliers and customers. More so, the risk of transmission is even profound if MNEs have a relatively large industrial or economy-wide market share. In the light of higher market competition, MNEs can displace domestic competitors (Backer and Sleuwaegen, 2003), thereby ensuing volatility tendencies due to the higher uncertainty faced by the domestic firms exposed to competitive pressure by MNEs. On the other hand, FDI inflows can help improve the competitiveness of domestic firms through production technology transfer and knowledge spillover effects, which can stimulate the creation of new product lines (Gorodnichenko et. al, 2010) and upgrade existing products in host economies (Swenson and Chen, 2014).

Given the different channels by which FDI affects output volatility, the question of whether or not the impact is positive is an empirical issue. Hence, in this paper, we study the impact of inward FDI stock on output growth volatility. More specifically, we analyze the FDI-output volatility nexus by focusing on the manufacturing sector of OECD countries. If output growth across industries is imperfectly correlated and if these correlations change over time, then aggregate sector-level volatility may develop differently. However, this paper does not study the correlation of growth or the co-movement [2] of growth across industries but shed light on heterogeneous volatility paths across sectors which receive a heterogeneous amount of FDI. Following existing literature (Ramey and Ramey, 1995; Acemoglu et al., 2003; Kalemli-Ozcan et al., 2014, among others), we measure volatility as the standard deviation of industry-level real output growth. Additionally, and as a robustness check, we prove the robustness of our findings to an alternative indicator which is

[2] See Comin and Philippon, 2005 and Imbs, 2007.

the square of the residual of a growth regression that has been adopted in further studies by (Kalemli-Ozcan et al., 2014, Alfaro and Charlton, 2013).

Our results are based on industry-level data collected from the OECD.stat database and UNIDO INDSTAT database. Also, data on control variables are sourced from the World Bank's World Development Indicators (WDI), IMF's IFS among others. We focus on thirteen manufacturing industries for 34 OECD countries during the period 1990-2015. We prove the robustness of our findings by using data on FDI targeting practices collected in the 2005 Investment Promotion Agency (IPA) Survey commissioned by the World Bank's Research Department together with other international institutions (Harding and Javorcik, 2011). The survey covered over 100 countries and allows us to extend the sample of countries in our analysis. Figure 1 (see appendix) presents the binscatter plot of the relationship between output volatility, inward FDI stock and output growth. It shows a positive correlation between each pair of output volatility, inward FDI stock and output growth. However, the graphical analysis shows a stronger correlation between output growth and inward FDI stock and output volatility and output growth than output volatility and inward FDI stock.

Anticipating our results, we find a positive and statistically significant correlation between inward FDI stock and sector-level output volatility. By exploring industry-level heterogeneity, we detect a strong impact of inward FDI stock on volatility in high capital intensive industries. Moreover, the results also show that the inward FDI stock in downstream activities seems to have a significant effect on volatility with respect to inward FDI in upstream activities that turns to be non-significant. Furthermore, by taking into account the different growth experienced by sectors, we find that the impact of inward FDI on volatility is larger in magnitude in high growth sectors than in low growth sectors. The use of a reduced-form model exploiting FDI targeting data suggests that FDI promotion practices increase output volatility. By focusing on countries that targeted at least an industry in the period of our analysis, we estimate a cross-sectional model and we find that output volatility is larger in the post-targeting period, thus providing further evidence in line with a positive relation between FDI and volatility. Our results are robust to the use of alternative measures of volatility and FDI targeting practices data.

The rest of the paper is organized as follows. In the next section, we review the existing literature and explore the gap on the empirical impact of FDI on output growth and its volatility. Section 3 offers a discussion of the empirical methodology and data used. Section 4 presents and discusses the results and Section 5 concludes the paper.

2 Literature Review

Several studies have been conducted on the relationship between FDI and output growth. The evidence presented in the literature is however far from uniform since conclusions arising from different studies yield different results. Theoretically, from the endogenous growth model, FDI is known to positively impact output growth by generating technological diffusion from the developed world to the host country (Li and Liu, 2005). Both Campos and Kinoshita (2002) and Moudatsou (2003) find a positive effect of FDI on economic growth economic growth that is positive, statistically significant and robust. The former focus on Central and Eastern European (henceforth, CEEC) and former Soviet Union "transition" countries between 1990 and 1998 and provide evidence that FDI is a crucial explanatory variable for growth in transition, showing direct impact of FDI on growth. The latter explores only EU countries and provide empirical results that show that FDI has a positive effect on the growth rate of EU economies both directly and indirectly through trade reinforcement.

The endogenous growth literature stress on several factors such as the degree of trade openness, financial openness, human capital, institutional quality and macroeconomic factors that are growth-enhancing and equally influence the capacity of countries to attract FDI (Alguacil et al., 2011; Asamoah et al., 2019). The link between these factors, FDI and growth is reinforced since they affect the ability of the host country to utilize them to benefit from inward FDI flows. FDI is able to stimulate domestic capital formation and enhance growth if the host country has sufficient "absorptive capabilities" to realize the benefits from FDI (Mehic et al., 2013).

For instance, Borensztein et al. (1998) develop a model that posit a positive effect of FDI on economic growth through enhanced technological progress of the recipient economy. The result from using a seemingly unrelated regressions with instrumental variables and panel data over two separate periods: 1970-79 and 1980-89, suggest that FDI is positive and significant and has long term effect on growth provided "absorptive capabilities" that mediate FDI spillovers of the host economy such as sufficient high levels of human capital exist. Blomström et al., (2001) find similar reasoning and argue that FDI contributes to economic growth of the host country only when a sufficient level of education is present. The main argument in these studies suggest that FDI is growth-enhancing only when the host country has absorptive capabilities, i.e, sufficiently developed market and human capital that can induce knowledge spillover. This is largely true for developed countries where local firms have the ability to invest in absorbing foreign technologies contrary to developing countries whose financial market and human capital are underdeveloped (Alguacil et al., 2011; Mensah et al., 2021)

On the contrary, Moudatsou (2003) show that growth effect of FDI is not conditional upon the level of human capital in developed host countries. Carkovic and Levine (2005) similarly do not find evidence that suggest the critical role of education on growth-enhancing effect of FDI. Focusing on OECD countries, De Mello (1999) find positive impact of FDI on growth only for countries in which domestic and foreign capital are complements. Alfaro and Charlton (2013) study on European

Union countries also show that, the quality of FDI has a larger effect on growth. With reference to UNCTAD's World Investment Report 2006, they describe "quality FDI" as the kind that would significantly increase employment, enhance skills and boost the competitiveness of local enterprises.

Blonigen et al. (2004) have shown that regarding the benefits of FDI, whether FDI crowds out or crowds in investment depends on countries' level of development. FDI is much less likely to crowd out (and then likely to crowd in) domestic investment for Least Developing Countries (LDCs) than Developing Countries (DCs). Thus, countries' level of development is crucial to the benefits and spillover effects of capital flows and the adverse impact of economic fluctuations. Balasubramanyam (1998) shows that the economic characteristics (such as sizeable domestic markets, infrastructure facilities, resource endowments etc.) of the host country determine the technology imported by MNEs. Furthermore, Alfaro and Charlton (2013) find similar results at the industry level.

At the country level, the literature has shown that output volatility affects countries disproportionately, and more specifically, developing countries seem to suffer more from output volatility than developed countries (Jansen et al., 2009). A plausible explanation is that these economies specialize in few tradable products and sectors and lag behind in the adaptation of cutting-edge technologies (Tenreyro and Koren, 2007; Krishna and Levchenko, 2013; and Tenreyro and Koren, 2013). Other factors connected to the structural vulnerability of developing countries regard their lack of proper financial, monetary and fiscal discipline which could serve as tools for mitigating the effect and intensity of economic shocks.

The shocks that most developing countries face are either internally generated or arguably the spillover effects of some external circumstances (Reinhart and Rogoff, 2009). A plunge in commodity prices over a long period of time affects foreign earnings of most developing countries, which could potentially precipitate domestic shock through production, investment and consumption uncertainty. While different existing contributions (Bejan, 2006; Abubaker, 2015; Balavac et al., 2016 and Di Giovanni et al., 2009) focus on international trade as a determinant of output volatility, we study the impact of foreign direct investment.

The literature on the role of FDI flows on output volatility is relatively scant. A strand of literature rests on the stylized fact that, among the components of capital flows, FDI flows are relatively stable and could, therefore, deliver higher stability. In this respect, Federico et al. (2013) show that output volatility depends not only on the volatility of FDI and portfolio and other investments, but also on the correlation among them and the share of FDI in total capital flows. They find that foreign investments decrease output volatility when the FDI share in total foreign capital flow is low. With regards to spillovers from FDI across industries, Javorcik (2004) tested and found positive productivity spillovers from FDI taking place through interactions between foreign suppliers of intermediate inputs and their domestic customers and foreign affiliates and their domestic suppliers using a firm-level panel data set from Lithuania. The test showed that spillovers are connected with projects with shared domestic and foreign ownership but not with fully owned foreign investments.

A different approach in the analysis of the FDI-output volatility nexus is followed by Kalemli-Ozcan et al. (2014). They study the relationship between output volatility and foreign ownership by using a firm-level panel data set for European countries. In their firm-level analysis, they find a positive relationship between foreign ownership and firm-level volatility. They conclude that the risky behaviour of foreign firms comes from their ability to diversify risk internationally. At the aggregate regional level, they show that micro-level (firm) patterns of volatility carry-over to the macro-level (regional). In particular, the evidence of consistency in the micro-level and macro-level patterns of volatility, as shown by Kalemli-Ozcan et al. (2014), originates from the "granular" (see, Gabaix, 2011) firm size structure of the countries they analyse. However, Imbs (2007) document a negative aggregate growth and volatility relationship, but a positive sectoral growth and volatility. Furthermore, Comin et al. (2005) find that there exists a negative relationship between firm-level and aggregate volatility. These contributions have shown that sector-level patterns of volatility could drive aggregate volatility, even if this is not always the case since co-movement of sector-level and country level volatility could develop differently.

Our work follows that of Federico et al. (2013) and Kalemli-Ozcan et al. (2014) in the scant FDI-output volatility literature. We distinguish our work from the one by Federico et al. (2013) by implementing an industry-country level analysis. While the effect highlighted in the Kalemli-Ozcan et al. (2014)'s paper captures the direct impact of firms' foreign ownership on their volatility, our analysis is able to capture a sector-level FDI-volatility nexus engendered by the impact of MNEs' presence on domestic actors, thus encompassing the different channels presented above. Moreover, we also focus on a larger sample of countries with respect to the work by Kalemli-Ozcan et al.(2014), especially when we extend the analysis to FDI targeting.

3 Empirical Methodology and Data

We use a panel data of 34 OECD countries. The data covers thirteen (13) manufacturing industries following the International Standard Industrial Classification (ISIC revision 3- 2 digit) for the period 1990-2015 (a standard consistent with that used by Jiménez-Rodríguez, 2008). The sample selection and countries is based on data availability. Data on industrial variables are collected from UNIDO INDSTAT database (INDSTAT2) which provides industrial data for a large set of countries. Our main explanatory variable is inward FDI. For inward FDI stock, we use data from the OECD FDI database. We consider an explanatory trade openness variable which is obtained using industry-level import and export trade data from WITS-COMTRADE database. We exploit industry-specific characteristics retrieved from the NBER manufacturing industry database. Also, we use the OECD input-output table (IO) to compute the industry-level share of output and intermediate input supplies. In terms of control variables, we considered data on other country-level variables such as financial openness, secondary school enrollment and portfolio investments that are used widely in other studies (see e.g., Balavaca and Pughb 2016; Asamoah et al., 2019). These variables are obtained from diverse sources. For instance, secondary school enrollment data are taken from the World Development Indicators (WDI) of the World Bank, while financial openness and portfolio investment data are sourced from Chinn-Ito Index (KAOPEN) and the International Financial Statistics (IFS) of the IMF respectively.

We begin a baseline model exploring the link between industry-level inward FDI stock and output growth volatility. The first is an output volatility represented by a 5-year standard deviation of real output growth rates given as follows:

$$Vol_{cit} = \sqrt{\frac{1}{20}\sum_{t=1}^{20}(y_{cit} - \bar{y}_{ci})^2} \tag{1}$$

The variable Vol_{cit} is the standard deviation in a 5-year time window covering the period 1990-2015 for country c in industry i at time period t. The 5-year time window is the typical length of a business cycle (Madsen 2002; Beck and Levine, 2001). Similarly, Blanchard and Simon (2001) and Abubaker (2015) both use a time window of 20 quarters. We divide the sum of squared deviations by $\frac{1}{20}$ because we have 5 years spread over 20 quarters. y_{cit} is the country-industry growth rate for quarter q in country i within the time period t and $\bar{y}_{ci}$ is a five-year average of growth rate for a particular country i. The country-industry growth rate at time t is computed as

$$y_{cit} = y_{cit-1} + \alpha_t + \delta_{ci} + \varepsilon_{cit}, Vol_{cit} = \hat{\varepsilon}^2 \tag{2}$$

where α_t, δ_{ci} and ε_{cit} are the time fixed effect, country-industry fixed effect and residuals respectively.[3] Considering the lack of sectoral price index for a large number of countries used, we deflate sector level output by using the country level GDP deflator. It follows that our measure of volatility may reflect in part volatility in relative prices. However, our focus on the manufacturing sector mitigates this drawback, as price volatility is much less severe issue for manufacturing than for agricultural commodities or agricultural sector. Moreover, our analysis focuses on developed countries (OECD countries), which are less likely to experience frequent price changes. Also, we focus on a sample period that did not record large changes in prices (at least not for the majority of countries we analyze).

To empirically investigate the impact of inward FDI on output growth volatility, we estimate the following dynamic panel fixed-effect model:

$$lnVol_{cit} = \beta_0 + \beta_1 shFDI_{cit-1} + \beta_2 lnOutput_{cit-1} + \beta_3 TrdOpenness_{cit-1} + \beta_4 FinOpenness_{ct-1} + \beta_5 lnSch\_enrol_{ct-1} + \beta_6 lnSalaries\_Wages_{cit-1} + \beta_7 lnGFCF_{cit-1} + \beta_8 shPfl\_Invst_{ct-1} + \alpha_t + \delta_{ci} + \varepsilon_{cit}. \quad (3)$$

Given the 5-year window for dependent variable, Vol_{cit}, this gives a total of five non overlapping time windows: 1991-1995, 1996-2000, 2001-2005, 2006-2010, 2011-2015. A similar model is estimated by using as dependent variable an alternative measure of volatility computed as the square of the residual of an AR(1) growth regression in each year. The variable of interest, $shFDI_{cit-1}$, is a year lag of the share of inward FDI stock of country c in industry i at time t ($\frac{FDIstock\_in\_value}{Output\_value}$). We control for other plausible determinants of volatility namely the Output level (Output), trade openness (TrdOpenness) , financial openness (FinOpenness), secondary school enrollment (Schenrol), wages and salaries (Salaries_Wages), gross fixed capital formation (GFCF) and portfolio investments (shPfl_Invst). Portfolio investment, which is computed as a share of GDP, controls for all other foreign capital flows below 10

[3]Before computing the standard deviation in (A) we exclude those country-industry pairs with growth rates above the top 1 percent and below 99 percent of the output growth rate distribution. Likewise, we follow similar treatment before estimating the growth model in (B).

percent of owners' equity. All controls follow the industry-country-year dimension, except (Sch_enrol), (FinOpenness) and (shPfl_Invst) which are country-level variables. α_t is the time fixed-effect, δ_{ci} is the country-industry fixed-effect and finally, ε_{cit} is the error term which is assumed to be uncorrelated with the controls and the variable of interest.

A methodological concern on FDI - output volatility regressions is the issue of potential endogeneity since growth rates, current and past have potential influence on both components FDI and openness (trade and finance). The argument is extensively debated in the literature (see e.g. Li and Liu, 2005; Alguacil et al., 2011, Balavaca and Pughb 2016). The endogenous growth literature emphasizes that FDI inflows are likely to increase long-run growth due to their capital accumulation. The theoretical narrative for the correlation between FDI and output volatility holds in both positive and negative directions. Just as inward FDI can stimulate competition and consequentially eliminate inefficient firms leading to long-run stability, it can also stifle credit and crowd out domestic firms leading to domestic demand instability. Both explanations though likely to have different long-run effect seem to indicate a similar short-run effect of FDI impact on output volatility. Thus, one would expect the impact of FDI to be positive, given this intuition which is also consistent with the idea that the manufacturing industries face high demand and supply risk following domestic or external shocks.

Importantly, the argument concerning the potential endogeneity or exogeneity of FDI in volatility models is inconclusive and often supported by models in the context of output growth rather than output growth volatility or the country in question. For non-OECD countries, De Mello (1999) showed that FDI has a negative time trend in output growth which is indicative of a linear endogenous relationship between output growth and FDI. On the other hand, there is no time-series evidence of the time trend of linear endogenous growth derived from FDI to growth. A general assumption is that FDI and openness including trade and finance are exogenous with respect to output volatility. Notwithstanding and accordingly, we use the fixed effects (FE) estimation strategy to correct for any endogeneity caused by ignoring unobserved heterogeneity and omitted variables. Consistent with the strategy employed in Alguacil et al. (2011), a potential endogeneity bias is taken into account in these regressions by including the lagged value of the considered variables (instead of the current) as the main regressors (see equation 3). Besides, the reason for the choice of FE in opposition to the random effect (RE) estimator in our panel analysis is borne by the structure of our sample, noting that the FE estimation addresses any doubts we may have concerning the correlation with the output growth volatility with the country-specific effects and, hence, with respect to a potential source of endogeneity bias.

4 Results

4.1 The FDI-Output growth volatility nexus

From model [1] to [7], volatility is computed following the 5-year standard deviation measure, while the residual measure is used in model [8] to [13]. Moreover, in model [1] to [7], the lagged variables refer to the last year of the previous time window, while in model [8] to [13] lagged variables refer to the previous year. Table 1 reports our findings on the impact of inward FDI stock on output growth volatility obtained from the estimation of equation 1.

The estimates show a positive and statistically significant correlation between output growth volatility and a year lag of inward FDI stock. This finding is confirmed when using both measures of volatility and controlling for other determinants of output growth volatility. With reference to model [1] to [7], the estimated effect[4] is between 38-65 percent and statistically significant at 1 percent level. Models [8] to [13] report a positive impact of inward FDI on volatility but a lower magnitude.

[4]This is computed as: $100 \times (exp^{\beta_1} - 1)$

Table 1: Estimates- Impact of inward FDI stock on output growth volatility

	Dependent Variable: ln[SD_output_growth]						
VARIABLES	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**	**Model 7**
L.shFDI	0.353***	0.352***	0.487***	0.501***	0.404***	0.316***	0.325***
	(0.118)	(0.117)	(0.086)	(0.088)	(0.090)	(0.085)	(0.088)
L.lnOutput		-0.005	0.044	0.067	0.288*	0.214	
		(0.086)	(0.111)	(0.119)	(0.162)	(0.178)	
L.TrdOpenness			0.125**	0.132**	0.154***	0.101*	0.079
			(0.060)	(0.061)	(0.059)	(0.057)	(0.052)
L.FinOpenness				-0.066	-0.122*		
				(0.049)	(0.066)		
L.lnsch_enrol					0.205	0.318	0.197
					(0.331)	(0.327)	(0.351)
L.lnwage_salaries					-0.084	-0.135	0.013
					(0.136)	(0.157)	(0.100)
L.lnGFCF					-0.068	-0.035	-0.036
					(0.070)	(0.073)	(0.076)
L.shPfl_invst						0.277**	0.289***
						(0.111)	(0.111)
A_out_grwth							-0.314
							(0.570)
Year FE	YES	YES	YES	YES	YES	YES	YES
Country_Industry FE	YES	YES	YES	YES	YES	YES	YES
Observations	769	769	726	726	637	581	581
R^2	0.358	0.358	0.422	0.425	0.483	0.492	0.488
	Volatility: Residual Method						
	Model 8	**Model 9**	**Model 10**	**Model 11**	**Model 12**	**Model 13**	
L.shFDI	0.0149***	0.0146***	0.0173***	0.0181***	0.0224***	0.0205***	
	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)	
L.lnOutput		-0.111	-0.208	-0.168	0.673***	0.664**	
		(0.130)	(0.139)	(0.141)	(0.241)	(0.299)	
L.TrdOpenness			-0.001***	-0.001***	-0.012**	-0.012**	
			(0.003)	(0.003)	(0.006)	(0.006)	
L.FinOpenness				-0.173*	0.063		
				(0.092)	(0.111)		
L.lnsch_enrol					-0.863	-0.847	
					(0.813)	(0.844)	
L.lnwage_salaries					-0.883***	-0.896***	
					(0.277)	(0.320)	
L.lnGFCF					-0.082	-0.082	
					(0.142)	(0.152)	
L.shPfl_invst						-0.335	
						(0.300)	
Year FE	YES	YES	YES	YES	YES	YES	
Country_Industry FE	YES	YES	YES	YES	YES	YES	
Observations	4,029	4,029	3,935	3,934	3,032	2,784	
R^2	0.058	0.059	0.063	0.064	0.051	0.049	

∗ ∗ ∗,∗∗,∗ represent 1%, 5% and 10% significant level respectively, standard errors are in brackets. The dependent variable in model [1] to [7] follows the standard deviation method, while in model [8] to [13] we apply the residual method.

This difference can be attributed to the fact that the standard deviation measure exploits a longer year-on-year variation compared to the residual measure.

Importantly, in the specifications where we use the standard deviation measure of volatility, we include the average sectoral output growth (A_out_grwth) which controls for heterogeneous growth across sectors which may affect the results. Additionally, as the evidence of a positive FDI- output volatility nexus could be driven by peculiar characteristics of some sub-sample groups, we estimate the model by splitting the sample into high and low growth sectors. A sector is classified as high growth if the output growth of the sector exceeds the average sector growth defined at the country level. To capture the changing nature of sectors' productivity, the classification is based on a time window of 5 years.

The results (see table A4 and A5 in the appendix) show a positive relationship between FDI and output volatility in both high and low growth sectors. They, however, indicate that high growth sectors have larger (in magnitude) volatility than low growth sectors. Furthermore, we split the sample into high and low sectors according to sectors' pre-sample share of value-added. We use the value-added shares in 1990. While the results (see table A6 in the appendix) are consistent with our baseline findings, we, however, do not find any significant difference of the impact of FDI on volatility in sectors with either high or low initial share of value-added.

We also report in Table 2 the contemporaneous impact of average inward FDI on output volatility (using the standard deviation measure). In this estimation, we take the average of the variables of each time window by excluding from the computation those time windows which present at least one missing data point. This strategy ensures consistency in computing the averages across countries-industry-year. Consistent with our previous findings, the results indicate that contemporaneous average inward FDI stock increases output growth volatility. The results also indicate that the contemporaneous impact of inward FDI seems larger than the lag effect of inward FDI. This seems quite intuitive since generally the impact of economic shocks is profound during its early period but dissipates over time.

As shown in previous results, the estimated partial elasticities of $shFDI$ are statistically significant at 1 percent level after controlling for trade openness, financial openness and portfolio investment. Also consistent with findings in the literature, the positive impact of trade openness on volatility is correctly identified as shown in Model [5] and [6]. The results, however, indicate that financial openness[5] has no significant effect on volatility, while portfolio investment is significant at 5 percent level as shown in Model [6].

Table 2: Contemporaneous average effect of inward FDI stock

	Dependent Variable: ln[SD_output_growth]					
VARIABLES	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
shFDI	0.669***	0.688***	0.607***	0.592***	0.761***	0.764***
	(0.136)	(0.137)	(0.167)	(0.170)	(0.178)	(0.179)
lnOutput		0.0825	0.0874	0.171	0.804*	1.581***
		(0.115)	(0.121)	(0.139)	(0.477)	(0.382)
TrdOpenness			0.066	0.0668	0.347***	0.388***
			(0.079)	(0.077)	(0.106)	(0.137)
FinOpenness				-0.197	-0.304	
				(0.128)	(0.189)	
lnsch_enrol					3.794***	4.369***
					(1.337)	(1.378)
lnwage_salaries					-0.00298	-0.684*
					(0.568)	(0.378)
lnGFCF					-0.466***	-0.464***
					(0.155)	(0.157)
shPfl_invst						0.594**
						(0.257)
Year FE	YES	YES	YES	YES	YES	YES
Country_Industry FE	YES	YES	YES	YES	YES	YES
Observations	498	498	465	465	331	305
R^2	0.337	0.338	0.417	0.426	0.576	0.628

$***$,$**$,$*$ represent 1%, 5% and 10% significant level respectively, standard errors are in brackets. The dependent variable is the standard deviation of output growth.

4.2 FDI-Output growth volatility nexus in capital intensive industries

In most developed countries, production is highly mechanized and essentially capital intensive. While huge capital requirement in high capital-intensive industries poses an inherent entry barrier for domestic firms, MNEs are more likely to enter

[5]This measure is likely to be associated to greater flows of FDI and portfolio investments.

high capital intensive industries as they have at their disposal higher financial resources and are less likely to be credit constrained. Hence, except for government investments, MNEs are the natural players in high capital intensive industries. In this section, we analyze the impact of inward FDI stock on volatility in high capital intensive industries using NBER manufacturing industry data. We measure capital intensity as the ratio of industry-level stock of capital and value-added. We then estimate the model:

$$lnVol_{cit} = \beta_0 + \beta_1 shFDI_{cit-1} + \beta_2 shFDI_{cit-1} * CapInt_{cit-1} + \beta_3 CapInt_{cit-1} + Z'_{cit-1}\Theta + X'_{ct-1}\Phi + \alpha_t + \delta_{ci} + \varepsilon_{cit} \quad (4)$$

Equation (2) follows the definitions given in equation (1), and we use the residual measure of volatility in the estimation. *CapInt* is the measure of capital intensity, while Z'_{cit} and X'_{ct} are the vectors of country-industry-year and country-year controls respectively. Since the share of inward FDI stock and the measure of capital intensity are both continuous variables, we estimate the FDI effect on output volatility along sectors' capital intensity distribution.

Table 3 presents the results of the impact of inward FDI stock on output volatility in capital-intensive industries. The results seem to suggest a negative relationship between volatility and capital-intensive industries as
shown by the main effect variable *CapInt*. That notwithstanding, inward FDI significantly flip the negative effect, indicating a positive relationship as reported in model [1] to [5] by the interaction term of inward FDI and capital intensity measure. By resting on these results, the effect of inward FDI on volatility differ across sectors with different level of capital intensity.

We estimate the FDI effect on volatility along the distribution of the capital-intensive measure by focusing on the 10th, 25th, 50th, 75th and 90th percentiles of the *CapInt* distribution. We consider industries to be relatively high capital intensity if their *CapInt* value equals or exceed the value of the 50th percentile. The

Table 3: Estimates- Impact of inward FDI on Volatility in Capital Intensive industries

	Dependent Variable: ln[Volatility_output_growth]					
VARIABLES	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
$L.shFDI$	-0.021	-0.021	-0.033	-0.033	-0.032	-0.020
	(0.019)	(0.019)	(0.020)	(0.021)	(0.021)	(0.022)
$L.shFDI \times L.CapInt$	0.037*	0.036*	0.051**	0.052**	0.054**	0.041
	(0.021)	(0.021)	(0.023)	(0.023)	(0.024)	(0.026)
$L.CapInt$	-0.312	-0.357	-0.452**	-0.443**	-0.294	-0.341
	(0.211)	(0.217)	(0.220)	(0.218)	(0.263)	(0.327)
$L.lnOutput$		-0.176	-0.310**	-0.275*	0.617**	0.432
		(0.141)	(0.139)	(0.140)	(0.243)	(0.317)
$L.TrdOpenness$			-0.014***	-0.013***	-0.013**	-0.015***
			(0.003)	(0.003)	(0.006)	(0.005)
$L.FinOpenness$				-0.138	0.064	
				(0.095)	(0.113)	
$L.lnsch\_enrol$					-0.866	-0.530
					(0.806)	(0.818)
$L.lnwage\_salaries$					-0.857***	-0.699**
					(0.279)	(0.320)
$L.lnGFCF$					-0.074	0.036
					(0.144)	(0.160)
$L.shPfl\_invst$						0.213*
						(0.114)
Year FE	YES	YES	YES	YES	YES	YES
Country_Industry FE	YES	YES	YES	YES	YES	YES
Observations	3,793	3,793	3,699	3,698	3,032	2,776
R^2	0.042	0.043	0.049	0.05	0.052	0.049
	FDI Effect along the capital intensity distribution					
$10^{th} Percentile$	0.005	0.005	0.004	0.004	0.007	0.010*
	(0.005)	(0.005)	(0.006)	(0.006)	(0.006)	(0.006)
$25^{th} Percentile$	0.008*	0.008*	0.008	0.008*	0.011**	0.013***
	(0.004)	(0.004)	(0.005)	(0.005)	(0.005)	(0.005)
$50^{th} Percentile$	0.013***	0.013***	0.015***	0.016***	0.019***	0.019***
	(0.004)	(0.004)	(0.005)	(0.005)	(0.005)	(0.005)
$75^{th} Percentile$	0.019***	0.018***	0.022***	0.023***	0.026***	0.025***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.007)	(0.008)
$90^{th} Percentile$	0.025***	0.024***	0.031***	0.032***	0.035***	0.031***
	(0.009)	(0.009)	(0.009)	(0.010)	(0.010)	(0.011)

∗ ∗ ∗,∗∗,∗ represent 1%, 5% and 10% significant level respectively, standard errors are in brackets. The dependent variable follows the residual method of computing volatility.

mean and standard deviation of the $CapInt$ distribution[7] is 1.009 and 0.379 respectively. However, the results are robust to dropping industries that are inherently high capital-intensive.

Using the 10th, 25th, 50th, 75th and 90th percentile value of $CapInt$, the results indicate that inward FDI stock impact positively on volatility in capital-intensive industries. This impact seems to be statistically significant and larger in magnitude in predominately high capital-intensive industries. For example, the estimated impact is approximately zero and insignificant (except in Model 6) for industries in the 10th percentile. Intuitively, in high capital intensive sectors, volatility may ensue from higher competition associated with the presence of MNEs. In general, the structure of capital-intensive industry permit the operation of a few number of firms, therefore new or existing MNEs might have to compete fiercely to maintain or extend their market shares hence the higher output growth volatility in high capital intensive industries.

4.3 Output growth volatility and FDI spillover

Since industries depend on each other due to their Input-Ouput (IO) relationships, the impact of inward FDI in the host industry is likely to spillover to other industries that are directly or indirectly connected in the supply chain. According to Javorcik (2004), spillovers from FDI take place when the entry or presence of MNEs increases the productivity of domestic firms and the MNEs do not fully internalize the value of these benefits.

Existing literature (Blalock, 2001; Schoors et al., 2001; Javorcik, 2004) point at the existence of some positive FDI spillover effect through backward linkages. Ideally, this positive effect is more likely to exist in upstream than in downstream activities. Thus, MNEs will be more willing to share cutting-edge production tech-

[7]The outliers in the $CapInt$ distribution are expected. The coke, refined petroleum products and nuclear fuel industries require huge capital and are extremely capital intensive than the food products and beverages industry both included in our sample.

niques with their local supplies than with their competitors. On the other hand, downstream activities are more likely to be volatile than upstream activities. The intuition is that firms providing finished products to customers mostly compete over market shares.

In this section, we analyze how the presence of inward FDI in downstream and upstream activities contributes to a sector's output volatility. We used the 1995 OECD input-output table to compute country level input-output shares between sectors. While our sample focuses on manufacturing industries in the OECD area, we normalize each manufacturing industry's input purchases on the total purchases and each industry's output on the total sales. We then estimate the following models:

$$lnVol_{cit} = \beta_0 + \beta_1 shFDI^{downstream}_{cit-1} + \beta_2 shFDI^{upstream}_{cit-1} + \beta_3 shFDI_{cit-1} + Z'_{cit-1}\Theta + X'_{ct-1}\Phi + \alpha_t + \delta_{ci} + \varepsilon_{cit} \quad (5)$$

Where downstream and upstream FDI are defined as fellows:

$shFDI^{downstream}_{cit} = \sum_j \mu_{cij} * shFDI_{cjt}, i \neq j, where \quad j \in M$, and M is the set of manufacturing sectors.

$shFDI^{upstream}_{cit} = \sum_j \nu_{cij} * shFDI_{cjt}, i \neq j$

The input-output shares (μ_{cij}, ν_{cij}) are computed excluding within industry transfers. μ_{cij} represents the share of sales (over total sales) of industry i to industry j in country c, while ν_{cij} are the share of purchases (over total purchases) of industry i from industry j in country c and $shFDI$ is computed as before.

In table 4, we report the results of the impact of inward FDI stock in downstream and upstream activities on a sector's volatility (we use the standard deviation measure). As shown in our baseline results, we find inward FDI stock in the sector under analysis to be positive and significant. Moreover, the effect of inward FDI in downstream activities is positive and significant in all reported models. However, FDI in upstream activities bear a positive coefficient, but it is significant just in model model 3 and 4. As expected, the reported partial elasticity of inward FDI in downstream activities on volatility seems larger with respect to that associated with upstream activities.

Firms in downstream sectors compete over market shares. They internalize the benefits of their production know-how and technology from other downstream firms. The outcome of the competitive pressure in downstream activities is the evidence of a significantly large (in magnitude) output growth volatility as shown by our results. Importantly, because of backward spillover effect, firms active in upstream activities may be more exposed to output growth volatility due to their relationships with firms in downstream sectors. Thus, their exposure to volatility originates from firms volatile activities in the downstream sectors. Consistent with our results, we find a positive FDI-volatility nexus in upstream sectors.

Table 4: Estimates- FDI spillover effect on volatility

	Dependent Variable: ln[Volatility_output_growth]							
VARIABLES	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**	**Model 7**	**Model 8**
$L.shFDI^{downstream}$	1.174*	1.159*	2.530***	2.502***	1.946**	1.629*	1.629*	1.629*
	(0.649)	(0.638)	(0.852)	(0.829)	(0.777)	(0.901)	(0.901)	(0.902)
$L.shFDI^{upstream}$	0.907	0.902	1.610**	1.631**	0.992	1.203	1.203	1.204
	(0.810)	(0.809)	(0.777)	(0.762)	(0.656)	(0.774)	(0.774)	(0.771)
$L.shFDI$	0.280**	0.279**	0.351***	0.359***	0.333***	0.257**	0.257**	0.257**
	(0.113)	(0.111)	(0.110)	(0.112)	(0.109)	(0.108)	(0.108)	(0.110)
A_out_grwth								0.009
								(0.593)
$L.lnOutput$		-0.008	0.031	0.048	0.220	0.222	0.222	0.223
		(0.086)	(0.108)	(0.115)	(0.160)	(0.177)	(0.177)	(0.186)
$L.TrdOpenness$			0.118**	0.123**	0.145**	0.101*	0.101*	0.101*
			(0.058)	(0.059)	(0.058)	(0.058)	(0.058)	(0.058)
$L.FinOpenness$				-0.045	-0.095	-0.016	-0.016	-0.016
				(0.045)	(0.061)	(0.059)	(0.059)	(0.060)
$L.lnsch\_enrol$					0.235	0.362	0.362	0.362
					(0.320)	(0.326)	(0.326)	(0.328)
$L.lnwage\_salaries$					-0.060	-0.140	-0.140	-0.140
					(0.140)	(0.162)	(0.162)	(0.161)
$L.lnGFCF$					-0.049	-0.035	-0.035	-0.035
					(0.070)	(0.072)	(0.072)	(0.073)
$L.shPfl\_invst$						0.213*	0.213*	0.213*
						(0.119)	(0.119)	(0.120)
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Country_Industry FE	YES	YES	YES	YES	YES	YES	YES	YES
Observations	765	765	722	722	635	581	581	581
R^2	0.367	0.367	0.447	0.448	0.497	0.496	0.496	0.496

$***$,$**$,$*$ represent 1%, 5% and 10% significant level respectively, standard errors are in brackets. The dependent variable follows the standard deviation measure of computing volatility.

4.4 Output growth volatility and FDI targeting

According to most investment promotion practitioners, the most effective way of attracting FDI is through prioritizing industries and targeting the industries with higher priority. This is very crucial as FDI flows could potentially restructure firms and ultimately industries in the host country. Wells and Wint (1990) define investment promotion as activities through which governments aim to attract FDI inflows. These activities are sometimes comprehensive, going from fiscal incentives like tax cut and tax holidays to administrative incentives such as investors servicing etc. FDI targeting has been shown to be positively correlated with FDI flows, with developing countries being the main beneficiaries (Harding and Javorcik, 2011).

On this basis, we use FDI targeting data in a sort of reduced form model in order to analyze the FDI-volatility relationship. The FDI targeting data we used are retrieved from a World Bank commissioned survey conducted in 2005. This data is extensively described in Harding and Javorcik (2011). It is important to stress that the survey provides time-varying industry-specific information about whether an industry was targeted or not over a defined period of time. The data cover 124 countries for the period 1989-2004.

We exploit the data in two ways. First, we take advantage of the large cross-section of countries by estimating a model which covers 95 countries (referred to as the world sample) over the sample period 1980-2010. The overlap in our sample period comes from the fact that the lagged variables follow a 5-year time window. Second, we limit the sample to only OECD countries as we have done in our baseline estimations. This allows us to understand if there exist significant differences between the average impact of FDI targeting on output volatility focusing on these two sample groups.

In table 5, we report the impact of FDI targeting on output volatility. The upper table shows the estimates using all the sample of countries, while the lower table shows that for the OECD sample. Moreover, we use the residual measure of volatility in the upper table, and the standard deviation

Table 5: Estimates- FDI targeting on Volatility

	Dependent Variable: ln[Volatility_output_growth]					
			WORLD SAMPLE			
VARIABLES	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
L.Targeted	0.528***	0.476***	0.323**	0.339**	0.369*	0.708***
	(0.132)	(0.133)	(0.138)	(0.142)	(0.206)	(0.222)
L.lnOutput		0.119***	0.145**	0.146**	0.192**	0.441***
		(0.025)	(0.067)	(0.066)	(0.082)	(0.148)
L.TrdOpenness			0.485***	0.483***	5.702**	4.405
			(0.082)	(0.081)	(2.608)	(5.539)
L.FinOpenness				-0.151**	-0.0889	-0.00829
				(0.059)	(0.070)	(0.101)
L.lnsch_enrol					0.394	-0.347
					(0.534)	(0.839)
L.lnwage_salaries					-0.270*	-0.871***
					(0.164)	(0.254)
L.lnGFCF					-0.0743	-0.0638
					(0.077)	(0.122)
L.shPfl_invst						-0.617*
						(0.372)
Year FE	YES	YES	YES	YES	YES	YES
Country_Industry FE	YES	YES	YES	YES	YES	YES
Observations	10,106	10,106	6,315	6,243	3,822	2,684
R^2	0.033	0.037	0.035	0.037	0.035	0.066
			OECD SAMPLE			
L.Targeted	0.477***	0.470***	0.551***	0.405***	0.729***	0.352*
	(0.123)	(0.126)	(0.128)	(0.145)	(0.159)	(0.200)
L.lnOutput		0.174*	0.196*	0.239*	0.0467	0.0421
		(0.092)	(0.109)	(0.140)	(0.116)	(0.152)
L.TrdOpenness			-9.619***	-21.81	-9.882***	5.445
			(2.796)	(58.760)	(3.424)	(73.430)
L.FinOpenness					-0.171***	-0.522***
					(0.064)	(0.114)
L.lnsch_enrol						1.795**
						(0.767)
L.lnwage_salaries				0.629***		0.499**
				(0.200)		(0.199)
L.lnGFCF				-0.281***		-0.168*
				(0.081)		(0.085)
Year FE	YES	YES	YES	YES	YES	YES
Country_Industry FE	YES	YES	YES	YES	YES	YES
Observations	656	656	586	465	544	429
R^2	0.169	0.179	0.112	0.167	0.158	0.296

$*{*}*,{*}*,*$ represent 1%, 5% and 10% significant level respectively, standard errors are in brackets. The dependent variable in the upper table follows the residual method while we use the standard deviation method in the lower table

measure in the lower table. The dummy *Targeted* is our variable of interest and it takes value 1 if an industry was targeted by the host government usually through investment promotion agencies (IPAs) at a given period and 0 otherwise.

The results thus indicate that there exists a positive and statistically significant impact of FDI targeting on output volatility. Put differently, industries that were targeted experience higher volatility of output than industries that were not targeted. This finding is consistent irrespective of the measure of volatility or the country group used. Thus, the impact of FDI targeting on volatility in developed (OECD) countries does not differ significantly from the world average. Moreover, and as expected, the estimated effect is quite similar to that obtained by using inward FDI stock.

We verify this finding further by estimating an alternative model where we consider FDI targeting as a treatment variable. More specifically, we focus on just countries that start targeting an industry in one specific year. This allows us to easily define a pre- and post-targeting period, which will differ across countries but is the same across all sectors in a given country. In this flavour of difference-in-difference estimation, we analyze if the impact of FDI targeting on output growth volatility is significant in the post-targeting period. Importantly, since we are able to identify one single targeting year for each country, we consider this year when computing the post and pre targeting period even for non targeted sectors. For example, in our sample, Austria targeted the food processing industry beginning 1997. Hence, we, therefore, impute 1997 to all non targeted industries as the year of targeting. We are thus able to identify the post and pre-targeting period for all sectors. We then estimate a cross-sectional model of the form given below as:

$$\Delta_{\tau+5,\tau-5} lnVol_{ci\tau} = \beta_0 + \beta_1 Targeted_{ci\tau} + \Phi X'_{ci} + \lambda_c + \gamma_{i\tau} + \epsilon_{ci\tau} \qquad (6)$$

The dependent variable is the difference of a 5-year lead and lag of output growth volatility. The leads and lags are computed using the year of industry targeting as the reference. τ in equation (4) correspond to different calendar years across sectors as the targeting year ($t = 0$) is different across countries. For example, in our sample, Austria targeted some industries in 1997 while Canada began its targeting in 2003. Thus, despite the different time period, country-industry pairs are included only once in the estimation. The dummy $Targeted$ takes value 1 if the industry was targeted and 0 otherwise. X'_{ci} is a vector of country-industry controls, λ_c is the country FE, and $\gamma_{i\tau}$ is the industry-year FE.

Table 6: Cross-Sectional effect- Volatility and FDI targeting

	Dependent Variable: $Volatility_{Post} - Volatility_{Pre}$			
	[Model 1]	[Model 2]	[Model 3]	[Model 4]
Targeting	**0.418****	**0.421****	**0.600***	**0.690***
	(0.166)	**(0.174)**	**(0.342)**	**(0.349)**
Fixed Effects:				
Sector × Year	NO	NO	YES	YES
Country	NO	NO	YES	NO
Country-industy covariates	NO	YES	NO	YES
Observations	102	101	102	101
R^2	0.214	0.269	0.823	0.833

∗ ∗ ∗,∗∗,∗ represent 1%, 5% and 10% significant level respectively, standard errors are in brackets.

Table 6 reports estimates of the cross-sectional effect of FDI targeting on output volatility. Volatility was computed using the 5-year standard deviation measure. The results in table 6 complement our baseline findings, in showing that output volatility is larger in the post-targeting period. The point estimate of the effect of FDI targeting on volatility in the post-targeting period is similar to our baseline results. Moreover, the results of Model 3 and 4 show a similar effect than the contemporaneous effect of FDI on volatility reported in Table 2.

5 Conclusion

The aim of this paper was to analyze the relationship between industry-level output volatility and inward FDI stock focusing on the manufacturing sector. While existing literature on the subject is scant, Kalemli-Ozcan et al., (2014) provide some firm-level evidence on the FDI-output volatility nexus. This paper tackles the sector-level dimension engendered by the impact of MNEs' presence on domestic actors, thus encompassing the different channels presented in the paper. We extend the analysis by exploring the existence of some heterogeneity according to the capital intensity of sectors and by shedding light on the impact of the inward FDI stock in downstream and upstream activities on a sector's output volatility.

We document a positive and statistically significant correlation between inward FDI stock and sector-level output volatility which the estimated effect is between 38-65 percent. Our results are robust to the use of an alternative measure of volatility and the inclusion of control variables. By exploiting industry-level heterogeneity, we find that inward FDI stock increases volatility in high capital intensive industries. Moreover, the results also show that inward FDI stock in downstream activities seems to have a significant effect on volatility with respect to inward FDI in upstream activities.

We conclude on a positive FDI-volatility nexus at the sector level, adding to the firm-level evidence in Kalemli-Ozcan et al., (2014). Further analysis using a measure of FDI targeting practices supports our baseline findings. An increasing number of governments want to attract FDI because the positive effects (growth and development, increasing innovation, human capital development) of FDI fit into the development agenda of policymakers. That notwithstanding, the risk of income inequality, profit repatriation and output volatility, the latter shown by our results, always revive the question about the dangers of inward FDI in the policy cycles.

Our results do not imply that policymakers should discourage or refrain from attracting FDI or practicing investment promotion. They rather highlight the strong connection between inward FDI stock and output volatility. The results, however, highlight the vulnerability of some industries to inward FDI which in this case requires some degree of policy intervention. For example, for countries with sufficiently large high capital-intensive sectors, much is required in term of policy intervention as inward FDI increases volatility in these sectors.

In this regard, policymakers could prioritize and monitor sectors that are likely to present higher volatility. Capital intensive and downstream sectors are relatively volatile as shown by our results. Moreover, our results show that high growth sectors face larger output volatility than low growth sectors. This is usually a concern in countries that depend on a few sectors and in cases where these sectors represent a significant domestic market share. A wider scope of prioritized sectors and a timely redistribution and promotion of investment in negligible sectors is key in managing inward FDI and output volatility. Thus, higher diversification of the economic structure would smoothen the effects of higher volatility experienced by a specific sector.

Our paper can be extended in a number ways. An unexplored relationship is the likelihood of risk-averse investors choosing to invest in high volatile sectors. This is another important relationship between FDI and output volatility that we leave for future research. Moreover, the identification of the nexus could be strengthened with the impact of the recent financial or economic crises and the interaction of FDI with factors such as global competitiveness and business freedom index, all under the availability of a larger database for a wider time span and covering a larger number of countries.

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Appendix

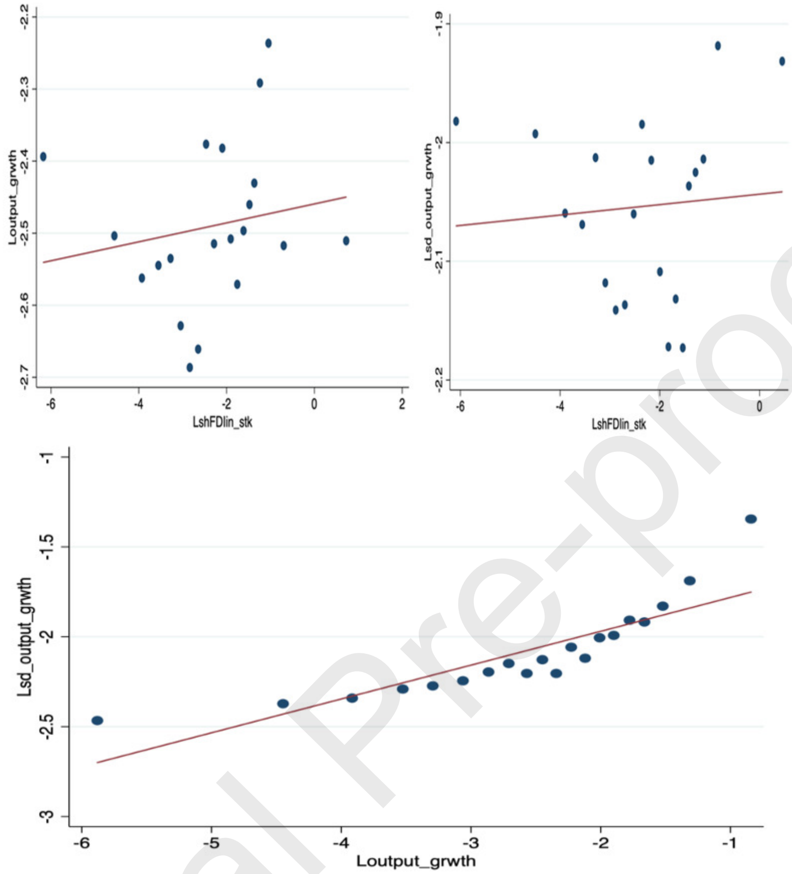
Table A1: List of Countries

Australia	Isreal	Austria	Italy
Belgium	Japan	Canada	Korea
Switzerland	Netherlands	Chile	Norway
Czech Republic	New Zealand	Germany	Poland
Denmark	Portugal	Spain	Slovakia
Estonia	Slovenia	Finland	Sweden
France	Luxembourg	UK	Mexico
Greece	Turkey	Hungary	USA
Ireland	Iceland		

A2: List of Industries- ISIC Rev. 3

No.	Codes	Names	Remark
1	15	Manufacture of food products and beverages	
2	17	Manufacture of textiles	Combined
	18	Manufacture of wearing apparel; dressing and dyeing of fur	
3	20	Manufacture of wood and of products of wood and cork	
	21	Manufacture of paper and paper products	Combined
	22	Publishing, printing and reproduction of recorded media	
4	23	Manufacture of coke, refined petroleum products and nuclear fuel	
5	24	Manufacture of chemicals and chemical products	
6	25	Manufacture of rubber and plastics products	
7	27	Manufacture of basic metals	Combined
	28	Manufacture of fabricated metal products	
8	29	Manufacture of machinery and equipment	
9	30	Manufacture of office, accounting and computing machinery	
10	32	Manufacture of radio, television and communication equipment	
11	33	Manufacture of medical, precision and optical instrument, watches etc.	
12	34	Manufacture of motor vehicles, trailers and semi-trailers	
13	35	Manufacture of other transport equipment	

Figure 1: Graphical descriptive evidence of the nexus among Inward FDI Stock, Ouptut Volatility and Volatility growth



A3: Summary Statistics

Variable		Mean	Std. Dev.	Min	Max	Observations
shFDI	overall	0.514	5.192	-17.738	130.585	N = 4370
	between		1.875	-0.636	16.601	n = 360
	within		4.790	-16.587	114.499	T = 12.139
TrdOpenness	overall	1.683	15.325	0.002	517.560	N = 8979
	between		13.699	0.004	189.010	n = 432
	within		10.547	-187.244	330.234	T-bar = 20.785
lnGFCF	overall	19.532	2.038	5.733	24.193	N = 7781
	between		2.013	12.235	23.644	n = 424
	within		0.724	9.002	24.376	T-bar = 18.351
lnSalaries_Wages	overall	20.626	2.033	11.081	25.554	N = 9404
	between		2.034	12.299	25.043	n = 433
	within		0.610	16.426	24.237	T-bar = 21.718
shPfl_Invst	overall	1.517	6.966	0.000	63.011	N = 9721
	between		8.599	0.002	50.931	n = 442
	within		1.007	-10.787	13.596	T-bar = 21.993
FinOpenness	overall	1.603	1.188	-1.904	2.374	N = 10722
	between		0.913	-0.576	2.374	n = 429
	within		0.761	-1.189	3.668	T-bar = 24.993
InSch_enrol	overall	4.616	0.166	3.918	5.091	N = 8801
	between		0.143	4.211	4.966	n = 442
	within		0.086	4.143	4.896	T = 19.912
lnOutput	overall	22.658	2.098	11.101	27.445	N = 9649
	between		2.099	13.651	27.048	n = 433
	within		0.666	15.914	26.512	T-bar = 22.284
CapInt	overall	1.047	0.425	0.638	3.327	N = 9721
	between		0.328	0.775	2.095	n = 442
	within		0.271	-0.236	2.280	T = 21.993

Table A4: Estimates- Impact of inward FDI on output growth volatility in high and low growth Industries

Dependent Variable: log[Volatility_output_growth]							
HIGH GROWTH INDUSTRIES							
VARIABLES	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**	**Model 7**
L.shFDI	0.825***	0.841***	0.852**	0.940**	0.995**	0.598**	0.629**
	(0.284)	(0.305)	(0.336)	(0.371)	(0.428)	(0.272)	(0.252)
L.lnoutput		0.583***	0.357**	0.396**	0.463	0.489	
		(0.157)	(0.170)	(0.183)	(0.296)	(0.390)	
L.TrdOpenness			0.504**	0.482**	0.459*	0.531**	0.428*
			(0.235)	(0.238)	(0.239)	(0.243)	(0.258)
L.FinOpenness				-0.0761	-0.221**		
				(0.090)	(0.108)		
L.lnsch_enrol					0.534	0.426	0.119
					(0.797)	(0.758)	(0.740)
L.lnwage_salaries					-0.039	-0.308	0.0459
					(0.251)	(0.430)	(0.278)
L.lnGFCF					0.00429	0.178	0.125
					(0.147)	(0.197)	(0.188)
L.shPfl_invst						0.603*	0.654**
						(0.317)	(0.324)
A_out_grwth							-0.406
							(1.676)
Year FE	YES	YES	YES	YES	YES	YES	YES
Country_Sector FE	YES	YES	YES	YES	YES	YES	YES
Observations	339	339	298	298	278	245	245
R^2	0.358	0.414	0.564	0.566	0.576	0.527	0.511

Dependent Variable: log[Volatility_output_growth]							
LOW GROWTH INDUSTRIES							
VARIABLES	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**	**Model 7**
L.shFDI	0.354***	0.346***	0.347***	0.349***	0.304**	0.244*	0.244*
	(0.102)	(0.107)	(0.105)	(0.106)	(0.117)	(0.135)	(0.139)
L.lnoutput		-0.099	0.037	0.040	0.185	0.214	
		(0.095)	(0.093)	(0.094)	(0.227)	(0.226)	
L.TrdOpenness			0.182***	0.184***	0.182***	0.158*	0.130
			(0.036)	(0.037)	(0.044)	(0.087)	(0.099)
L.FinOpenness				-0.011	-0.004		
				(0.057)	(0.084)		
L.lnsch_enrol					0.203	-0.285	-0.414
					(0.662)	(0.941)	(0.962)
L.Lwage_salaries					-0.051	-0.077	0.082
					(0.230)	(0.236)	(0.155)
L.LGFCF					-0.075	-0.085	-0.072
					(0.098)	(0.091)	(0.096)
L.shPfl_invst						-0.057	-0.020
						(0.208)	(0.199)
A_out_grwth							0.051
							(1.475)
Year FE	YES	YES	YES	YES	YES	YES	YES
Country_Sector FE	YES	YES	YES	YES	YES	YES	YES
Observations	430	430	428	428	359	336	336
R^2	0.234	0.243	0.297	0.297	0.379	0.392	0.386

∗ ∗ ∗,∗∗,∗ represent 1%, 5% and 10% significant level respectively, standard errors are in brackets. The dependent variable follows the standard deviation method

Table A5: Estimates- Impact of inward FDI on output growth volatility in high and low growth Industries

	Dependent Variable: log[Volatility_output_growth]					
	HIGH GROWTH INDUSTRIES					
VARIABLES	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
L.shFDI	0.023***	0.022***	0.027***	0.027***	0.032***	0.027**
	(0.008)	(0.008)	(0.009)	(0.009)	(0.009)	(0.011)
L.lnOutput		-0.276	-0.312	-0.339*	0.607*	0.415
		(0.177)	(0.192)	(0.196)	(0.363)	(0.444)
L.TrdOpenness			-0.007*	-0.008*	-0.068	-0.025
			(0.004)	(0.004)	(0.059)	(0.068)
L.FinOpenness				0.096	0.741***	
				(0.132)	(0.182)	
L.lnsch_enrol					-1.218	-0.935
					(1.203)	(1.219)
L.lnWage_salaries					-1.880***	-1.017**
					(0.449)	(0.469)
L.lnGFCF					0.025	-0.071
					(0.222)	(0.236)
L.shPfl_invst						-1.133**
						(0.489)
Year FE	YES	YES	YES	YES	YES	YES
Country_Sector FE	YES	YES	YES	YES	YES	YES
Observations	2,044	2,044	1,999	1,999	1,538	1,426
R^2	0.075	0.076	0.079	0.079	0.074	0.060

	Dependent Variable: log[Volatility_output_growth]					
	LOW GROWTH INDUSTRIES					
VARIABLES	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
L.shFDI	0.003	0.003	0.005	0.008	0.010*	0.010*
	(0.006)	(0.006)	(0.005)	(0.005)	(0.005)	(0.006)
L.lnOutput		0.151	0.113	0.229	1.137***	1.362***
		(0.184)	(0.193)	(0.191)	(0.366)	(0.421)
L.TrdOpenness			-0.007	-0.005	0.003	-0.008
			(0.008)	(0.009)	(0.009)	(0.009)
L.FinOpenness				-0.553***	-0.603***	
				(0.143)	(0.163)	
L.lnsch_enrol					0.207	-0.229
					(1.148)	(1.172)
L.lnWage_salaries					-0.337	-0.999**
					(0.394)	(0.448)
L.lnGFCF					-0.300	-0.224
					(0.225)	(0.233)
L.shPfl_invst						0.267
						(0.476)
Year FE	YES	YES	YES	YES	YES	YES
Country_Sector FE	YES	YES	YES	YES	YES	YES
Observations	1,972	1,972	1,923	1,922	1,494	1,358
R^2	0.096	0.097	0.103	0.113	0.108	0.100

∗ ∗ ∗,∗∗,∗ represent 1%, 5% and 10% significant level respectively, standard errors are in brackets. The dependent variable follows the residual method.

Table A6: Estimates- Impact of inward FDI on output growth volatility in sector's initial share of VA

Dependent Variable: log[Volatility_output_growth]							
HIGH SHARE OF VA SECTORS							
VARIABLES	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**	**Model 7**
L.shFDI	0.583***	0.614***	0.581***	0.615***	0.454***	0.354**	0.376**
	(0.147)	(0.145)	(0.159)	(0.161)	(0.157)	(0.163)	(0.177)
L.lnOutput		0.0927	0.241**	0.314***	0.468***	0.394**	
		(0.112)	(0.099)	(0.110)	(0.173)	(0.190)	
L.TrdOpenness			0.171***	0.193***	0.139**	0.09	0.0556
			(0.063)	(0.065)	(0.059)	(0.062)	(0.054)
L.FinOpenness				-0.117**	-0.135**		
				(0.051)	(0.065)		
L.lnsch_enrol					0.447	0.348	0.0502
					(0.397)	(0.378)	(0.412)
L.lnWage_salaries					-0.204	-0.254	0.0455
					(0.149)	(0.175)	(0.123)
L.LGFCF					-0.122	-0.102	-0.113
					(0.080)	(0.079)	(0.090)
L.shPfl_invst						0.136	0.18
						(0.156)	(0.153)
A_out_grwth							-0.399
							-0.603
Year FE	YES	YES	YES	YES	YES	YES	YES
Country_Sector FE	YES	YES	YES	YES	YES	YES	YES
Observations	501	501	471	471	412	380	380
R^2	0.397	0.4	0.474	0.485	0.545	0.544	0.53

Dependent Variable: log[Volatility_output_growth]							
LOW SHARE OF VA SECTORS							
VARIABLES	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**	**Model 7**
L.shFDI	0.244*	0.238*	0.465***	0.468***	0.407***	0.359***	0.365***
	(0.130)	(0.123)	(0.122)	(0.125)	(0.134)	-0.122	(0.121)
L.lnOutput		-0.142	-0.174	-0.172	0.041	0.024	
		(0.124)	(0.153)	(0.153)	(0.299)	(0.314)	
L.TrdOpenness			0.161	0.155	0.215	0.039	0.044
			(0.220)	(0.219)	-0.199	-0.195	(0.189)
L.FinOpenness				-0.039	-0.050		
				(0.119)	(0.150)		
L.lnsch_enrol					0.241	0.515	0.524
					(0.595)	(0.581)	(0.597)
L.lnWage_salaries					0.116	0.071	0.0706
					-0.284	-0.272	-0.172
L.lnGFCF					(0.026)	0.008	0.0119
					(0.120)	(0.127)	(0.128)
L.shPfl_invst						0.448***	0.444***
						(0.162)	(0.162)
A_out_grwth							-0.302
							(1.013)
Year FE	YES	YES	YES	YES	YES	YES	YES
Country_Sector FE	YES	YES	YES	YES	YES	YES	YES
Observations	263	263	250	250	222	198	198
R^2	0.319	0.33	0.4	0.4	0.452	0.48	0.481

* * *,**,* represent 1%, 5% and 10% significant level respectively, standard errors are in brackets. The dependent variable follows the standard deviation method.