

# Spillover Effects of Foreign Direct Investment: Evidence from the West Midlands of England

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## ABSTRACT

*This paper investigates the spillover effects of inward foreign direct investment (FDI) on firm-level productivity growth in the West Midlands of England for 2,198 firms operating in 75 industries over the period 2004–2011. In contrast to earlier literature that emphasises the importance of backward linkages in both advanced and emerging market economies, our empirical analysis suggests there are strong forward spillovers from FDI taking place, through the linkages between foreign affiliates and their local consumers in downstream sectors in the West Midlands. However, we only find zero or weak positive spillover effects through backward and horizontal linkages.*

*JEL Classification: F21, O33*

*Keywords: Foreign direct investment, Productivity growth, Technology spillovers*

## 1. INTRODUCTION

There is a common view that FDI benefits recipient economies through superior technology transfer from multinational firms and therefore can be a potential source of positive productivity ‘spillovers’. Productivity spillovers take place when the multinational enterprises (MNEs) enter or increase their foreign presence in the host country/region with indirect channel effects through different linkages. The spillover effects of inward FDI through horizontal linkages occur when domestic firms are affected by MNEs within the same industry, while the effect through vertical linkages (backward and forward) emerge when domestic firms and MNEs connect across different stages of production.

Although a number of empirical studies have analysed the issue of FDI spillovers (Aitken and Harrison 1999, Liu *et al* 2000, Javorcik 2004, Javorcik and Spatareanu 2008, Du, Harrison and Jefferson 2012, Xu and Sheng 2012, Doan *et al* 2015, Fatima 2016), most have focused on one specific country and have provided mixed results. For example, Aitken and Harrison (1999) estimate the FDI productivity spillovers of Venezuelan manufacturing plants and find a negative relationship between foreign investment and domestically-owned

plants' productivity. Javorcik (2004) finds that domestic firms in Lithuania only benefit from FDI when they are the suppliers to foreign firms. Javorcik and Spatareanu (2008) find that vertical spillovers are associated with projects with shared domestic and foreign ownership in Romania. Du, Harrison and Jefferson (2012) and Xu and Sheng (2012) indicate positive vertical spillovers from FDI to domestic manufacturing firms in China. However, Doan *et al* (2015) find little evidence of substantial positive spillover effects from FDI to local firms' productivity in New Zealand. Recently, Fatima (2016) finds both negative horizontal spillover effects and positive vertical spillover effects of FDI on domestic firms in Turkey.

The inconclusive findings of FDI spillover effects might result from the heterogeneous nature of MNEs targeting markets which are even in the same country. For example, the above research that has assessed the benefits (and costs) of FDI into a host country at the national level does not reflect the impact of spillover effects of FDI in different regions. Even within the same industry, FDI spillover effects may differ considerably in their ability to contribute to host regions' economies (Girma and Wakelin 2002).

Whether FDI brings benefits to local firms in the host economies is largely dependent on the region's capacities, including the technology gap between MNEs and local firms (Sawada 2010) and the absorptive capabilities of local firms to emulate and integrate the knowledge from MNEs (Ford *et al* 2008; Huang *et al* 2010). Limited empirical work has been carried out in this respect, only focusing on specific regions. For example, an early study by Ashcroft and Love (1993) casts doubt on whether spillover benefits from the entry of foreign firms occur to any significant degree in British regions. However, the inherent defects of their methodology, such as treating regional FDI inflows as a whole without disaggregating the channel and the linkages of FDI spillovers, impedes their analysis and derived policy implications. Hence, by utilising a modern empirical framework to distinguish the FDI spillovers through different linkages, this paper tries to shed some light on the regional FDI spillover effects in the West Midlands of the United Kingdom (UK).

In relation to the UK, regional differences in terms of industry-specific factors, natural resource allocation and the level of market development, result in an industrial layout characterised by unbalanced regional spatial disparities. The value of the local contribution of MNEs is thus expected to vary across regions. For example, finance and related services industries, overwhelmingly located in London and the South East, led to rapid economic growth, while northern areas (including the West Midlands), where manufacturing sectors have lagged behind because of deindustrialisation, have witnessed the decline of manufacturing employment (Gardiner *et al* 2013).

We focus on the West Midlands since the region is the UK's industrial heartland, where manufacturing is more important within the economic structure than in any other region of the country. Like most regions in northern areas, it faces a number of challenges related to industrial restructuring and

the economy underperforms relative to national and international competitors. On the other hand, the West Midlands is the major region in terms of the proportion of FDI received as a whole in the UK (Fallon and Cook 2009). Therefore, the question arises: whether and how do local firms in the West Midlands benefit from FDI inflows? The West Midlands might take their advantage in the traditional manufacturing sector to integrate the knowledge from MNEs for improving productivity. This will be important for the regional economic development in the future.

This paper uses a panel dataset of 2,198 firms operating in 75 industries over the period 2004–2011, with an unbalanced dataset of 9,311 firm-year observations in the West Midlands. The study contributes to the empirical literature by investigating FDI spillover effects via industrial linkages as a way to improve firm-level productivity in the West Midlands. Our results identify strong and positive spillover effects from FDI through forward linkages; statistically insignificant effects through backward linkages; and a negative impact from horizontal linkages. Also, we find that the positive effect from forward linkage appears to diminish in the long run, while the negative impact from horizontal linkages persists.

The remainder of the paper is organised as follows. Section 2 provides a brief theoretical background and discusses previous studies relating to the spillover effects of FDI. Section 3 describes the methodology and data. Section 4 discusses the empirical results. Section 5 concludes and presents policy implications.

## 2. LITERATURE REVIEW

### 2.1. *FDI, economic growth and spillover effects*

A number of cross-level studies focus on the relationship between FDI and economic growth. Most use aggregated FDI data and demonstrate mixed results. For example, Balasubramanyam *et al* (1996) use aggregate FDI inflows data from UNCTAD and find that FDI enhances economic growth. Borensztein *et al* (1998) use annual gross FDI data from OECD and argue that FDI can have a significant and positive effect on economic growth only if host countries have a certain level of human capital development. Using aggregate data from the IMF, Bosworth *et al* (1999) indicate that FDI generates large increases in domestic savings and economic growth; however, their findings are not robust since they suggest that the potential positive effect of FDI is contingent on the development of the banking sector in the host country. De Mello (1999) also uses aggregate FDI data from the IMF and claims that FDI does not always promote economic growth. Lensink and Morrissey (2006) use data from the World Bank and suggest that FDI has a positive but non-robust impact on economic growth, irrespective of the effect of human capital.

Moran (2011) categorises the above studies as ‘first generation’ FDI research. The major drawback is that they use aggregate FDI data. It is clear that FDI in different industries or economic sectors is likely to have different impacts on

economic growth. For instance, FDI in the extractive sector usually relates to the 'resource curse', which triggers civil conflict and seriously harms economic growth. FDI in the manufacturing sector may raise the productivity growth of the host country, create a competitive business environment for the host country (especially when the country mainly has state-owned enterprises and lacks competition) and generate externalities that benefit domestic firms. Therefore, disaggregated data are preferable as they can distinguish different industry-level impacts from FDI.

In terms of firm-level studies, it has been widely recognised that foreign firms take advantage of technology and management skills (Griffith 1999). Local firms benefit from FDI via both direct capital inputs and indirect productivity and knowledge spillovers (Balasubramanyam *et al* 1996). For example, local firms improve their productivity by receiving better quality products from foreign suppliers and advanced technology support from foreign customers (Doan *et al* 2015; Liang 2009). Using firm-level data for Estonia over the period 1994–1999, Sinani and Meyer (2004) examine FDI spillover effects empirically using three different proxies, the ratio of foreign firms' employment, foreign share of equity, and industry sales. Their analysis suggests that all the measures of FDI spillovers have a positive and significant effect on the output growth of domestic firms. However, they point out there are negative effects of inward FDI inflows on domestic firms, for instance MNEs with higher productivity usually have lower marginal costs than domestic firms, so MNEs can take market share from domestic firms in the host country. As a consequence, domestic firms might experience productivity reduction in the short run.

Since the seminal work of Sinani and Meyer (2004), who consider both positive and negative effects of FDI spillovers, researchers have begun, in more recent studies, to develop the framework for empirical estimation strategies, accounting for the channel effect with different linkage between MNEs and domestic firms in the host country, when assessing the benefits and costs.

There are two main channels of spillover effects from FDI. The first is through horizontal linkages that can occur within industries through employment turnover, imitation, observational learning and competition. The second is vertical linkages (forward and backward) that can occur between industries, through the leakage of their intellectual assets, management skills, and technology to their customers and suppliers. Javorcik (2004) relies on the input-output matrix to construct measures of both horizontal linkages, and (forward and backward) vertical linkages between MNEs and domestic firms. Most subsequent firm-level studies of FDI spillovers follow the empirical framework of Javorcik (2004).

## 2.2. Horizontal Linkages

Marcin (2007) and Javorcik and Spatareanu (2008) conclude that three main mechanisms may occur through horizontal linkages (Blomstrom *et al* 2003; Görg and Greenaway 2004). First, knowledge may leak out by labour mobility,

such as employees taking their knowledge when moving to local firms (Fosfuri *et al* 2001; Görg and Greenaway 2004). Second, local firms may benefit from advanced technology by imitating foreign firms' products and innovations via reverse engineering (Wang and Blomstrom 1992). Third, increased competition induced from foreign firms entering may force local firms to improve their productivity (Glass and Saggi 2002).

These mechanisms occur between firms located in the same industry. However, it has been argued that foreign firms have a strong incentive to prevent knowledge leakages or spillovers to their competitors - the local firms. Thus, the effect of horizontal spillovers might be limited. Empirical studies have so far produced mixed results. For example, Javorcik and Spatareanu (2008) study the FDI spillover effects employing firm-level data for Romania over the period 1998–2003. Doan *et al* (2015) explore the relationship between FDI spillovers and TFP growth with controls for the heterogeneity and the endogeneity issues of FDI, using panel data for firms in New Zealand during 2000–2010. Both studies identify a negative or insignificant effect of FDI spillovers through horizontal linkages. In contrast, Haskel *et al* (2007) investigate FDI spillover effects in the United Kingdom using firm-level data for the British manufacturing sector from 1973 to 1992 and find a positive effect from horizontal linkages.

### *2.3. Vertical Linkages*

As discussed above, the existence of horizontal linkages is limited and empirical evidence is mixed. In contrast, the effect of vertical linkages (between industries) is far more likely, because multinationals may generate knowledge diffusion to their upstream local suppliers (backward linkages) and possibly to their downstream local customers (forward linkages) as well. With regard to backward spillovers, foreign firms transfer new technologies or business practices (such as quality control processes or inventory management techniques) to suppliers to reduce input costs, increase input quality and thus benefit multinationals (Javorcik and Spatareanu 2008). The empirical evidence on backward spillovers is mixed, however. For example, Javorcik (2004), using firm-level data for Lithuania covering the period 1996–2000, finds positive backward spillovers for Lithuanian firms in the manufacturing sector. Bwalya (2006), Suyanto *et al* (2014) and Anwar and Nguyen (2014) reach similar findings in Zambia, Indonesia and Vietnam, respectively.

In contrast Stancik (2007), utilising firm-level data over the period 1995–2003, finds negative FDI spillovers through backward linkages in the Czech Republic. Liu (2008) investigates FDI spillovers for manufacturing firms in China covering the period 1995–1999, considering vertical linkages in both the short- and long-run. He finds that there is an adverse impact in the short-run and a positive impact in the long-run of FDI spillover effects on domestic firms' TFP growth. Further, domestic firms take around 11 years to overtake the initial productivity losses. Liu (2008) also shows that only backward linkages

have a robust and statistically significant effect. It should be noted that previous studies have reported that the effect of backward spillovers is more important (exhibiting high significance in empirical estimation) in less advanced countries or regions. For example, Bitzer *et al* (2008) argue that backward spillovers are higher in central and eastern European countries than other OECD countries. Du, Lu and Tao (2012) fail to find backward spillovers in advanced regions in China, but they find positive effects in less advanced regions.

With regard to forward spillovers, the better quality of intermediate goods produced by foreign firms with superior technology may increase the productivity of local firms operating in downstream industries. Empirical studies on forward spillovers are also mixed, however. For example, Javorcik (2004) fails to find evidence on forward spillovers in Lithuania whilst, in the UK, Driffield *et al* (2002) suggest that forward spillovers are more significant than other types of spillover.

#### *2.4. FDI Spillovers in Regions*

The majority of prior studies exploring FDI spillover effects at the firm level focus generally on one specific country, typically a developing country, rather than a region. Despite the heterogeneity of FDI – the effects of FDI spillovers differing considerably in different regions of a country – few studies have paid attention to this issue.

Aitken and Harrison (1999) are the first to examine the regional dimension of FDI spillovers, in Venezuela, and find that there is no significant impact of FDI on domestic firms' productivity within the same region. Girma and Wakelin (2002), using firm-level panel data for 3700 UK firms in the manufacturing sector over the period 1988–1996, find that domestic firms in the UK benefit from FDI in the same sector and region, but bear losses if MNEs are located in a different region. Xu and Sheng (2012) examine whether the spillover effects of FDI occur at the national or regional level. Using firm-level census data for Chinese manufacturing industry between 2000 and 2003, they provide empirical evidence that domestic firms benefit more from the presence of MNEs in the same sector within the same region, but the spillover effects are significant and negative across regions.

These studies all have a concern with the effect of regional disparity in investigating FDI spillovers. However, the present paper takes a different approach, emphasising the different linkages between MNEs and domestic firms in one specific region, rather than focusing on the regional disparity of FDI inflows.

### 3. ESTIMATION METHODOLOGY

#### *3.1. The Model*

In investigating the relationship between the spillover effects of FDI and firm productivity, we specify the model under an augmented Cobb-Douglas production function used in prior studies (e.g. Doan *et al* 2015; Javorcik 2004):



$$\ln VA_{ijt} = \beta_0 + \beta_1 \ln k_{ijt} + \beta_2 \ln l_{ijt} + \beta_3 \text{Horizontal}_{jt} + \beta_4 \text{Backward}_{jt} + \beta_5 \text{Forward}_{jt} + \beta_6 \text{HHI}_{jt} + \varepsilon_{ijt} \quad (1)$$

In this specification, real output (VA) of firm  $i$  in industry  $j$  at time  $t$  is written as a function of capital input ( $k_{ijt}$ , the value of fixed assets)<sup>2</sup>, labour input ( $l_{ijt}$ , the number of employees), horizontal linkages ( $\text{Horizontal}_{jt}$ ), backward linkages ( $\text{Backward}_{jt}$ ), forward linkages ( $\text{Forward}_{jt}$ ); and the Herfindahl–Hirschman index ( $\text{HHI}_{jt}$ ) which represents output concentration for industry  $j$  at time  $t$ , to isolate the effects that MNE entry has on competition, which forces domestic firms to improve efficiency<sup>3</sup>.

The estimation of Equation (1) is carried out using fixed-effects panel data instrumental variables regression. There are two main reasons for this choice. First, it may be possible that firms adjust their inputs in response to new information on their real output. Second, the higher output level might attract more FDI. Therefore, it is likely that reverse causality prevails between the real outputs of the firm and foreign penetration ( $\text{Horizontal}$ ). To prevent our model from capturing this adverse causality, we instrument against all inputs their first lag and year dummies in Equation (1).<sup>4</sup>

### 3.2. Adjusting for Endogeneity of Input Choice

In addition, given the above and taking into account the endogenous problem of input choice, we calculate the fitted value of total factor productivity (TFP) by regression of a Cobb–Douglas production function in logs, with the following model to be estimated:

$$y_{ijt} = \beta_0 + \beta_1 l_{ijt} + \beta_2 k_{ijt} + \varepsilon_{ijt} \quad (2)$$

where can be decomposed into firm-level TFP and which is an i.i.d. component. Then, the estimated TFP can be calculated as follows:

$$\widehat{TFP}_{ijt} = y_{ijt} - \hat{\beta}_1 l_{ijt} + \hat{\beta}_2 k_{ijt} \quad (3)$$

In the second step, we analyse the relationship between TFP and FDI spillover effects with the following specification:

$$TFP_{ijt} = \beta_0 + \beta_1 \text{Horizontal}_{jt} + \beta_2 \text{Backward}_{jt} + \beta_3 \text{Forward}_{jt} + \beta_4 \text{HHI}_{jt} + \varepsilon_{ijt} \quad (4)$$

### 3.3. Measuring FDI Spillovers

The principal focus of this study is to estimate within-industry and between-industry spillovers, as discussed in Section 2. Previous studies, such as Javorcik (2004), Liu (2008), Doan *et al* (2015) and Li and Tanna (2017), have quantified FDI spillovers and linkages between foreign affiliates and domestic firms for capturing their effects on TFP, which we adopt in this study.

Horizontal penetration in industry  $j$  at time  $t$  is represented by:

$$\text{Horizontal}_{jt} = \frac{\sum_{i \in j} \text{FDI}_{ijt} * Y_{ijt}}{Y_{jt}} \quad (5)$$

where  $Y_{ijt}$  refers to the output of firm  $i$  in industry  $j$  at time  $t$  and  $FDI_{ijt}$  is an indicator of whether firm  $i$  is foreign owned.<sup>5</sup> Following the study of Kimura and Kiyota (2007), foreign-owned firms are identified as those with 10 per cent or more of their assets owned by foreigners.

The forward and backward measures are estimated by the horizontal penetration (the shares of outputs and inputs between industries), represented by:

$$Backward_{jt} = \sum_{k, k \neq j} \alpha_{jk} Horizontal_{kt} \quad (6)$$

$$Forward_{jt} = \sum_{l, l \neq j} \beta_{jl} Horizontal_{lt} \quad (7)$$

where  $\alpha_{jk}$  is the share of industry  $j$  output used as an intermediate input by industry  $k$  and  $\beta_{jl}$  is the share of intermediate inputs purchased by industry  $j$  from industry  $l$ .  $\alpha_{jk}$  and  $\beta_{jl}$  are calculated from the national input–output table.

We should note here that the focus of this study is regional, namely, the West Midlands in England. We further employ the Location Quotients (LQs) approach to construct a regional output and input table to calculate the  $\alpha_{jk}$  and  $\beta_{jl}$  at the regional level.

Regional input-output tables obtained by the Sample Location Quotient (SLQ) for industry  $j$  in region  $R$  are defined as follows:

$$SLQ_j^R = \left[ \frac{E_i^R/E^R}{E_i^N/E^N} \right] \quad (8)$$

where  $E_i^R$  and  $E^R$  are employment in industry  $j$  in region  $R$  and total employment in region  $R$ , respectively, and  $E_i^N$  and  $E^N$  are employment in industry  $i$  and total employment at the national level, respectively. SLQ thereby reflects the relative importance of the regional industry  $I$  as compared with its national counterpart measured by employment (Kowalewski 2013). When  $SLQ_j^R > 1$ , it is assumed that the region is specialised in this industry. It implies that the regional industry can meet the regional demand requirements for its products or services and therefore the regional coefficient is assumed to be equal to the national coefficient. When  $SLQ_j^R < 1$ , it implies that the industry needs to import from other regions to meet regional demand requirements. Therefore, for row  $i$  of the regional table:

$$\alpha_{jk}^R = \begin{cases} \alpha_{jk}^N SLQ_j^R & \text{if } SLQ_j^R < 1 \\ \alpha_{jk}^N & \text{if } SLQ_j^R > 1 \end{cases} \quad (9)$$

### 3.4. FDI in the West Midlands

The West Midlands benefits from its central UK location, with good communication linkages between suppliers and consumer markets, and it has been an important location for new inward investment (Fallon and Cook 2009). Table 1 reports the trend of FDI inflows to the West Midlands from 2004 to 2011. There are a total of 290 FDI-related projects reported. These projects represent a total capital investment of US\$14.10 billion, with 32,175 jobs created. Table 2 provides a disaggregated classification of FDI inflows. According



to the sectoral classification created by fDi Markets Database<sup>6</sup>, out of the entire economy in the West Midlands, the manufacturing sector (Industrial Machinery, Equipment & Tools, Automotive OEM, Plastics and Automotive Components) accounted for at least 27 per cent of FDI-related projects, 20 per cent of jobs created and 17 per cent of capital inflows. The large value of each indicator in the manufacturing sector indicates the potential importance for analysing the manufacturing sector in this region.

Table 1A: FDI in West Midlands (from 2004 to 2011)

<i>Year</i>	<i>Number of projects</i>	<i>Jobs created</i>		<i>Capital investment</i>	
		<i>Total</i>	<i>Average</i>	<i>Total (USD m)</i>	<i>Average (USD m)</i>
2011	55	5,581	101	2,820.40	51.30
2010	40	2,294	57	1,155.20	28.90
2009	54	7,058	130	3,476.60	64.40
2008	34	8,002	235	4,015.90	118.10
2007	20	1,840	92	512.90	25.60
2006	29	2,397	82	834.90	28.80
2005	38	3,002	79	952.10	25.10
2004	20	2,001	100	335.40	16.80
Total	290	32,175	110	14,103.30	48.60

Source: fDi Intelligence from The Financial Times Ltd

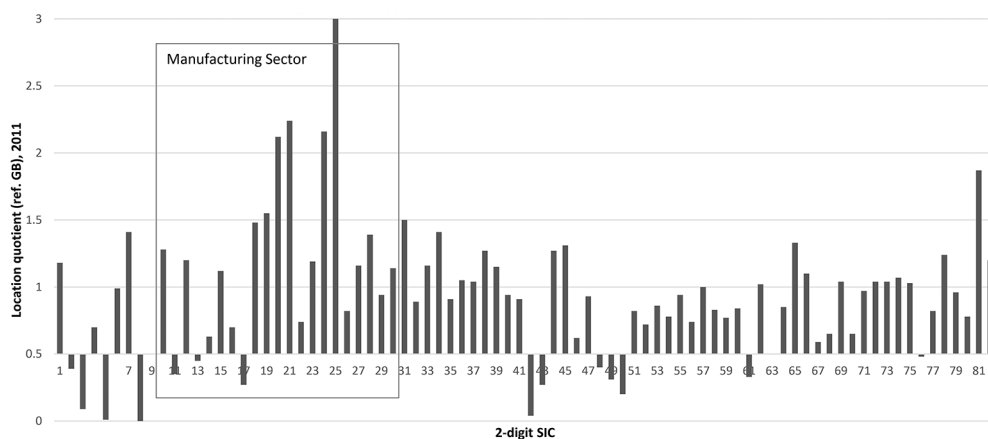
Table 1B: FDI in West Midlands by Sector (from 2004 to 2011)

<i>Sector</i>	<i>Number of projects</i>	<i>Jobs Created</i>		<i>Capital investment</i>	
		<i>Total</i>	<i>Average</i>	<i>Total (USD m)</i>	<i>Average (USD m)</i>
Industrial Machinery, Equipment & Tools	33	1,164	35	203.40	6.20
Software & IT services	28	1,756	62	350.50	12.50
Financial Services	26	860	33	623.70	24.00
Transportation	21	2,392	113	819.30	39.00
Automotive OEM	17	3,311	194	1,766.90	103.90
Real Estate	15	10,585	705	5,907.50	393.80
Hotels & Tourism	14	595	42	710.70	50.80
Plastics	14	545	38	147.00	10.50
Automotive Components	14	1,184	84	213.90	15.30
Business Services	14	948	67	145.40	10.40
Other sectors	94	8,835	93	3,215.10	34.20
Total	290	32,175	110	14,103.30	48.60

Source: fDi Intelligence from The Financial Times Ltd

The manufacturing sector has historically been dominant in the West Midlands, and there is still a relatively high concentration of employment in these sectors. Figure 1 demonstrates a higher concentration of employment in manufacturing industries in the West Midlands than other industries. The automotive sector, metals industry and construction sector employ a larger proportion of the regional workforce than at the national level (Clayton and Lee 2009).

Figure 1: Sector Specialisation with the West Midlands



Source: Annual Business Enquiry, 2011

De Vita and Lawler (2004) indicate that the significance of specific FDI determinants is contingent upon the type of FDI. The West Midlands seems unappealing to resource-seeking FDI (it is relatively poor in terms of natural resources) relative to efficiency-seeking and market-seeking FDI. As originally noted by Dunning (1993 p 60), efficiency-seeking FDI occurs when: (i) firms “take advantage of differences in the availability and costs of traditional factor endowments in different countries”; or (ii) they “take advantage of the economies of scale and scope and of differences in consumer tastes and supply capabilities.”.

Market-seeking FDI occurs when firms invest abroad to profit from foreign markets (Franco *et al* 2010) and can be drawn by the advantage of per capita incomes, population density and regional growth prospects (Billington 1999). The development of market access, quality of transport, infrastructure, and communications can attract market-seeking FDI. However, some studies (e.g. Franco *et al* 2010) consider that the category of market seeking overlaps or is closely linked with efficiency seeking FDI. Both have some common features, for example, diversifying firms’ assets, exploiting economies of scale and scope and recruiting highly-skilled labour (Campos and Kinoshita 2003; Kinoshita and Campos 2004).

### 3.5. Sample and Data

We start the construction of our sample by considering all West Midlands firms in the Fame database. We exclude firm-year observations for which at least one of the firm-specific variables is missing. Our final sample consists of 2,198 firms operating in 75 industries over the period 2004–2011. This results in an unbalanced dataset of 9,311 firm-year observations. All firm-specific data were obtained from the Fame database in GBP millions expressed in real 1995 terms. LQs are obtained from the Office for National Statistics, which constructs them using data on the number of employees derived from the Business Register and Employment Survey (BRES), 2011.

Table 2 reports the summary statistics. Horizontal linkages average around 0.4933 but vary considerably across the sample (from 0 for ‘insurance and reinsurance’ industry in 2005 to 1 for ‘air transport services’ in 2011). Backward linkages have a mean value of 0.0964, with a range from 0 for ‘wholesale trade service’ industry in 2004 to 0.4223 for ‘warehousing and support services for transportation’ industry in 2004. Forward linkages average around 0.31, with a minimum value of 0 for ‘wholesale trade service’ industry in 2007 and a maximum value of 0.8697 for ‘construction’ industry in 2009. The mean of TFP (in natural logarithms) is close to zero with a wide range across the sample exceeding 12.58 (from  $-7.0549$  to  $+5.3297$ ). Value-added (in natural logarithms) averages 3.3186 and also displays considerable variation across firms, from  $-5.9387$  to  $+9.2883$ . Other variables which display relatively high variation across the sample (with the standard deviation approximate or greater than the mean) includes  $\ln(k)$  and HHI.

Table 2: Summary statistics

<i>Variable</i>	<i>Mean</i>	<i>Std. Dev.</i>	<i>Min</i>	<i>Max</i>	<i>Observations</i>
Horizontal	0.4993	0.2596	0	1	9311
Backward	0.0964	0.1027	0	0.4223	9311
Forward	0.3100	0.3295	0	0.8697	9311
Capital (k, GBP m)	105.0229	1095.39	0.001	62454	9311
$\ln(k)$	1.2017	2.1723	$-7.2862$	10.7503	9311
Labour (l)	763.3496	3190.136	1	71898	9311
$\ln(l)$	5.28119	1.4417	0	11.183	9311
HHI	0.1742	0.1685	0.0249	1	9311
$\ln(VA)$	3.3186	1.1969	$-5.9387$	9.2883	9311
$\ln(TFP)$	2.45E-10	0.8266	$-7.0549$	5.3297	9311

## 4. EMPIRICAL RESULTS

### 4.1. FDI Spillover Effect Estimations

Table 3 reports the results of FDI spillover effects through different linkages between MNEs and domestic firms, using the full sample. The results, from the estimation of Equation (1), of the present and lagged effects of FDI spillovers on

firms' value-added are shown in columns 1 and 2. The estimated results based on Equation (4), examining the effects of FDI spillovers on TFP, are presented in columns 3 and 4.

In column 1 of Table 3, the results suggest that horizontal linkages exert a negative and significant impact on firms' output. This can be explained by the incentive of foreign-owned firms to prevent technology leakage and spillovers and is consistent with the findings from most of the previous studies. For example, Javorcik (2004) finds a similar result, that horizontal linkages appear to be negative in the Lithuanian manufacturing sector; and Liu (2008) suggests that the negative effect of horizontal linkages cannot be offset for a long time period in the Chinese manufacturing sector. FDI effects within industries appear to have a market-stealing effect<sup>7</sup> which crowds out domestic investment.

In terms of vertical linkages, forward linkages have a positive and significant effect, while backward linkages show no significant effects. Our findings here differ from prior studies (e.g. Javorcik 2004; Liu 2008; Li and Tanna 2017) which normally show backward linkages exhibit greater significance than forward linkages. Domestic firms' absorptive capacity in downstream industries in developing countries, to some extent, is limited by factors such as financial constraints, economic scale and managerial skill. Therefore, forward linkages are less important than backward linkages in developing countries. However, we focus on the FDI spillover effects in the West Midlands of the UK. This region has a high level of economic development with good fundamentals of modern technology and human capital accumulation. The issue of lack of absorptive capacity should not exist. Moreover, given that the spillovers from backward linkages are usually passive due to the fact that domestic firms as suppliers have to meet the quality requirements of MNEs, domestic firms in the West Midlands already have the qualification to satisfy MNEs' needs. The only way of learning from MNEs is through forward linkages, where domestic firms act as MNEs' consumers.

In column 2 of Table 3, after controlling for the lagged effect instead of the current effect of each linkage, the horizontal linkages are still negative and significantly related to firms' output, while vertical linkages appear to be insignificant. It has been argued that, in developing countries, the impact of FDI spillovers on productivity, especially across industries, may take time (Liu 2008). In our case, however, we suggest that domestic firms in developed regions can quickly absorb knowledge spillovers from MNEs, so that there will be no significant effect after a certain time has passed.

In addition, both columns reveal that HHI correlates negatively and significantly with firms' output, indicating that industry competition reduces firms' output; whereas capital and labour are statistically significant and positive, suggesting that an increase in inputs can effectively increase output.

In columns 3 and 4 of Table 3, the dependent variable is the natural log of TFP. In this case, the main results of this study continue to hold and provide further empirical support for the findings above.

Table 3: Spillovers of FDI on firm productivity

	(1)	(2)	(3)	(4)
Forward	0.3379*** (0.1316)		0.3171** (0.1339)	
Forward (-1)		0.0462 (0.1539)		0.0242 (0.1569)
Backward	-0.5396 (0.4454)		-0.4881 (0.4533)	
Backward (-1)		-0.2623 (0.4694)		-0.2155 (0.4785)
Horizontal	-1.2614*** (0.1678)		-1.3708*** (0.1708)	
Horizontal (-1)		-0.8124*** (0.1911)		-0.9725*** (0.1954)
HHI	-0.2857*** (0.0595)	-0.2350*** (0.0649)	-0.2983*** (0.0605)	-0.2360*** (0.0661)
ln(k)	0.0511*** (0.0064)	0.0398*** (0.0070)		
ln(l)	0.5889*** (0.0105)	0.5732*** (0.0117)		
Constant	0.9817*** (0.1825)	0.7929*** (0.1471)	0.9136*** (0.1767)	0.6386*** (0.1344)
N	9311	7595	9311	7595

Note: In columns 1 and 2, the dependent variable is the natural log of value added. In columns 3 and 4, the dependent variable is natural log of total factor productivity estimated from Equation (2). Standard errors are in parentheses. \*, \*\* and \*\*\* indicate the significance at 10%, 5% and 1% levels respectively.

#### 4.2. Further Analysis – The Manufacturing Sector

As discussed above, manufacturing industry dominates the West Midlands economy. Some prior studies (Javorcik 2004; Liu 2008; Suyanto *et al* 2014; Li and Tanna 2017) have focused on the manufacturing sector. Therefore, in this section, we investigate the FDI spillover effects in the manufacturing sector only. The results shown in Table 4 are similar to the ones presented in Table 3. However, coefficient results for the manufacturing sector in Table 4 (e.g. the estimated coefficients of *Forward* are 0.5537 and 0.5409 in columns 1 and 3 respectively) tend to be higher than the corresponding results shown in Table 3 (e.g. the estimated coefficients of *Forward* are 0.3379 and 0.3171 in columns 1 and 3 respectively). The results indicate that FDI spillover effects through different linkages are strong in the manufacturing sector, but such effects are

attenuated when considering the full sample. This might be explained by the fact that FDI is more concentrated in the manufacturing sector than other economic sectors in the West Midlands.

To conclude, we find a negative impact associated with horizontal linkages, strong forward linkages generated by foreign firms and insignificant backward linkages. The former finding implies that the market-stealing effect and crowding-out effect of the foreign presence on domestic firms in the same industry still exists in the manufacturing sector. Regarding the latter two, we argue that, nowadays, FDI is primarily market seeking - from the 2014 fDi Markets report, it is clear that around 45.4 per cent of FDI projects are driven by domestic market growth potential and around 33 per cent of projects are in proximity to markets or customers. Therefore, foreign firms are more likely to focus on their product buyers, which is associated with a high possibility to

Table 4: Spillovers of FDI on firm productivity – Manufacturing Sector

	(1)	(2)	(3)	(4)
Forward	0.5537*** (0.1531)		0.5409*** (0.1597)	
Forward (-1)		0.0228 (0.0435)		0.0217 (0.0454)
Backward	0.6442 (0.5768)		0.3521 (0.6000)	
Backward (-1)		-0.0009 (0.6185)		-0.6723 (0.6426)
Horizontal	-1.7191*** (0.2302)		-1.6568*** (0.2394)	
Horizontal (-1)		-2.4912*** (0.2691)		-2.5128*** (0.2792)
HHI	-0.6682*** (0.1008)	-0.3147*** (0.0881)	-0.6420*** (0.1050)	-0.2956*** (0.0919)
ln(k)	0.0088 (0.0116)	0.0123 (0.0126)		
ln(l)	0.7998*** (0.0217)	0.8063*** (0.0237)		
Constant	-0.2493 (0.2356)	0.4902** (0.2351)	0.7400*** (0.2167)	1.5917*** (0.2127)
N	2982	2448	2982	2448

Note: In columns 1 and 2, the dependent variable is the natural log of value added. In columns 3 and 4, the dependent variable is natural log of total factor productivity estimated from Equation (2). Standard errors are in parentheses. \*, \*\* and \*\*\* indicate the significance at 10%, 5% and 1% levels respectively.



generate positive spillover effects via forward linkages. On the other hand, domestic firms are benefiting more by purchasing from foreign firms with higher levels of service and products, from downstream industries, in terms of higher quality components, better technology, and lower prices. Here, there is a positive influence of forward linkages on local industry performance (Driffield *et al* 2002). In cases where foreign firms buy from local firms, the effect of backward linkages is far less.

## 5. CONCLUSIONS AND POLICY IMPLICATIONS

In this paper, we analyse the spillover effect of FDI. On the basis of well-established previous empirical considerations, we restrict our analysis to the West Midlands in England. Using firm-level data for the West Midlands, the empirical tests focus on the spillover effects through both vertical and horizontal linkages. An important finding is that there is a strong and positive spillover effect through forward linkages that is generated by foreign firms. However, we find an insignificant effect of backward linkages and a negative effect of horizontal linkages. After considering the time effect of FDI spillovers using the lagged term of linkage variables, we find that only horizontal linkages exhibit a significant negative relationship, whilst vertical linkages are insignificant. These results clearly suggest that: (i) domestic firms in the West Midlands benefit from FDI spillovers only through purchasing products or consuming services from MNEs from downstream industries, but this benefit will diminish within a short time period; and (ii) domestic firms have to bear the potential losses from within-industry FDI, and such losses remain in the long run.

The immediate policy implications derived from these findings are first that policymakers have to realise the different FDI spillover effects on domestic firms' output/productivity between developing and developed countries, and between regions in developed countries. Although backward linkages are usually the most important for domestic firms benefiting from FDI, FDI spillovers through forward linkages rather than backward linkages enhance domestic firms' performance in the West Midlands. Therefore, policymakers need to maintain or enhance the capability of local buyers to integrate the advanced products and services purchased from foreign firms.

Admittedly, local policymakers might also be advised to encourage technology transfer from MNEs that increases the competitiveness of local supplier firms. Once technological capability of local suppliers and the network between local suppliers and foreign buyers are established, policies should be implemented that provide a favourable environment to stimulate research and development investment. In addition, policymakers should be aware of the potential output/productivity losses of domestic firms due to the foreign presence within the same industries. Regulations against the market-stealing effect and crowding out effect should be implemented to reduce this negative impact.

Finally, another possible area for future research could be an analysis of the spillover effect of FDI for the other regions in the UK (e.g. London, East of

England and the North West). These issues have a wider relevance to the distribution of regional policy across different regions to maximise the gains from the entry of foreign firms.

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#### ENDNOTES

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2. The values of output and capital have been deflated using the annual producer price index.
3. In a broad sense, it can be defined as a kind of spillover effect, but it is outside of our interest in knowledge transfer from FDI spillovers.
4. The validity of random effects against fixed effects has been verified by a Hausman test.
5. Following Doan *et al* (2015)  $FDI_{ijt}$  is treated here as a dummy variable.
6. Please notice that the sectoral classification is neither a two-/three- digit level standard industrial classification (SIC), nor an official sectorial classification (primary, secondary and tertiary sectors). The classification is made by fDi Intelligence from The Financial Times Ltd - the owner of fDi Markets Database.
7. Aitken and Harrison (1999) raised a 'market-stealing' hypothesis suggesting that MNEs gain market shares at the expense of domestic firms by forcing the latter to produce less output at higher cost.

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