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Version: Accepted Version

Article:
Song, Y, Konwar, Z orcid.org/0000-0002-7890-147X and Berger, R (Cover date: 1 Jul 2019) Institutional Differences, Foreign Ownership Modes, Marketing Capabilities and Domestic Technological Catch-up: Evidence from India. Science, Technology and Society, 24 (2). pp. 338-364. ISSN 0971-7218

https://doi.org/10.1177/0971721819842010

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Institutional Differences, Foreign Ownership Modes, Marketing Capabilities and Domestic Technological Catch-up: Evidence from India

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Institutional Differences, Foreign Ownership Modes, Marketing Capabilities and Domestic Technological Catch-up: Evidence from India

This research examines FDI-mediated domestic firms' technological catch up by considering institutional differences between home and host countries, the role of marketing capabilities and the joint effects of institutional differences and the degree of foreign ownership. Using firm-level panel data for Indian manufacturing industries, we find that FDI-mediated technological catch up in domestic firms are conditional on institutional differences between the home and host country of multinational enterprises and the level of marketing capabilities of foreign-owned affiliates. In addition, we find that technological catch up in domestic firms are likely to be positively influenced by the presence of wholly foreign-owned firms from institutionally close countries whereas we find some evidence that the presence of minority foreign-owned firms may have a negative effect on domestic technological catch-up, regardless of institutional differences. We also provide theoretical and policy implications of our findings.

Keywords: foreign ownership modes, India, institutional differences, marketing capabilities, technological catch-up

1. Introduction

An extensive literature on FDI-mediated technological catch up from foreign direct investment (FDI) has emerged in the last few years (Crespo and Fontoura 2007; Görg and Greenaway 2004; Meyer and Sinani 2009; Smeets 2008; Wooster and Diebel 2010). There have been calls for discriminating approaches to identify how and when FDI generates technological catch up in domestic firms, especially within the context of FDI heterogeneity (Görg and Greenaway 2004; Smeets 2008). Emphasis is placed on developing models that incorporate the heterogeneous nature of FDI in terms of ownership modes, country of origin, quality of FDI etc. rather than conceptualising FDI as homogenous capital flows transferred across national boundaries (Fortanier 2007; Javorcik and Spatareanu 2008).

Given the scholarly emphasis on a contingency based approach to investigating FDI-mediated technological catch-up (Meyer and Sinani 2009; Wooster and Diebel 2010; Zhang et al. 2010), India is an interesting context to study as there are relatively few published studies that have employed such an approach and used firm-level data to investigate technological catch-up (Kathuria 2002; Marin and Sasidharan 2010). On one hand, Kathuria (2002) using a sample of 487 firms (which included 116 foreign firms), found that domestic technological catch up occurs only in those Indian firms that has sufficient absorptive capacity, i.e. firms with a threshold level of R&D investments. On the other hand, Marin and Sashidharan (2010) capturing another firm heterogeneity issue, i.e. technological orientation of foreign firms, and using a large sample (12,443 firms including 273 foreign firms) found that competence-creating FDI had a positive effect whereas competence-exploiting FDI had a negative effect on domestic technological catch-up. This study builds on Kathuria (2002) research by including absorptive capacity as a control (i.e. firm size and R&D intensity) and tackles few important foreign firm heterogeneity factors to investigate their influence on domestic firms' prospects for technological catch-up. Thus, this research adopts a contingency approach and explores domestic technological catch-up by considering three foreign firm heterogeneity factors, namely, the role of institutional differences, marketing capabilities and generic foreign ownership modes.

Institutional differences are likely to arise when multinational enterprises (MNEs), the agents of FDI, manoeuvre through host country institutions which can be significantly different from the home country (Kostova 1999). The effects of such differences on FDI-mediated domestic catch-up may be two-fold. First, the degree of institutional differences would influence transactions costs because MNEs have to cope with often quite different regulatory rules and administrative and legal systems in a host country(Brouthers 2002). They may be exposed to political hazards (Delios and Henisz 2000), which could affect

strategic decision-making (Ingram and Clay 2000) especially in the context of transfer and deployment of knowledge based assets (KBAs) in foreign-owned affiliates (FOAs). Second, institutional differences may influence the quality of inter-firm interactions and learning opportunities between FOAs and domestic firms in the host country. Higher level of institutional differences may hinder inter-firm collaboration resulting in weaker linkages between FOAs and domestic firms(Bellak 2004; Xu and Shenkar 2002) . These institutional differences are more likely to influence domestic technological catch-up in emerging economies, where domestic firms are highly dependent on foreign technology and know-how of MNEs(Moran 2006; Perez 1997) .

Marketing capabilities (MCs) of FOAs can also influence domestic technological catch-up. MCs reflect the extent to which interrelated organisational routines in FOAs enable engagement in specific marketing activities and respond to changes in markets conditions(Kamboj and Rahman 2015; Murray et al. 2007). Capabilities related to deploying effective marketing practices is an important KBA since they enable FOAs to introduce and supply products effectively(Tan and Sousa 2015), achieve specific customers' requirements and develop competitive advantages related to market sensing and customer linking (Krasnikov and Jayachandran 2008). As such, MCs can play a critical role in improving the performance of FOAs(Czinkota and Ronkainen 2013) especially in the context of challenging market environments of developing economies (Helm and Gritsch 2014). However, marketing capabilities of FOAs are also likely to influence domestic firms' through demonstration of the effectiveness of superior marketing practices and routines. These capabilities enables FOAs to increase output radically and exert a market-stealing effect through decrease in output and raising costs of domestic firms(Aitken and Harrison 1999). This effect, however, will induce domestic firms to invest in developing marketing channels to respond to foreign competition, especially in highly competitive product markets(Grewal

et al. 2013). Thus, this process is likely to enable domestic firms to identify better learning opportunities, innovate and reverse-engineer aspects of the marketing processes in FOAs to mitigate competitive pressures, thereby gradually catching up with FOAs within an industry.

The role of foreign ownership modes is also considered very important in influencing domestic technological catch-up (Abraham, Konings, and Slootmaekers 2010; Javorcik and Spatareanu 2008). It has been argued that domestic technological catch-up from presence of foreign-owned joint ventures (JVs) may be higher than from wholly foreign-owned subsidiaries (WOS). This is because the relatively deeper linkages of domestic partners in JVs to other domestic firms provide an effective mechanism for the diffusion of technology to the latter. It was further found that WOS are used by MNEs to maintain control of their knowledge-based assets (KBAs) and limit domestic technological catch up(Javorcik and Spatareanu 2008). Within JV's, differences exist between majority foreign owned joint ventures (MAJVs) and minority foreign owned joint ventures (MIJVs). The linkages that domestic partners in JVs have to other domestic firms may be stronger in MIJVs than MAJVs(Ramachandran V 1993). This is because the domestic partner which is locally self-sufficient in relation to foreign partner in a MIJV has frequent and deeper interactions with local agents (domestic firms, suppliers etc.). As a result the potential for diffusion of knowledge from MIJV may be higher. MAJVs, on the other hand, may be more likely to receive newer and more advanced technologies than MIJVs. The enhanced transfer of knowledge to domestic partners of MAJVs may therefore permit access to a higher quantity and quality of KBAs than is the case for MIJVs.

These three factors, namely, institutional differences, marketing capabilities and foreign ownership modes combined together provides us with a unique setting to investigate technological catch-up in the context of India. Whereas higher institutional differences between foreign firms' home and host country negatively affects their host country

performance (Shirodkar and Konara 2017), the impact of such institutional differences on domestic firms is yet to be investigated. Moreover, FDI from institutionally close and institutionally distant markets may induce different inter-firm interactions and linkages between domestic and foreign firms. The study by conceptualising how institutional differences will also matter for technological catch up in domestic firms extends the existing literature. Moreover, by including role of marketing capabilities as a distinct knowledge-based asset of foreign firms in emerging markets, and considering the level of generic foreign ownership in foreign firms, we adopt a contingency approach to unpack how they matter for domestic technological catch-up.

This research study by incorporating the role of institutional differences and addressing two important firm heterogeneity issues that reinforces MNEs role in domestic catch-up, attempts to fill an important research gap in the existing literature. An investigation of these three factors jointly will enhance the conceptual understanding of FDI-mediated technological catch-up. The research study also provides useful information for policy makers to enable them to better gear FDI policies to achieve development goals and for practitioners to consider means through which vulnerability of knowledge in emerging economies can be better understood and protected.

The next section provides a literature review and introduces the hypotheses of the research study which is followed by the methodology section and data analysis. The study concludes with discussion of some of the key policy implications of the findings.

2. Literature Review

2.1 Definition and channels of technological catch-up

The international business (IB) literature on FDI suggest that MNEs are endowed with ownership advantages, usually KBAs, in the form of new or advanced technologies and marketing and management know-how (Dunning and Lundan 2008). These KBAs can be leveraged by MNEs in host countries to overcome 'liability of foreignness'. The transfer of KBAs from MNEs to FOAs enhances the existing knowledge stock of the host country and increases catch-up potential of domestic firms in the host country. In this process, technological catch up is defined as the impact generated from knowledge transfer to third parties (i.e. domestic and other foreign firms) who are not directly involved in an economic transaction with MNEs(Macdougall 1960). The channels of technological catch-up includes demonstration, labour mobility, and competition effects (Görg and Greenaway 2004)[i].

Given our focus on an emerging market context, we conducted an intensive literature review on published studies using firm level panel data for developing and emerging economies only. The findings are summarised in Table 1 illustrating the mixed evidence.

Insert Table 1 about here

2.2. Institutional Differences and FDI-Mediated Domestic Technological Catch-up

Institutional differences arise out of economic, finance, political, administrative, cultural and technological differences between the home and host country of MNEs (Berry, Guillén, and Zhou 2010). In this research, we focus on differences related to formal and regulatory institutions (Ghemawat 2001; La Porta et al. 1998). By using the concept of national innovation systems (hereafter NIS) (Dosi and Freeman 1988; Lundvall 2010; Nelson

1993) in the host country and the likelihood of this being influenced by FDI from institutionally close and institutionally distant countries, we capture differences in formal institutional systems (Estrin, Ionascu, and Meyer 2007) and how this will facilitate technological catch-up. Details of national innovation systems and the consequences for inter-firm interaction is provided in the appendix.

The level of inter-firm interactions, including network connections between domestic and foreign firms is likely to be influenced by their embeddedness in the systems of national innovation (Castellacci and Natera 2013). Domestic firms may benefit additionally as a result of such interactions, especially when the home country NISs of foreign affiliates or FOAs with respect to engineering standards and specifications, technological development and technical educational systems are similar to the host country NISs (Joseph 2009). Consequently, FOAs will face higher or lower institutional differences, depending on their embeddedness in host country NISs, and this will influence their quality of interaction, knowledge transfer and network connections with domestic firms in the host country. For example, the prospects for technological catch-up by domestic firms through labour mobility may be higher when home country NISs of FOAs is similar to host country NISs (where domestic firms reside) as both types of firms (employers) and employees are familiar with the formal and informal arrangements that underpin employment contracts. This is also reflected in the approach to problem-solving and management techniques. Demonstration effects or reverse engineering is also facilitated through closer interactions between FOAs and domestic firms within NISs, especially in an industry that exhibits strong linkages of technologies and know-how between firms.

In summary, greater similarities between NIS in which FOAs of MNEs and domestic firms are embedded in will enhance the level of interaction. This will permit domestic firms to be able to better absorb and acquire knowledge resulting from the interaction.

Alternatively, when firms from different and relatively dissimilar NIS interact, greater institutional differences are bound to arise, which prevents deeper interaction between FOAs and domestic firms. Thus, the acquisition of knowledge by domestic firms would be limited.

The transfer of KBAs to FOAs enhances the pool of knowledge that is available for domestic technological catch-up (Dunning and Lundan 2008). However, when FOAs are embedded in host country NISs that are relatively dissimilar to its home country (i.e. facing high institutional differences), it may impede the transfer of KBAs due to high transaction costs (Gaur and Lu 2007; Wan and Hoskisson 2003; Xu and Shenkar 2002). Thus, the lack of complementarities between FOAs' home and host country NISs will result in high administrative institutional differences. Alternatively, the similarities in NISs will promote strategic coordination and governance among firms, both foreign and domestic alike. Therefore, countries with similar NISs can better facilitate firms in appropriating the advantages of these systems(Henisz and Zelner 2005). Conversely, the possibility of reaping the benefits from strategic coordination and governance are less likely for firms facing high institutional differences and therefore will hinder domestic technological catch-up. Based on the discussion above, we hypothesise that

H1: Ceteris paribus, the lower the institutional differences between home and host country, the more likely domestic firms will be able to benefit through technological catch-up.

2.3. Foreign ownership modes, and domestic technological catch-up

The conventional argument suggests that technological catch up by domestic firms are likely to be higher through the presence of JVs relative to WOSs (Abraham et al. 2010; Javorcik and Spatareanu 2008). This is because the linkages of domestic partners in JVs to other domestic firms provide an effective mechanism for diffusion of technology and know-how from FOAs to local firms. WOS are used by MNEs to maintain control of their KBAs

and prevent leakage of know-how (Desai, Foley, and Hines 2005; Ramachandran V 1993) and this limits technology diffusion from WOS regulating the scope for catch-up.

On one hand, the pool of knowledge that drives technological catch-up could be richer and deeper in WOS than in JVs because KBAs can be internalised within the MNE through WOS (Buckley and Casson 2010). Moreover, the perceived threat regarding leakage of KBAs is lesser in WOS than in JVs (Desai, Foley, and Hines 2004). Since WOS provide more control over KBAs than JVs, MNEs are likely to transfer sophisticated technologies and know-how through WOS (Mansfield and Romeo 1980). MNEs may also commit more resources to transferring KBAs to WOS (Blomström and Sjöholm 1999) with the incentives to protect KBAs likely to better in WOS compared to JVs and this will also enhance the pool of knowledge that is available for domestic firms' catch-up. On other hand, the linkages that domestic firms have with JVs are likely to be stronger than in WOSs. These linkages facilitates knowledge diffusion and they are likely to be strongest for tacit knowledge (Inkpen 2000; Kogut and Zander 1993) because the interpersonal connections between domestic partners in JVs and other domestic firms facilitate the process (Görg and Greenaway 2004; Javorcik and Spatareanu 2008). However, there may be differences between MAJVs and MIJVs (Ramachandran V 1993). The linkages that domestic partners have with other domestic firms may be stronger in MIJVs than MAJVs (Dimelis and Louri 2004), because the domestic partner in MIJVs have frequent and deeper interactions with domestic agents (suppliers, distributors etc). As a result, the potential for diffusion of knowledge externalities may be higher in MIJVs. MAJVs, however, may receive newer and advanced technologies than MIJVs, thereby providing access to higher quality and quantity of KBAs than in MIJVs. Existing studies consider either MAJVs and MIJVs (Dimelis and Louri 2004) or WOSs and JVs without distinguishing between MAJVs and MIJVs (Abraham et al. 2010; Javorcik and

Spatareanu 2008). A conceptualisation of key factors relating to foreign ownership modes which are important for technological catch-up are provided in Figure 1.

Insert Fig.1 here

2.3.1. Joint effects of institutional differences and foreign ownership modes

Earlier in the paper, we proposed that lower institutional differences will facilitate effective transfer of KBAs to FOAs in the host country due to lower level of transaction costs and greater complementarities between home and host country institutional domains. This scenario will be favoured by the presence of WOSs through transfer of newer technologies and know-how than JVs as MNEs have tighter control of their KBAs in WOS than in JVs (Mansfield and Romeo 1980). Thus, domestic firms are likely to have better access to higher quality and quantity of KBAs which will drive technological catch up. Furthermore, lower institutional differences would amplify interactions between domestic firms and FOAs including strategic coordination and governance because of complementary institutions. Thus, it is more likely for domestic firms to benefit from the high quality and deep knowledge flows associated with WOS.

In the case of foreign-owned JVs, the domestic partners of these JVs are connected with other domestic firms in the same industry through local market connections in the form of competitors, supply chain and distribution etc. On one hand, these local linkages are stronger in JVs than in WOS. Thus, the prospects for technological catch up in other domestic firms through diffusion of knowledge and proprietary know-how from JVs may be higher than in WOSs (Javorcik and Spatareanu 2008). On the other hand, relatively older technologies or know-how are transferred to JVs because of the need of MNEs to prevent appropriation of KBAs by domestic firms. As a result, domestic partners in JVs will have

swifter access to KBAs, albeit of inferior quality, relative to WOSs. Within JVs, the linkages in MIJVs are likely to be strongest, compared to MAJVs, because of the dominant domestic partners in MIJVs and therefore the diffusion of technology and know-how may be swiftest. However, as discussed earlier, MIJVs are more likely to be characterised by inferior quality and volume of knowledge (KBAs) compared to MAJVs. Thus, when comparing JVs, MAJVs are more likely to be benefit from intermediate level of knowledge pool and intermediate level of local linkages. This would have more beneficial effects in terms of domestic technological catch-up from presence of MAJVs.

The indirect knowledge diffusion from domestic partners in JVs to other domestic firms are likely to be improved in the context of lower institutional differences. This is likely to boost effective transfer of knowledge flows to JVs because there are lesser institutional impediments to transfer and the foreign partners (through their stake in the JVs) are familiar with the local institutions, thereby promoting domestic catch-up. However, in the presence of lower institutional differences, MAJVs are more likely to contribute to domestic technological catch-up than MIJVs. In line with this argument, we propose that:

H2: Ceteris paribus, the relationship between lower institutional differences and domestic technological catch up will be positively moderated by the presence of WOS and MAJVs relative to MIJVs.

Higher institutional differences imply weaker complementarities arising from the NIS between home and host country of MNEs (Meyer et al. 2009) . These differences deter MNEs from effectively transferring KBAs to FOAs (Xu, Pan, and Beamish 2004). This effect is more likely to be significant for the WOS as they are highly dependent on KBAs provided by the parent MNEs. As a result, this will hinder the speed of transfer and quality of knowledge flows thereby not effectively contributing to the existing knowledge pool in host

country. Thus, the domestic technological catch-up effects from presence of WOS in the context of weaker institutional differences would be negligible.

JVs, however, are less likely to be affected by higher institutional differences than WOS. The purpose of MNEs in collaborating with domestic partners is often to offset the barriers that emerge from high institutional differences (Chen and Hennart 2002). It is therefore quite possible that high institutional differences may not hinder MNEs in significantly transferring KBAs to JVs in the host country. However, the lack of complementarities between home and host country institutional domains (within a NIS context) may imply that the technology and know-how transferred to JVs could be of intermediate quality than would be in the case of low institutional differences. Thus, JVs will contribute to knowledge stock characterised by low quality but highly relevant local knowledge that may better aid catch up in other domestic firms. The tighter linkages between domestic partners of MIJVs and other domestic firms make MIJVs even more likely to access locally relevant knowledge although the flow of KBAs to MIJVS would be lower and of poorer quality than MAJVs. In summary, for domestic technological catch-up in the context of high institutional differences, MAJVs (relative to WOSs and MIJVs) are likely to be more beneficial as they are characterised by the presence of both linkages and intermediate technology and know-how (KBAs). Accordingly, we hypothesis that:

H3: Ceteris paribus, the relationship between higher institutional differences and domestic technological catch up will be positively moderated by the presence of MAJVs relative to WOSs and MIJVs.

2.4. Marketing Capabilities and FDI-Mediated Domestic Technological Catch-Up

The role of marketing capabilities (MCs) in improving performance of FOAs is well established in the literature (Czinkota and Ronkainen 2013; Kamboj and Rahman 2015) and this capability is even more important for performance in the challenging market context of emerging and developing economies (Helm and Gritsch 2014; Konwar et al. 2017). MCs as an important KBA of MNEs may enable FOAs to introduce and supply products effectively (Tan and Sousa 2015), achieve specific customers' requirements and develop competitive advantages related to market sensing and customer linking (Krasnikov and Jayachandran 2008). This is because marketing channels in emerging and developing economies are often underdeveloped and necessitates development of MCs to construct key elements of marketing channels to permit effective systems of delivering products.

Furthermore, MCs in FOAs can also influence the extent of domestic technological catch up. A higher level of MCs reveal how superior marketing practices and routines in FOAs are effectual in their own output maximisation and exerting a market-stealing effect, thereby decreasing output and raising costs of domestic firms (Aitken and Harrison 1999). This effect will induce domestic firms to invest in developing marketing channels to respond to foreign competition, especially in highly competitive product markets (Grewal et al. 2013). Gradually, this may enable domestic firms to identify better learning opportunities, innovate and reverse-engineer aspects of the marketing processes in FOAs to mitigate competitive pressures, thereby gradually catching up with FOAs within an industry. The superior demonstration of marketing capabilities by FOAs of MNEs and its subsequent adoption by domestic firms often occurs in an intangible way, which makes it difficult to capture how and where imitation and adoption of marketing practices by domestic firms take place (Blomström and Sjöholm 1999). We propose that marketing related domestic catch-up are

likely to be driven by a combination of both competition (market-stealing) effect and demonstration effects.

The competitive dynamics literature introduces competitor analysis to forecast competitive behaviour and competitive rivalry among firms (Chen 1996; Chen and Miller 2012). Chen (1996) proposes two constructs, i.e. market commonality and resource similarity, as the driver of firms' competitive behaviour. Whereas market commonality denotes the degree of overlap among firms in the product and customer segments, resource similarity denotes the comparable possession of strategic endowments among firms. The degree of market commonality and resource similarity increases competitive rivalry among firms, influences the competitive behaviour by enhancing awareness and motivation of the competitor to react and determines the capability of reacting to the competitor's action.

The role of MCs in influencing domestic catch-up is likely to be significant when FOAs and domestic firms compete within the same industry. This is because, as market commonality suggests, the motivation for domestic firms to imitate the marketing orientation of products and marketing processes of FOAs are more likely, due to product similarity or close resemblance of product design (Brambilla, Hale, and Long 2009). In the case of emerging or developing economies, domestic firms are more likely to benefit from adoption of standardized knowledge through imitation because of the existence of a large skill gap between the domestic firms and FOAs (Meyer and Sinani 2009). In other words, imitation is an important mechanism through which domestic firms could learn to compete more effectively in emerging markets (Lu, Pattnaik, and Shi 2016). Thus, when FOAs are endowed with higher level of MCs, they are more likely to use sophisticated marketing practices to target specific customers and enhance their overall market position. This may threaten the competitive position of domestic firms within an industry and thereby their retaliation is likely to include closer observation and imitation of products and processes of the focal

foreign firm. As a result, the beneficial effects of observation and imitation are likely to enable them to learn wholly and quickly through adequate responses to foreign competition and improving their competitive market position. We therefore propose that:

H4: Ceteris paribus, FOAs with a higher level of MCs (relative to FOAs with lower level) are more likely to be positively associated with domestic technological catch up.

Figure 2 provides a conceptual framework of the key hypotheses (along with predicted sign) developed for institutional differences, foreign ownership modes, marketing capabilities and domestic technological catch-up.

Insert Fig.2 here

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3. Methodology

3.1. Data and Variable Measurement

The research study uses the PROWESS database of the Centre for Monitoring Indian Economy (CMIE). This database provides information on domestic firms and the affiliates of MNEs listed on India's Stock Exchanges. It includes firms that account for 75% of all corporate taxes, more than 95% of excise duty and 60% of all savings of the Indian corporate sector (Marin and Sasidharan 2010). There is a significant advantage of employing this dataset as the majority of these firms are large enough to be listed on India's stock exchanges, thus enabling the investigation of technological catch-up from large FOAs to large domestic firms. Large domestic firms are better at adopting managerial best practices, including the introduction of new production techniques and management of human capital, to improve firm productivity (Bloom and Van Reenen 2007). Large firms also adopt innovations earlier and more comprehensively than small firms and therefore are more likely to catch-up swiftly and fully through FDI (Baptista 1999). In addition, firm size is an important determining factor of their relative absorptive capacity. This is because large firms have better access to finance and have greater ability to exploit external knowledge associated with knowledge diffusion activities(Cohen and Klepper 1996). National Industrial Classification (NIC) 2008 code for the manufacturing sector is used in this study to categorise industrial groupings. The definition of foreign ownership is foreign equity equals to or is greater than 10% of the total equity. To supplement missing information in PROWESS on the level of foreign ownership, company websites and annual company reports are used. Furthermore, the adjustment of nominal data for sales, assets and expenditures are deflated using GDP deflator and wholesale price index obtained from the Reserve Bank of India.

Overall, there have been a significant increase in growth of FDI in India over the last decade. For example, the aggregate FDI inflows in 2005 was US$ 6051 million, increasing to US$ 37745 million in 2010 and stood at US$ 60082 million in 2017(DIPP 2018). This is also mirrored by a significant increase in technological activities of MNEs including the proportion of foreign R&D investment and new product development in India to cater to their global product mandate (Krishna, Patra, and Bhattacharya 2012). Within this changing industrial context, it is very important to understand the implications for domestic firms and whether or to what extent domestic firms are benefitting indirectly (through technological catch-up process) from the presence of foreign firms.

In the data cleaning and inputting process, firms that did not report, or provided insufficient information on key economic activities were excluded. The final dataset contains 1,624 firms with 5,203 observations covering the period of 1998-2014. 1,398 firms were domestic firms and 226 were foreign firms. A detailed breakdown is provided in the appendix. The number of foreign firms in our sample is in line with other studies using PROWESS, for example Marin and Sasidharan (2010) included 273 foreign firms. Similar studies on the manufacturing sector in Argentina by Chudnovsky et al (2008) and Marin & Bell (2006) which had 145 and 283 foreign firms respectively in their samples are more examples.

India is a country with unique institutional (colonial and administrative) ties to Anglo-Saxon countries. Although India is catching up swiftly in terms of higher innovation and technology standards, the nature of its NIS is closer to Anglo-Saxon countries because of colonial and administrative ties that drive modern scientific traditions and initiatives in science and technology policies (Arnold 2005). This is further evidenced from India's colonial ties with the UK which has created national institutions such as rule of law, legal, administrative, political and financial systems that are similar to other Anglo-Saxon countries

(Mueller 2006).India has a higher education establishment which is a cumulative combination of British and US educational systems, such as internal structure of universities, mode of knowledge delivery, classroom learning techniques and assessment methods(Joseph 2009). In recent years, India has followed a policy of greater integration between technical universities and industrial knowledge intensive sectors that cater to the demands of the high skilled workforce required in these sectors, e.g. software, IT, and banking. This is somewhat based on the American system of setting up closer ties or knowledge clusters between educational sector (technical and science based) and industrial sectors. Furthermore, language is an important aspect which binds India closer to Anglo-Saxon countries. The medium of instruction in public and private universities is English and the same is used for administrative purposes, whether at the national or regional level. Linguistic similarities can also minimise the difficulties associated with transferring tacit know-how as well as transmitting prescriptive knowledge (Polanyi 1958). Thus, India in having closer institutional ties to Anglo-Saxon countries is in a better position to reap benefits associated with knowledge flows from FDI. Alternatively, the knowledge flows emerging from FDI from non-Anglo-Saxon countries are less likely to be beneficial because of the dissimilarities of the NIS between these groups and India. In order to capture these broad institutional differences, we categorise our FDI sample into foreign firms from Anglo-Saxon and Non-Anglo Saxon countries[ii].

In order to capture marketing capabilities in FOAs, we use the variable marketing intensity (i.e. marketing expenditures as a total of foreign firms' sales). There are detailed level of marketing expenditures reported in the Prowess dataset including the firms' commissions, rebates, discounts and promotional sales, expenses on direct selling agents and entertainment expenses (CMIE 2015). The marketing intensity variable is a good measure to capture the capabilities associated with selling (Griffith, Yalcinkaya, and Calantone 2010),

promotion (Troilo, De Luca, and Guenzi 2009) and skills associated with segmenting and targeting markets(DeSarbo et al. 2005). Thus, this measure captures the 'historical dynamics in investment levels' in marketing expenditures (Kor and Mahoney 2005). The international business (IB) literature heavily relies on marketing intensity as a proxy for MCs (Dutta, Narasimhan, and Rajiv 1999; Kotabe, Srinivasan, and Aulakh 2002). We split the FDI sample into foreign firms with higher and lower marketing intensity by adopting a threshold. Since we cannot be sure what constitutes a high marketing intensity in the context of India, we experiment with two cut-off points: the top quartile and the top 10% of each distribution following a similar approach to capture high R&D and export intensity in Marin and Sashidharan(2010).

3.2. Panel data estimation (2-stages)

In this study, following highly cited research on technological catch-up in India (Marin and Sasidharan 2010) and China (Wang et al. 2012), we use a 2-stage estimation process to model FDI-mediated domestic technological catch-up. In the first stage of the estimation, we compute the dependent variable required for the study. Assessment of technological catch-up in domestic firms requires the estimate of a firm's total factor productivity (TFP). Using the ordinary least squares (OLS) technique to estimate TFP suffers from simultaneity bias since it treats labour and capital inputs as exogenous and ignores time-invariant and firm-specific characteristics (Levinsohn and Petrin 2003). Moreover, problems of estimation leading to endogeneity can arise if firms adjust their inputs according to their expectations about economic conditions, leading to the possibility that idiosyncratic shocks in productivity are captured in the error term (Griliches and Mairesse 1995). The Levinsohn and Petrin (2003) approach, henceforth the LP method, is commonly used to overcome this potential endogeneity problem in estimation of TFP (Blalock and Gertler 2004; Javorcik and

Spatareanu 2008; Liu, Wang, and Wei 2009). The LP technique is easier to implement than the alternate method by Olley and Pakes (1992) because there is no prerequisite for evidence on firm entry and exit and no evidence of loss subsequent from negative tenets in the proxy investment variable. Very few firms exited the PROWESS dataset which provides another reason to use the LP method. The LP method of estimating TFP for 2-digit industry production functions offers the data for the dependent variable, TFP of domestic firms.

In the second stage of the estimation process, we relate the TFP of domestic firms to measures (i.e. proxies) of foreign presence or foreign participation using a fixed effects model estimated in first differences. The major factors affecting catch-up are controlled for including the competitive characteristics of industries and key conditions in domestic firms that affect absorptive capacity.

The baseline model is:

$$\ln TFP_{ijt} = \alpha_0 + \alpha_1 FORFPAS_{jt-1} + \alpha_2 FORFPNAS_{jt-1} + \alpha_3 HHI_{jt-1} + \alpha_4 IMP_{jt-1} + \alpha_5 RD_{ijt-1} + \alpha_6 SCALE_{ijt-1} + \mu_{ijt} \quad (1)$$

Where $\ln TFP_{ijt}$ is the logarithm of the TFP of domestic firm i in industry j at time t. FORFPAS and FORFPNAS are foreign presence from Anglo-Saxon countries and foreign presence from non-Anglo-Saxon countries respectively.

Following Wei and Liu (2006) and Liu et al.(2009), we use different measures to capture FDI-mediated domestic catch-up effects (FORFP), namely, foreign presence measured through employment, foreign presence measured through domestic sales and foreign presence measured through fixed assets in the industry. The purpose of using different measures is driven by theoretical arguments on which measures are like to be a good proxy to capture technological catch-up effects. It is proposed that different measures capture different channels or aspects of catch-up from foreign presence. If a single proxy such as

fixed assets (or capital) of foreign firms to total fixed assets in the industry is used in the estimation, then the positive catch-up effect simply indicates that the foreign presence (through FDI) produces a positive catch-up effect through fixed assets (i.e. capital). In this specific case, the positive externalities are likely to be closely related to successful imitation or reverse-engineering as a result of suitability of the FDI project by domestic firm (i.e. demonstration effect)(Meyer and Sinani 2009). Similarly, if presence through foreign firms' domestic sales in the industry is used as a measure, a positive catch-up effect would indicate that learning in domestic firms (through FDI presence) are connected to the knowledge diffusion of superior product and marketing skills. Again, with the use of foreign presence through employment measure, a positive effect would imply either contagion between employees in foreign and domestic firm as well as employee turnover (Driffield, Munday, and Roberts 2002). Some scholars in the existing literature suggests that if one measure is used to capture catch-up effects, the findings may be interpreted either as the presence or absence of technological catch-up effects through foreign presence. However, other scholars (Wei and Liu 2006) propose that the use of multiple measures may lead to different results. The implication is that when an individual measure (say, domestic sales) is used, then the research is likely to explore only a distinct aspect of domestic technological catch-up rather than domestic technological catch-up from foreign presence as a whole. As we use three measures of foreign presence including fixed effects (capital), employment and domestic sales, our dataset enables us to examine multiple channels and aspects of domestic technological catch-up (as a function of foreign presence) in India manufacturing industries. Thus, consistent with recent research, this approach enables us to maximise the detection of FDI-mediated domestic catch-up(Wang et al. 2012).

FORFPAS captures FDI catch-up effects from FOAs whose home country is institutionally close to the host country and is measured by the share of Anglo-Saxon FOAs'

employee compensation in the 3-digit industry (Employment), the share of domestic sales by Anglo-Saxon FOAs in the 3-digit industry (Domestic Sales) and the share of Anglo-Saxon FOAs' fixed assets in the 3-digit industry (Fixed Assets). Similarly, FORFPNAS captures FDI catch-up effects from FOAs whose home country is institutionally different to the host country, India and is measured by the share of non-Anglo-Saxon MNEs in 3 digit industry (domestic sales, fixed assets and employment compensation). HHI (Herfindahl index of concentration) and IMP (import penetration ratio) are the two industry level proxies for industry competitive conditions. The domestic firms' RD (R&D intensity) and SCALE (firm scale) are two firm level variables acting as proxies for absorptive capacity of domestic firms. All right-hand variables are lagged by one year which deals with the impending justification that technological catch-up will not increase instantaneously.

To estimate the role of foreign firms' marketing capabilities in domestic catch-up, we use the following estimation model in equation 2:

$$\ln TFP_{ijt} = \alpha_0 + \alpha_1 FORHMC_{jt-1} + \alpha_2 FORLMC_{jt-1} + \alpha_3 HHI_{jt-1} + \alpha_4 IMP_{jt-1} + \alpha_5 RD_{ijt-1} + \alpha_6 SCALE_{ijt-1} + \mu_{ijt} \quad (2)$$

Where FORHMC and FORLMC represents foreign presence with both high and low marketing capabilities respectively. As before, three different measures are used here to capture foreign presence, i.e. employment, domestic sales and fixed assets of foreign firms.

In this study, we also seek to assess the moderating role of foreign ownership modes which are categorised by:(1) wholly owned subsidiaries (WOS), where the MNE has 100% promoter's equity; (2) majority joint-ventures (MAJV), where the MNE has 51% to 99% promoter's equity, and (3) minority joint-ventures (MIJV), where the MNE's promoter's equity is from 10%-50%.[iii]

The study measures technological catch-up from WOS, MAJV and MIJV using the same method as used in equation 1 (catch up through FDI), i.e. by shifting the shares of all

MNEs to the shares of WOS, MAJV and MIJV in the 3-digit industry, respectively. Comprehensive variable measurements are provided in the appendix. Thus, the inclusion of these variables leads to the following model:

$$\ln TFP_{ijt} = \alpha_0 + \alpha_1 WOSFPAS_{jt-1} + \alpha_2 MAJVFPAS_{jt-1} + \alpha_3 MIJVFPAS_{jt-1} + \alpha_4 WOSFPNAS_{jt-1} + \alpha_5 MAJVFPNAS_{jt-1} + \alpha_6 MIJVFPNAS_{jt-1} \; \alpha_7 HHI_{jt-1} + \alpha_8 IMP_{jt-1} + \alpha_9 RD_{ijt-1} + \alpha_{10} SCALE_{ijt-1} + \mu_{ijt} \quad (3)$$

We utilize fixed effects model in Stata to estimate equations (1), (2) and (3) with corrections for heteroskedasticity and for clustering at the industry - year level to account for correlations between firm observations within the same industry - year (Wooldridge 2010). We also conducted the Hausman test in Stata and found that the fixed effects estimator is appropriate in comparison with random effects estimator. Furthermore, the use of random-effects specification may introduce bias in the coefficient estimates if the covariates are correlated with the unit effects. The fixed effects estimation enables to address this issue. It is quite possible that other factors might be connected to correlations between foreign presence and productivity. These factors could be assumed to be fixed, such as firm-, year-, industry-, and region-specific factors and might be connected to more micro-level determinants such as organisational culture, available opportunities regarding technology in an industry or macro-level factors such as external policy shocks and infrastructure conditions. To control for these fixed effects, the year-, industry-, and region-dummies are used in a fixed effects panel data model.

4. Data analysis and discussion

Table 2 provides the key summary statistics and correlation matrix. It is seen that there are no severe issues related to multicollinearity. We also inspected the variance inflation factors (VIF) and observe that none of the variables exceed more than 2.0 and is regarded as an acceptable threshold (Mansfield and Helms 1982). The results for domestic technological catch-up estimated in equations 1 and 2 are presented in Table 3. The difference between each column lies in the use of different measures of FDI-mediated domestic catch-up variable. Column 1 uses the share of foreign-owned firms' employment in total employment, column 2 the share of domestic sales accounted for by foreign-owned firms' to total domestic sales and column 3 the share of foreign-owned firms' assets in total assets.

Insert Tables 2 & 3 about here

Table 3 (columns 1 to 3) reveals that technological catch-up in domestic firms which are driven by presence of foreign firms entering from institutionally close countries (FORFPAS) are positive and significant for all the measures used. On the contrary, FORFPNAS is not statistically significant. This result supports our first hypothesis H1. The coefficient for FORHMC is positive and significant (when domestic sales and fixed assets measure are used) but it is not significant for FORLMC. This suggests that marketing capabilities as an important KBA used by FOAs can drive domestic technological catch-up and thereby supports our final hypothesis H4. The controls used for firm characteristics, RDINTEN and SCALE, are also positive and statistically significant, whereas for industry-level variables, HHI is positive and statistically significant and positive but IMP is not statistically significant. In studies of FDI-mediated technological catch-up in India, the results from Banga (2006) and Marin and Sasidaran (2010) can be compared to our findings. Banga

(2006), using data from 1985-1990, finds that Japanese investment is more likely to generate domestic catch-up than US investment. This is contradicted to our finding where MNEs from institutionally close countries (such as US) have a positive effect and those from institutionally distant countries have an insignificant effect. This is not surprising because Banga (2006) study only covers period before India liberalised its economy while this research study covers post-liberalisation period. Kathuria (2002) study of the effect of liberalisation reports that technological catch-up have increased during the liberal regime for those local firms actively engaging in R&D. Although the country of origin effects is not considered in the study, there is a possibility that such effects could be altered under the liberal regime. Marin and Sasidaran (2010)'s findings are more in line with ours. By considering foreign firm heterogeneity, they find that 'the technological catch-up (exporting) effect driven by FDI with greater linkages with the innovation system is positive and significant'. The difference between their approach and ours lies on the fact that they use firm level information, i.e. royalty payments to construct a proxy of embeddedness inside the innovation system (IS) of the host country, and group firms accordingly while ours is based on a macro-level proxy, i.e. Anglo-Saxon countries vs. non Anglo-Saxon countries. It should also be noticed that our dataset only includes listed firms which are large in size and often actively engaging with R&D activities. This implies that the absorptive capacity and innovation capability of domestic firms in our data, though lower than those of foreign firms, are of respectable standard and more likely to be above the technological threshold for catch-up to be facilitated. In this regard, our findings that positive intra-industry technological catch-up in the context of low institutional differences is certainly plausible. This is also in line with the findings by Pradhan(2004) that 'the presence of foreign firms per se may not be important for productivity growth of domestic firms unless it is complemented by the latter's R&D activity or size'. In addition, our results further add an interesting context that high

level of marketing capabilities in FOAs may have beneficial effects as domestic firms are more motivated to engage in imitation and learning.

One of the primary purposes of the study was to investigate the joint effect of institutional differences and foreign ownership modes. Equation 3 is estimated, and the results are presented in Table 4. The coefficients on WOS from Anglo-Saxon countries are positive and significant for all measures of spillovers (columns 1-3). In contrast, coefficients on MAJVs and MIJVs from Anglo-Saxon countries are positive and significant only for one measure each and using fixed assets measure; the coefficient on MIJVs from Anglo-Saxon countries is negative and statistically significant. Such a set of result be an indication when countries are institutionally closer, WOS will provide with the highest prospects for technological catch-up than other FDI ownership modes. Also, MAJVs are more likely to be a better ownership mode for knowledge diffusion to domestic firms than MIJVs as the latter is associated with a negative (and highly significant) effect.

Insert Table 4 about here

It is seen that when foreign ownership modes are considered under high institutional distance, the significance for JVs are much more compared to WOS. The coefficient for MAJVs suggest a positive and highly significant effect for the fixed assets measure whereas MIJVs have a negative and significant effect with the use of fixed assets measure. This evidence on the moderating effect of foreign ownership modes on institutional distance fully supports the second hypothesis (H2) and there is partial support for H3. The reason for MAJVs being the only foreign ownership mode (in the context of high institutional differences) associated with positive and significant effect (with assets measure) could be explained by the role that foreign affiliates of MNEs play in diffusion of knowledge when a

domestic partner from an institutionally distant country is used. The close linkages that domestic partner of a MAJV has with other local firms could also be a crucial factor when the foreign affiliate is institutionally distant and unfamiliar with the local environment. Similar to findings from estimations without consideration of ownership effects, coefficients on industry concentration (HHI), R&D intensity (RDINT) in firms and SCALE are positive and significant whereas import penetration (IMP) does not reveal any significance although it is positive.

Following the method used in Wei and Liu (2006), we also adopt a principle components approach to combine all indicators into a 'grand' composite index. The rationale behind the use of a grand composite index is that one measure of domestic technological catch-up (for example, domestic sales) is likely to explore only a distinct aspect or channel rather than technological catch-up from foreign presence (FDI) as a whole. This is in principle used as a check to assess the overall effect of technological catch-up in domestic firms. The first factor from the principle component is identified and it explains more than 74% of the variance of these three indicators. The results are shown in the fourth column. It shows that, with all other things remaining constant, domestic firms benefit from the presence of foreign firms through technological catch-up.

The current evidence from this paper however contradicts existing studies which have looked at the role of foreign ownership modes. In the case of another emerging economy with a very liberal FDI policy, China, it was found that JVs are more likely to be associated with positive spillovers than WOS (Abraham et al. 2010; Tian 2010). In our case, it is WOS which have relatively higher and significant effects than both MAJVs and MIJVs. The evidence regarding MIJV's in our study is negative and significant which also contradicts earlier studies by Dimelis and Louri (2004). However, our findings are partially in line with Mansfield and Romeo (1980), Ramachandran (1993), Javorcik (2008) and Almeida and

Fernandes (2008) that MNEs are more likely to transfer advanced technologies and know-how to WOS and generally are consistent with Marin and Sasidharan (2010) that 'MNEs with a higher foreign equity share are more able to convey export spillover because of the higher quality of the technology transferred from parent company'. Different from these studies, our approach takes into the consideration of mediating role that institutional difference can play in technological catch-up from foreign firm with different level of ownerships in the host country and uses data which only covers listed firms whose absorptive and innovative capability are relatively high. Our findings assert the importance of institutional ties between the FDI home and host country as well as foreign ownership and demonstrate that the similarities in formal and regulatory frameworks between an emerging host country and its institutionally close countries could bring about positive technological benefits through FDI with high level of foreign ownerships.

Conclusions

The findings reported in this paper add to the growing stream of literature that suggests that models of FDI-mediated technological catch-up need further development to enable better identification (Crespo and Fontoura 2007; Marin and Sasidharan 2010). The evidence from this paper points towards the fact that technological catch-up are conditional on foreign ownership modes and marketing capabilities of FOAs and institutional distance between the home and host country of MNEs. Positive intra-industry technological catch-up exist only for WOS and MAJVs from Anglo-Saxon firms (i.e. firms facing lower institutional distance) whereas in the case of Non-Anglo-Saxon firms (i.e. firms facing higher institutional distance), MAJVs are the most important driver of technological catch-up. Marketing capabilities as an important determinant of FDI-mediated catch-up also plays an important role and we find evidence to document this proposition in our study. We also find negative

effects from MIJVs from Anglo-Saxon firms, with limited evidence that positive catch-up effects arise from MIJVs too. The results also suggest that a contingency approach, based on a fuller classification of foreign ownership modes than is normally used in the literature, consideration of the role of MCs and the facilitation of catch up conferred by institutional differences enables a more detailed identification than seems to be the case in more aggregated studies.

The interpretation of the arguments and results presented in this paper require caution. First, our findings draw on a specific sample of firms of the Indian economy, i.e. large listed firms in the manufacturing industry whose absorptive and innovative capability are relatively high. Therefore, any generalisation from this in terms of both sector and firm selection needs caution. Second, our study focuses on analysis of one aspect of institutional differences, i.e. differences in NIS frameworks and uses Anglo-Saxon vs. non-Anglo-Saxon country classification to capture the institutional differences. However, it could be argued that other institutions e.g. contract enforcement are also important for catch-up, as they affect MNEs operations, technology transfer and transfer of know-how to its affiliate and domestic firms in the host country. In future, more direct measures of institutional differences could be used in to investigate catch-up effects. Third, our focus is only on intra-industry technological catch up as the study of inter-industry domestic catch-up requires the employment of input-output tables, which unfortunately is not available for this study. Finally, although our study takes measures to mitigate the indigeneity issue, a more effective solution involves using datasets that cover a longer period and contain information on effective instrumental variables.

Despite the limitations listed above, we believe our findings could feed well into discussions of FDI and its related public affairs polices. In recent years, these policies attracted FDI in developing countries and presumed that JVs are more likely to beneficial for catch-up. Our results, however, demonstrate that domestic firms that are large and innovative

in nature could benefit more from the presence of WOS in the case of institutional similarities between home and host country. This is not to say that only FDI in the form of WOS and from institutional close countries are welcomed in the host country. Rather, we believe it is important to take into considerations of foreign firm heterogeneities in terms of ownership, depth of capabilities (especially marketing related) and institutions in which they embed and local firm heterogeneities in terms of size, absorptive capability and consequently design and implement policies which are not discriminating against any types of foreign firms as well as local firms. Early liberalised countries including Hong Kong, Singapore and Ireland have showed the way on this regard and late comers including India and some of Eastern European countries are moving towards this direction.

Acknowledgement

This paper is supported by Youth Foundation of Humanities and Social Sciences, Ministry of Education of China (No. 17YJC790129; No.15YJC790152), National Social Science Fund of China(18VSJ085), Jilin Province Science and Technology Development Plan Project (20180418128FG).

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APPENDIX A: National innovation systems

The NIS framework refers to the technological and innovative developments of a nation driven by dynamic interaction among different economic agents which results in new knowledge development through changes in products, processes, or services (Freeman 1995; Nelson 1993). NIS comprises of nationally inter-connected institutions that are continuously engaged in development, accumulation and transfer of knowledge (Carlsson 2006). The element of nationality is significant here as the system of innovation emerges not only from policies created by technology, legal, regulatory and economic institutions but also from attributes such as shared language, norms of behaviour and culture which binds the system together (Niosi, Godin, and Manseau 2000). NIS are likely to contribute to productivity improvements in four ways (Baskaran and Muchie 2008):

a. development of infrastructure, e.g. science & technology base, government policies, intellectual property rights;
b. fostering investment incentives, e.g. improvements in R&D investment, venture capital and FDI;
c. developing knowledge and talent pool, e.g. human capital accumulation, labour flexibility;
d. fostering linkages and relations, e.g. university-industry links, globalisation of MNE R&D and transnational networks.

The relative strengths of these four elements of NIS determine the extent of technological diffusion that are likely to be associated with FDI by MNEs. Thus, a country's NIS determines the extent of knowledge and technology available for diffusion and providing opportunities for domestic firms to catch-up (Herstatt et al. 2008).

National innovation system influences domestic firm's ability to develop or absorb new knowledge, benefit from technology diffusion and be innovative. The level of innovation capabilities in domestic firms shape their absorptive capacity and enhances knowledge exploration capabilities (Kogut and Zander 1993). NIS aids in creation and dissemination of technologies and know-how which can empower firms within this system to adopt relevant technologies and know-how (Pradhan 2007), although the pace of knowledge diffusion will vary by countries. Thus, the quality of knowledge accumulation process and capabilities related to technology absorption for firms are significantly influenced by NIS (Patel and Pavitt 1991). As a result, firms embedded in a particular NIS develop and exhibits distinct learning patterns (Lundvall 2010).

Appendix B: Variable definition and measurment

Variable	Definition and measurment
LTFP	Logarithm of Total Factor Productivity (TFP)
(FORFPAS/ FORFPNAS)	Technological catch-up variable proxied by the share of foreign affiliates from Anglo Saxon/ Non Anglo-Saxon countries in a 3-digit industry, excluding the focal firm.
(FORHMC/ FORLMC)	Technological catch-up variable proxied by the share of foreign affiliates with high/low marketing intensity in a 3-digit industry, excluding the focal firm.
WOSFPAS/ WOSFPNAS	Technological catch-up variable proxied by the share of wholly-owned foreign firms from Anglo-Saxon/ Non-Anglo Saxon countries to total foreign firms in the industry
MAJVFPAS/ MAJVFPNAS	Technological catch-up variable proxied by the share of majority-owned joint ventures from Anglo-Saxon/ Non Anglo-Saxon countries to total foreign firms in the industry
MIVJVFPAS/ MIJVFPNAS	Technological catch-up variable proxied by the share of minority-owned joint ventures from Anglo-Saxon/ Non Anglo-Saxon countries to total foreign firms in the industry
HHI	The sum of squared firm shares of sales in a 3-digit industry
IMP	The ratio of imports to domestic demand in a 3-digit industry
RDINT	The ratio of domestic firm's R&D expenses to sales
SCALE	The ratio of domestic firm's sales to average 3-digit industry-level sales

Appendix C: Distribution of foreign and domestic firms' obervations in our sample (1998-2014; manufacturing sector)

Time-period	Nos. of foreign firm observations	Nos. of domestic firm observations
1998	14	79
1999	21	134
2000	24	104
2001	18	89
2002	54	357
2003	72	446
2004	61	402
2005	58	345
2006	58	369
2007	72	446
2008	50	312
2009	36	223
2010	29	167
2011	35	189
2012	36	223
2013	43	267
2014	58	312
	N=739	N=4464

Table 1: Summary of research findings on FDI spillovers or FDI-mediated technological catch-up using firm-level panel data in developing and emerging countries[1]

Sl. No.	Country	Authors	Sample	Findings[2]	Factors that affect spillovers
1	Argentina	(Marin and Bell 2006)	1992-1996	-	Lesser technological capabilities of MNE subsidiaries
2	Argentina	(Chudnovsky et al. 2008)	1992-2001	*/+	Improved absorptive capacity of domestic firms
3	China	(Liu et al. 2009)	1998-2001	+	Higher technological capabilities of domestic firms
4	China	(Wei and Liu 2006)	1998-2001	+	Higher level of technological capabilities
5	China	(Liu 2002)	1993-95	+	Enhanced technical capabilities of domestic firms
6	China	(Tian 2007)	1996-99	+	Spillovers from MNEs positively if domestic firms have tangible rather than intangible assets
7	China	(Tian 2010)	1996-99	+	Employment of unskilled labour and engagement of intangible assets (input) along with locally sold products and not newly developed products (output) give rise to positive spillovers
8	India	(Kathuria 2001)	1976-89	+	Higher R&D capabilities of domestic firms
9	India	(Kathuria 2002)	1990-97	-	Lack of R&D capabilities of domestic firms
10	India	(Siddharthan and Weekly 2004)	1993-2000	+	Improved absorptive capacities of domestic firms
11	India	(Banga 2006)	1985-90	+	Nationality of the foreign investor matters
12	India	(Marin and Sasidharan 2010)	1994-2002	+/-	Competence creating MNE subsidiaries generate positive while competence exploiting subsidiaries generate overall negative effects
13	India	(Iyer 2009)	1989-2004	+/-	Strong industry effect due to nature of competition in each industry
14	Indonesia	(Blalock and Gertler 2004)	1988-96	*	Lack of absorptive capacity
15	Lithuania	(Javorcik 2004)	1996-2000	*	Partially-owned foreign projects lead to greater vertical spillovers than wholly-owned projects
16	Morocco	(Haddad and Harrison 1993)	1985-89	-	Negative competition effects
17	Poland	(Zukowska-Gagelmann 2000)	1993-97	-	Negative competition effects
18	Romania	(Javorcik and Spatareanu 2008)	1998-2003	+	JV's generate positive significant spillover benefits than WOS
19	Russia	(Yudaeva et al. 2003)	1992-97	+	Better absorptive capacity leading to positive significant horizontal effects
20	Bulgaria Romania Poland	(Konings 2001)	1993-97 1994-97 1993-97	- - +	Negative competition effects/ Lack of firms' restructuring Lack of firms' restructuring (lot of missing observations) Strategic restructuring of firms enabling spillovers
21	Bulgaria Poland Romania	(Nicolini and Resmini 2010)	1998-2003	+	MNEs operating in labour intensive sectors gives rise to horizontal spillovers whereas that operating in high-tech sectors gives rise to vertical spillovers Size of domestic firms moderates spillover effect
22	Venezuela	(Aitken and Harrison 1999)	1976-89	-	Negative competition effects
23	Zambia	(Bwalya 2006)	1993-95	-/+	No horizontal spillovers due to insufficient absorptive capacity and negative competition effects.

[1] The definition of developing and emerging economies follows World Economic Outlook Report (2010) published by the International Monetary Fund (http://www.imf.org/external/pubs/ft/weo/2010/01/weodata/groups.htm#oem).

[2] +, -, and * denotes positive, negative and insignificant effects respectively

Table 2 (Correlation matrix)

	Mean	s.d.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
1. LTFP	1.55	1.59												
2. FORFPAS	0.16	0.18	0.13											
3. FORFPNAS	0.08	0.13	-0.02	0.29										
4. WOSFPAS	0.06	0.09	0.00	0.45	0.08									
5. MAJVFPAS	0.09	0.15	0.18	0.78	0.30	-0.07								
6. MIJVFPAS	0.01	0.06	-0.06	0.32	-0.01	0.00	-0.07							
7. WOSFPNAS	0.06	0.11	0.05	0.29	0.93	0.10	0.30	-0.02						
8. MAJVFPNAS	0.01	0.04	-0.09	0.07	0.49	-0.01	0.07	0.06	0.19					
9. MIJVFPNAS	0.00	0.02	-0.16	0.08	0.18	-0.01	0.11	-0.02	-0.01	0.04				
10. HHI	0.21	0.20	-0.22	-0.13	-0.14	-0.20	-0.02	-0.04	-0.15	0.00	-0.03			
11. IMP	0.05	0.09	0.01	-0.13	0.06	0.04	-0.14	-0.07	0.02	0.16	-0.03	-0.04		
12. RDINTEN	0.00	0.06	-0.02	0.03	0.03	-0.01	0.03	0.02	0.02	0.04	0.00	0.01	0.00	
13. SCALE	0.86	2.46	0.03	-0.07	-0.07	-0.03	-0.07	0.00	-0.07	-0.02	0.00	0.02	0.00	-0.01

s.d. = standard deviation. All technological catch up variables are measured by foreign employment compensation.

Table 3. Domestic Technological Catch-up Effects from Institutional Differences and Marketing Capabilities

	(1)	(2)	(3)	(4)
FDI spillover variable measurement	Employment	Domestic Sales	Fixed Assets	First factor from principal component analysis based on employment, domestic sales and fixed assets
FORFPAS	0.136**	0.001***	0.136*	0.017**
	[0.064]	[0.000]	[0.077]	[0.008]
FORFPNAS	-0.118	-0.073	0.060	-0.006
	[0.145]	[0.049]	[0.096]	[0.012]
FORHMC	0.019	0.188**	0.283***	0.148**
	[0.065]	[0.077]	[0.086]	[0.058]
FORLMC	0.022	-0.001	-0.012	-0.019
	[0.074]	[0.073]	[0.076]	[0.018]
HHI	0.184***	0.199***	0.197***	0.185***
	[0.062]	[0.062]	[0.062]	[0.062]
IMP	0.114	0.094	0.091	0.119
	[0.093]	[0.092]	[0.091]	[0.093]
RDINTEN ($*10^{-3}$)	0.070**	0.063**	0.054*	0.060*
	[0.035]	[0.030]	[0.030]	[0.031]
SCALE	0.015**	0.015**	0.015**	0.015***
	[0.006]	[0.006]	[0.006]	[0.006]
Industry effects	yes	yes	yes	yes
Region effects	yes	yes	yes	yes
Time effects	yes	yes	yes	yes
N	5203	5202	5203	5202
R^2	0.261	0.261	0.262	
F-stats	1.54**	1.53**	1.65**	

Dependent variable is the logged TFP calculated using Levinsohn and Petrin (2003) procedure.
Key variables are lagged one year.
Robust standard errors clustered by industry-year in brackets.
* p < 0.10, ** p < 0.05, *** p < 0.01.
No. of firms = 1398.

Table 4. Joint Effects of Institutions and Foreign Ownership on Domestic Technological Catch-up

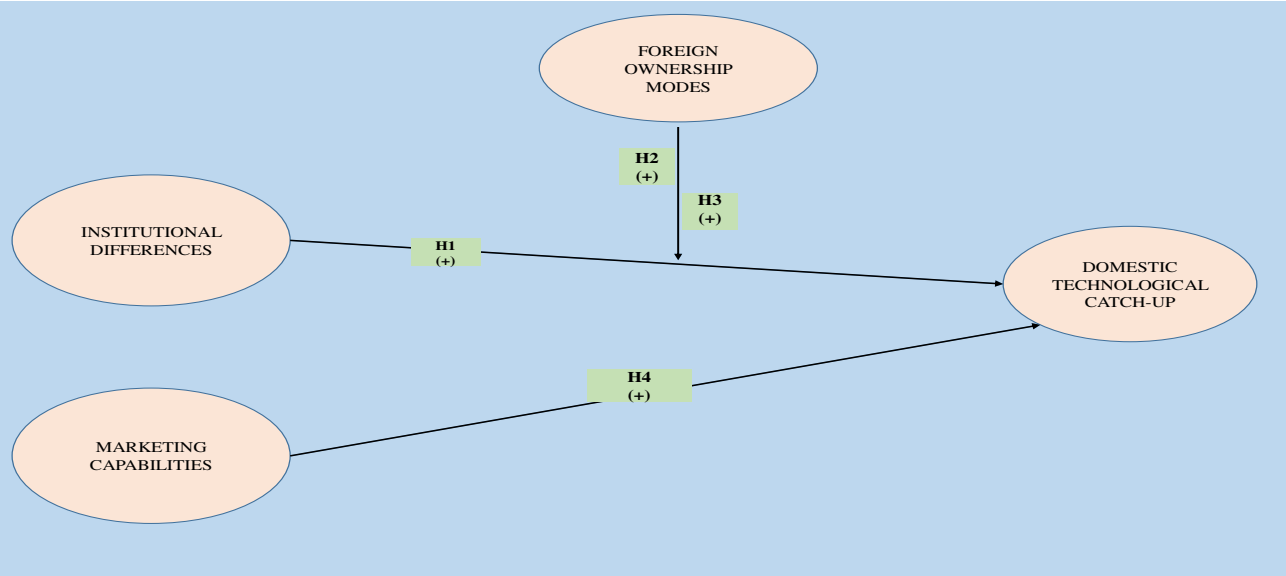
	(1)	(2)	(3)	(4)
FDI spillover variable measurement	Employment	Domestic Sales	Fixed Assets	First factor from principal component analysis based on employment, domestic sales and fixed assets
WOSFPAS	0.232**	0.001***	0.361**	0.017**
	[0.107]	[0.000]	[0.173]	[0.007]
MAJVFPAS	0.118	0.073	0.198**	0.013**
	[0.073]	[0.058]	[0.077]	[0.006]
MIJVFPAS	0.000	0.355*	-0.592***	-0.002
	[0.242]	[0.183]	[0.217]	[0.010]
WOSFPNAS	-0.208	-0.049	-0.023	-0.007
	[0.174]	[0.083]	[0.116]	[0.011]
MAJVFPNAS	0.216	-0.091	0.470***	0.011
	[0.194]	[0.063]	[0.157]	[0.009]
MIJVFPNAS	-0.626	-0.089	-0.324**	-0.011
	[0.381]	[0.379]	[0.156]	[0.007]
HHI	0.200***	0.183***	0.198***	0.192***
	[0.067]	[0.070]	[0.063]	[0.069]
IMP	0.095	0.120	0.054	0.105
	[0.097]	[0.094]	[0.078]	[0.091]
RDINTEN ($*10^{-3}$)	0.076**	0.060**	0.064*	0.063*
	[0.036]	[0.030]	[0.036]	[0.032]
SCALE	0.015**	0.015***	0.017***	0.016***
	[0.006]	[0.006]	[0.006]	[0.006]
Industry effects	yes	yes	yes	yes
Region effects	yes	yes	yes	yes
Time effects	yes	yes	yes	yes
N	5203	5203	5203	5203
R^2	0.428	0.419	0.419	
F-Stats	1.68**	1.46**	1.76***	

Dependent variable is the logged TFP calculated using Levinsohn and Petrin (2003) procedure.
Key variables are lagged one year.
Robust standard errors clustered by industry-year in brackets.
* p < 0.10, ** p < 0.05, *** p < 0.01.
No. of firms = 1398.

Figure 1: Author's schematisation of interplay between key factors relating to foreign ownership modes that drive domestic technological catch up

Ownership Modes ➡ Key factors ⬇	**MIJVs**	**MAJVs**	**WOSs**
Knowledge pools (KBAs)	Low	Intermediate	High
Linkages (network connections)	High	Intermediate	Low

<u>Figure 2</u> Conceptual framework



[i] Demonstration effects occur when domestic firms observe and imitate MNEs' operations. Labour mobility effects arise, when skilled employees that are trained by MNEs, move away from their employers to commence with entrepreneurial ventures or work for other domestic employers. The entry of MNEs into an industry may force domestic firms to reduce X-inefficiencies or to upgrade their technological capabilities to remain competitive resulting in domestic firms' productivity enhancements. Alternatively, MNE's entry may increase competition in output and input markets. Competition in output market may reduce domestic firm's market share forcing them to produce less output and thereby pushing up their average costs (Aitken & Harrison, 1999). This may occur when domestic firms are forced to upgrade their technology, management and marketing capabilities to compete with MNEs (Blomstrom and Kokko 1998; Spencer 2008). Competition in input market such as labour market may lead to increase in wages and employee compensation (Driffield & Taylor, 2000). This may be unfavourable to domestic firms and have a negative effect on their productivity.

[ii] *To capture our primary explanatory variable, i.e. institutional differences, we classified the FDI sample into developed country FDI from Anglo-Saxon and developed country FDI from non Anglo-Saxon countries. FDI*

from Anglo-Saxon countries include foreign firms originating from AUSTRALIA, CANADA, UNITED KINGDOM, UNITED STATES of AMERICA, NEW ZEALAND and IRELAND. FDI from non Anglo-Saxon countries include foreign firms originating from BELGIUM, DENMARK, FINLAND, FRANCE, GERMANY, ITALY, JAPAN, NETHERLANDS, SOUTH KOREA, SPAIN, SWEDEN, SWITZERLAND, TAIWAN, UAE and HONG KONG. We excluded foreign firms originating from MAURITUS and LIECHTENSTEIN as these countries are regarded as tax havens and are not likely to be genuine sources of inward foreign capital and technological investments. We also exclude the handful of foreign firms from BANGLADESH as it is a developing country.

[iii] The improvement in definition of ownership in this study following (Ayyagari, Dau, and Spencer 2015; Sarkar 2001) is that the share of foreign ownership is by reference to the dominant shareholder with voting rights. This definition of foreign ownership is better than used in most studies that do not distinguish between promoters and non-promoters. Shareholders with voting rights (promoters), such as firms or corporate groups, possess significant control and decision-making authority over the firm, whereas those without voting rights (non-promoters), such as foreign institutional investors, venture capital funds, banks, mutual funds and insurance companies, do not exercise direct control over the firm (Chalapati and Dhar 2011). Studies that rely on foreign equity share information to construct foreign ownership modes do not distinguish between promoters and non-promoters and are likely to measure the degree of control over resources and capabilities that rest with foreign firms inaccurately. This issue is likely to be important in emerging economies such as India where the ownership with control rights of MNEs' (promoters) are diluted with non-promoters shares to overcome institutional regulations connected to the formation of the FDI project (Sarkar 2001). Observing the aggregate foreign equity-ownership share (i.e. of both promoters and non-promoters) might therefore be misleading on the extent of actual control exercised by MNEs' corporate owners. The assumption underlying the hypotheses of this study is that control and transfer of resources and capabilities rests with the majority shareholder in different foreign ownership modes. By using foreign equity ownership data from Prowess of foreign promoters, and excluding non-promoters, this study utilises a more accurate measure of the degree of control exercised by foreign firms than most other studies in this area.